Digitized by the Internet Archive
in 2010 with funding from
University of Toronto

http://www.archive.org/details/emjengineeringmi107newy

Volume 108 No. 5

Engineering and Mining Journal

August 2, 1919

Two Sections—Section Two

INDEX TO VOLUME CVII

January 1 to June 30, 1919

153231
12/11/19.

McGRAW-HILL COMPANY, INC.
10TH AVENUE AT 36TH STREET
NEW YORK

TN

Engineering and Mining Journal

INDEX TO VOLUME CVII

January 1 to June 30, 1919

EXPLANATORY NOTE

Illustrated articles are denoted by an asterisk (*); book notices by a dagger (†).

This index is made comprehensive but concise. Pains are taken to bring together matter belonging to the same subject, so that when a reader looks up an article, he will be cited to related data. Series of simple page numbers, following names of mines or companies, usually refer to news notes. With a major entry or series of entries, may be placed several minor ones, relating to the same subject in order that its history may be followed. If the author's name be known, it is the simplest means of reference. Productions are indexed under names of metals and countries or states. The mere juxtaposition of a mineral and geographical name usually signifies an output, but may cover other statistical or news matter. Not all news are indexed but a liberal selection of them is made.

Following is a list of the pages included in the several numbers of the volume, by date:

Jan.	4	Pages	1- 38
"	11	"	39-134
"	18	"	135-174
"	25	"	175-216
Feb.	1	"	217-256
"	8	"	257-298
"	15	"	299-342
"	22	"	343-384
Mar.	1	"	385-428
"	8	"	429-468
"	15	"	469-512
"	22	"	513-554
"	29	"	555-596
Apr.	5	"	597-640
"	12	"	641-682
"	19	"	683-730
"	26	"	731-774
May	3	"	775-814
"	10	"	815-858
"	17	"	859-898
"	24	"	899-940
"	31	"	941-984
June	7	"	985-1024
"	14	"	1025-1068
"	21	"	1069-1106
"	28	"	1107-1184

A

Page
Abe Lincoln, Ariz. 169, 593
Abe, M. Analysis of concrete frames....†889
About Spanish 198, 578, 588, 706
Aby, C. W., death.... 547
Accidents—Ala. 810
—Calif. 337
—Coal mines, U. S. 1918.... 954
—Editorials 1058
Fatality and injury. Ratios.... 761
—Hoisting-rope 435
—Mine 971
—Reduction works 1111
—Reeducation vs. compensation.... 474
Accountants wanted 801
Acid mine water neutralization.... 478
Across the Atlantic. Editorial.... 931
Actinolite—Canada 618
Adams, F. D. 1000
Adams, J. H.... 547
Adams vs. Yukon Gold Co 359
Adanac, Ont 254, 382, 464, 510, 638, 678, 854, 938
Adapting railway curves to mines.... 539
Adhar Devel, Minn.... 74, 464
Addams, C. E. 167
Addicks, L. 414
Addison Copper, Wash 552
Addy, M. Co. 336
Adirondacks. See "New York."
Adit, Driving, Copper mountain....*567
Adjustment of Mexican finances.... 416
Admiralty Zinc, Okla. 145
Adsorption 100, 696
—Aurocyanide 518
Advantages of under feed firing 190
Aerial transportation. Editorial.... 766
Aero station service 245
Aeronautics—Aluminum in 8
—Helium 273
—Editorials 931, 976
Aeroplanes for mine managers.... 1176
Aetna Iron & Steel, B. C. 75
Aftermath in Paris and London 324
Afterthought Copper, Calif 35, 72, 381, 463, 771, 1063
Agreement on Oil Lands Bill 413
Agricola 1126
Aguila Oil Co., Mexico 736
Ahmeek, Mich 300
—Dividends 25, 626
—Production 35, 213, 381, 551, 879
Aid for war minerals producers. Editorial.. 164
Air booster for centrifugal pumps.... 757
Air compressors *1041
Lubrication *392
Air. Effect in cyanidation.... 522.
Air-lift, Compound *436
Air-volume regulation in furnaces....*654
Ajax, Minn. 981
Ajo-Cornelia, Ariz.... 894
Akron Mines, Colo. 73
Alabama—Graphite 147, 453
Costs 195
List of companies 306
Review, 1918 194
—Iron 770, 792, 852, 980, 1063, 1179
Situation 636, 963
Alameda Copper Mines, Ore. 74, 106
Alamo L. & Z., Okla....728, 1104
Alaska—Assessment work relief.... 243
Alaska—Copper 213, 894
Alaska Copper Corporation.... 107
Alaska Endicott Mining 981
Alaska Gastineau Mining....35, 107, 981
—Quarterly report.... 622
Alaska Gold 56, 76
Alaska Gold Mines Co....158, 169, 509
—Annual report 871
—Production 381
—Quarterly report 21
Alaska Juneau Gold Mining....71, 107, 508, 894
Stockholders' meeting 34
Alaska Mexican, Alaska 409
Alaska—Minerals 1011
Alaska Mines, Alaska 894
Alaska—Mining, 1918 107
Alaska Peerless Mining 981
Alaska—Railroads 445
Alaska Treadwell 894, 981
—Annual report 409
Alaska Tunnel, Colo. 253
Alaska United Gold Mining 409
Albion Consol., Utah 510, 510
Alcock, J. 1098
Alcyone, Ariz. 810
Aldridge, W. H. 336
Alexander, J. Colloidal metals.... 354
Alignment, Inclined-shaft timbering....*349
Algeria—Iron 834
Algoma, Minn. 464
Alien Property Custodian 532
Alkalinity, Available, in lime.... 739
Allen, A. C. Teaching engineers economics 366
Allen, A. W....674, 850, 891, †890, 1019
—Compound air lift *436
—Defining "tailings" and "residue".... 317
Flotation process 97
Fluid ton 16
—Metallurgy of gold 92
—Mill and cyanide handbook....†208
—Milling in cyanide solution 22
—Notes on ore dressing 100
—Precipitation of gold by charcoal....516
Allen, J. R. 891
Allen, R. C. Mineral products in Mich....†723
Allied Divide, Nev.... 638
Allied Mach. Co. of Amer.... 978
Allied Metals Co. 103
Alling, H. L. 148
Allison Ranch, Calif. 293, 1063
Allocating surplus explosives 761
Allouez, Father 207
Allouez Mining Co....168, 300, 426
—Dividends 25, 626
—Production ... 35, 169, 213, 381, 551, 727, 937
Alloys, Aluminum 698
Alsace—Potash 585, 989, 1093
Alta Consol Utah 294, 811, 812
Alta Lake, B. C., limonite.... 197
Alta Mining, Mont. 74
Alta, Utah 179
Alto, Ariz 981
Alto Divide, Nev. 426, 638, 854
Alumina—Recovery from alunite.... 388
Aluminum alloys 698
Aluminum and the war 228
Aluminum Ore Co. 548, 913
Aluminum Potash Co. of Amer. 938
Aluminum Precipitation 94
Price 1895-1918 352
Alunite problem 388
Amalgamated Miners' Asso., Australia 902
Amalgamated Pioche M. & S. Corp., Nev.. 852
Amalgamated Silver, Mont 638, 727
Amalgamation—Gold 93
—Silver 93
Amazon Dixie, Ida 426, 895
[illegible], Ida. 425
American Abrasive Metals Co. 1081
American Assn. of Petroleum Geologists . 460
American Assn. of Pig Iron Mfrs. 202
American Atmos Corporation 290
American Bauxite Co *1074
American Blower Co 507, 935
American Bureau of Welding 891
American Cement Co 1019
American Chem. & Industrial Co. 426
American Chemical Society 547, 967
American Consol., Utah 1022
American Eagle, Utah 552
American Electro Chemical Society 669
American Engineer. Mexico from within.. 530
—Mining in Mexico *175
American Engineering Standards Asso....1091
American Exped. Force School 1006
American Federation of Labor 508
American Fork Explor. Co., Utah 75
American Gold Committee 277
American Gold Dredging, Calif.... 72
American Graphite Co. 281
American Inst. of Chem. Engrs. 1060, 1100
American Inst. of Electrical Engrs.... 978
—Denver Section 378
—Edison medal award 953
American Inst. of Mining & Metall. Engrs. 251, 500, 634, 724, 768, 850, 891
Annual meeting 202, 414
—Annual report 373
—Chicago meeting 1012
—Columbia Section 167
—Mont. Sect. 336, 891
—N. Y. Section 885, 1100
Program 283
—Officers *487
—Papers 351, 358
—R. W. Raymond *135
American Manganese Mfrg., Minn. 73
American Manufacturers' Export Assoc. .. 675, 724
American merchant marine. Editorial 629
American Metal Co....82, 239, 532
—Sale of stock 669
American mine, N. Y. 148
American Mineral Co., Vt. 75
American mineralogist 210
American Mining Congress 33
—Address of B. Wells 489
—Ala. Chapter 883, 893
—Ariz. Chapter 210, 1102
—Calif. Chapter....168, 238, 329, 423
—Colorado Chapter 211
—Editorials 457
—Mo. chapter 212
—Okla.-Kan.-Mo. Branch 292
—Papers 364
—Unemployment 408
—Utah Chapter 769
—War Minerals Division 163
American Oil Co. 549
American Petroleum Inst. 670
American Petroleum, Tex. 728
American quicksilver industry 878
American Relief Administration 1048
American Smelters Securities Co. 54
American Smelting & Refining 54, 71, 110, 153, 158, 182, 219, 239, 382, 461, 679, 851, 855
—Annual report 606
—Chihuahua smeltery 871
—Dividends 25, 285, 626, 801
—Moebius refining process *789
American Soc. of Civil Engrs. 336, 591, 674
American Soc. of Mechanical Engrs. 167, 500, 674, 891
—N. Y. Sect. 460
American Society for Testing Materials 674, 891
American Spelter Co. 58, 961
American Spiral Pipe Works 978
American Steel & Wire, Penn. 961
American Tin & Tungsten Co. 75, 510
See also "American Tin."
American tin slag analysis 576
American Tin, S. D. 552
American Trona Corp. 125
American Vanadium Co. 149
American Welding Society 507, 634
American Zinc Co. of Ill. 961
American Zinc Institute 168, 543, 850
—Annual meeting 1095
American Zinc, Lead & Smelting Co. 58, 158, 807, 961
Annual report 798
Dividends 456, 1012
American Zinc Products Co. 73, 312
Americanization. Editorial 333
Amidon, C. E. 724
Ammonia leaching, Copper ores 1162
Amparo Mining Co. 112
Annual report 969
Dividends 456, 1012
Amperage for induction motors.... 764
Ampere efficiency in copper refining....*743
Anaconda Copper Mining Co. 74, 86, 158, 211, 291, 294, 426, 551, 808, 811, 937, 979, 1064, 1101, 1104, 1181
—Accidents 676
—Annual report 968
—Bond issue 170
—Bonus system 885
—Contract system 851
—Copper concentrating mill 1128
—Curtailment 676
—Dividend reduced 635
—Dividends 456, 1012
—Fume dust collector 91
—Furnace arm carriage *369
—Labor 635

Page
Anaconda Copper Mining Co.—Continued.
—Levine's attack 578
—Non-producing properties closed 635
—Production 70, 340, 371, 510, 541, 762, 892, 907, 1092
—Rod and wire mill *747
—Shareholders pamphlet 234
—War minerals claim 800, 1053
—Washoe Smeltery 678
Analyses—Graphite ores 709
—Time limits 241
Anarchy in Mexico 219
Anchor bolt securing 15
—Setting with sulphur *708
Anchor, Ida. 213
Ancon Oil Co., Ecuador 942
Anderson, A. E. 251
Anderson Apache Copper Mining, N. M. 854
Anderson, L. D., photo *951
Anderson, R. J. 507, 674
—Ferro-alloys in 1918 83
Andes Mining Co. 514
Andrews, F. H. 210
'Andy man (Poem) 459
Angelica, Mont. 170, 594
Anglo-French-China Corp. 445
Anna Beaver, Okla. 214, 638
Anniston Steel Co. 851, 1088
Annual review 39
Anthracite. See "Coal."
Anti-trust legislation 667
Anticlinal theory and quicksilver *916
Antimony—Canada 618
—China 273
—Data compiled 502
—Price, 1895-1918 352
  1918 64
—Review, 1918 64
—U. S. 502, 542
  Imports and exports 619, 884, 1031
Antofagasta, Cia. de Salitres de 266
Anvil, Ariz. 677
Anzac, Ont. 812
Apache R. R., Ariz. 252
Apex rights 379
Apex Standard, Utah 938
Apex suits—United Eastern vs. Tom Reed 549, 936
Applebey, M. P. Titration of copper 242
Application of mine shoveling 545
Aragon, Mich. 1021
Arc welding, Electric *743
Arcadian, Calif. 727
Archibald, W. M. 315
Argentina—Commerce and mining 628
—Fuel developments 950
—Minerals 502
—Mining, 1918 117
—Petroleum 950
Argonant Mining, Calif. 169, 213, 425, 463, 727, 769, 811, 981, 1021
—Dividends 25, 626
—Fire 635, 1061
Argonne, Ariz. 894, 937
Ariadne, Colo. 339
Arica, Chile.—Smeltery 212
Arizona Binghamton Copper Co. 637
—Copper Queen suit 770
—Dividends 285
Arizona Commercial, Ariz. 293
—Annual report 970
—Iron Cap suit 462
Arizona—Copper 168
  Deposits 689
  Review, 1918 49
Arizona Copper Belt 213
Arizona Copper Co. 71, 425, 669, 810, 894, 1103
—Annual report 583
—Five day week basis 592
—Production 371, 381, 541, 762, 917, 1092
Arizona, Deportation suits 852
Arizona Desert M. & M. 381
Arizona—Freight rates 953
Arizona Hercules Copper, Ariz. ..425, 551, 894
—Plant *1117
Arizona—Iron
  Magmatic ore *353
—Labor 243, 291, 379, 423, 461, 509, 592, 944, 1020, 1101
  Wage schedule 1009
—Law 337, 423, 508, 635, 980, 1178
Arizona Middlemarch Copper, Ariz. 937
Arizona—Mineral locations 906
—Miners' Home 291
—Mining, 1918 103
Arizona Mossback, Ariz. 1103
Arizona Ore Reduct. Co. 71
Arizona—Petroleum 1055
—State smelting plant 252
Arizona Tax Commission 885
Arkansas—Bauxite *1074
—Mining, 1918 106
—Zinc 212, 1170
  Zinc camp *607
Arkansas Zinc & Smelting Corp. 58, 961
Arkins & Grant, Wash. 594
Arko Mining, Minn. 74
Arlington, B. C. 36
Armitage, P. Depletion of mineral deposits and income tax 750
Armsby, Mr. 287
Armstead Mines Corp., Ida. 73, 509
Armstrong, L. V. 724
Army gas masks in sulphur dioxide atmospheres ....*693, (erratum) 801, 1008

Page
Arnold, R. 934
Arsenic—Canada 618
Arsenic in 1918 86
—Refining 263
—U. S. Regulations 23
  Review, 1918 86
Artificial limbs *529
Asbestos and Mineral Corp. 51, 183
Asbestos—Canada 183, 618
Asbestos Corp. of Canada 592
—Dividends 801
Asbestos industry 51
Asbestos, Quebec 252
  Mills *1042
  Mining *570
  1918 587
  Views *830
Asbestos, Review, 1918 51
Asbury vs. Hecla Mining 441
Ash Peak, Exten., Ariz. 169, 425
Ash Peak Mining, Ariz. 894, 169
Aspromet Co. 336, 675
Assay office, U. S 994
Assayers wanted 944
Assaying—Minor economies 241
Assessment law, Ida. 34
Assessment work relief, Alaska 243
Associated Goldfields, Ont 638, 772
Associated Mfrs. of Merchant Pig Iron .. 202
Associated Oil Co., Calif. 146
Associated, Okla. 36
Association of Twenty Seventh Engrs. See "Twenty."
Atchison, Topeka R. R. 882
Athabasca River, Ont., salt. 1102
Athletic Mining & Smelting 961
Atlas M. & M., Colo 552, 1102, 1130
Atlas Powder Co. Cost of explosives 12
Atolia Tungsten, Calif 593, 677
—Dividends 25
Atwater, M. W. 33
—Death 1060
Atwood, N. M. 170, 254
Aurocyanide adsorption 518
Austin-Ameron., N. M. 170
Austin, J. S., death 507
Austin, O. P., Prices 713
Australasia in 1918 121
Australia—Copper 738
  1918 122
—Gold 121, 293, 738
—Impressions of 5
—Labor 6
  Union demands 902
—Mining 204, 490, 845
  1918 121
  1919 244
—Peace effects 11
—Trade with 715
Automatic car-dumper *1087
Automatic feeder for Lane mill *759
Automatic ore-pulp sampler *412
Auxiliary hoist for traveling cranes 653
Auxiliary power-plant requirements 647
Available alkalinity in lime 739
Available shipping. Editorial 848
Average price of metals, 24 years 352
Aztlan, Ariz. 1063

B

Babine-Bonanza, B. C. 36
Baca Float, Ariz. 593
Backus & Johnston—Production 371, 541, 672, 917, 1092
Bacon, C. V. 674
Badger M. & D., Mo. 551
Bailey, G. H. 1169
Bailey Meter Co. 768, 1100
Bailey, Ont. 170, 594, 896
Bain, H. F. 891
Baker, F. D. 167
Baker Lead Co., Mo. 133
Balaklala Consolidated Copper 294
—Mammoth Copper suit 883
Bald Dave, Ark 213
Baldwin, Ont. 1064
Ball, Ark. 213
Ball-milling 101, *151
—Flotation and 453, 708
Ball, S. H. Magmatic iron ore, Ariz. 353
Ballooning—Helium 273
Baltic, Mich. 340, 772, 879
Baltimore, Mont. 937
Bamboo roads, Burma 11
Banca—Tin 955
Banks, J. H. & Son 978
Bannack Mining & Milling, Mont. 74
Barbour, P. E. 167, 460, 891
Barker, E. E. 547
Barker, R. E. 724
Barkley, J. F. Measuring gas temperature .. 608
Barnes, C. S. Platoro-Summitville, Colo ... 999
Barnes-Hecker, Mich. 937
Barnes King, Mont 105
—Dividends 456, 1012
Barneveld, C. E. Van. Sulphur dioxide method .... †335
Barney Copper, Ariz. 1179
Barron, C. W. 334
Barron, G. O. 373
Barry, E. P. 378
Barstow Mine, Colo. 1179
Bartlesville Zinc Co., Okla. 58, 961
Base-metal thermocouples, Calibration ..442, 579, 707

Page
Base metals. Price, chart 1916, 1918
Basic refractory sources 648
Bastin, E. S. 160, 345, 624
Batchelder, J. N., death 547
Bates, B. R. Conditions in Mexico 837
Bates, L. W 691
Batesville district 212, 549
Bauxite—Ark. *1074
Bawdwin Mines, Burma 1182
Beach, Ariz. 593
Beam, T. W., death 460
Bear Creek, Ida 771
Bearden, Ark. 381
Beaudry, W. 674
Beaver Consol, Ont 812, 896
—Production 340
Beaver River Power Co., Utah 211
Beck, Okla. 594, 678
Becker, G. F., Career and death 768, *836
Becky Sharp, Colo 509
Beer, Sondheimer & Co 532
Belcher, Colo. 213
Belgium—German destruction 476
—Industrial situation 24
—Iron 1070
—Reconstruction 546
Bell Asbestos Co., Que 592
Bell Boy, Mont 170
Bell, R. N. Mine ventilation, Coeur d'Alenes 603
—Mining in Ida., 1918 236
Bella Union, Ariz 425
Belmont-Shawmut, Calif 35
Belmont Surf Inlet, B. C. 801
Belmont-Wagner Mining, Colo 35, 73, 1130
Belts, Conveyor—Reducing wear 498
—Repairs 1153
Belting and shafting 1132
Belts, Driving, Hair 490
—Paper 302
—Repairing *497
Ben Hur, Nev 638
Bendelari, A. E. Miami district, Okla 145
Bendelari, Kan. 678
Bennett, Minn. 727, 811
Bennett, R. B 768
Bernardi, Calif. 293
Bernhard, R. 908
Berry, E. S. 591
Bessemer Iron Co., Minn 74, 150
Bethlehem Mines Corp., Pa 800
Betson Plastic Fire Brick Co. 1060
Beulah, Ark. 463
Big Bell, Ark 339, 425
"Big Bend" situation 923
Big Bug Copper, Ariz 293, 937
Big Cave, Ark 381
Big Cottonwood Consol., Utah 36
Big Creek, Ida 340, 895
Big Elk Mining, Kan 678
Big Five, Colo 509
Big Five Mining, Utab 938
Big Four, Colo. 727
Big Indian Copper, Utah 75
Big Toad Mining and Milling, Colo. 73
Big Tunnel State, Calif. 593
Billiton tin, Java 1148
Bingay, T. W. 664
Bingham Amalgamated, Utah 36
Bingham Mines Co. 181
—Annual report 666
—Dividends 25, 626
Bins, Concrete underground 1071
—Steel storage 1075
Birch, S. 635
Birmingham district, Ala. 636
Bisbee. See Arizona.
Bischoff, W. 724
Biscomb, J., death 934
Bismuth—Calif. 587
—Price 102
—Review, 1918 102
Bituminous coal. See "Coal."
Black & Decker Mfg. Co. 873, 892, 1019
Black Bear, Ida. 1103
Black Butte, Ariz. 425
Black Cap, N. M. 938
Black Hawk, Calif. 593
Black Hawk, N. M. 36
Black Hawk Mining & Milling, Nev. 812
Black Lake Asbestos & Chrome, Canada 144
Black lists withdrawn 842
Black Rose, Colo. 853
Black Wonder, Calif. 593
Blackening sand in filters 1051
Bland, Ariz. 1021
Bland, J. Screening practice 1112
Blasting—Lowering dynamite into holes *925
—Manufacturing detonators 666
—Use and abuse of safety fuse 229
—Use of tamping bag 602
Blaylock, S. G. 315
Blewett Mining Co., Ill. 73
Bloomer Hill, Calif. 293
Bloomfield, M. Workers' right to choose .. 671
Blow of the drill bit *735
Blower, Turbo 557
Blowers—Valve control *411
Blue Bird, Mont. 937
Blue Bonnet, Mo. 1102
Blue Flag, Colo. 35, 169
Blue Grouse, B. C. 36
Blue Mounds, Kan. 637, 895
Blue Point, Calif. 425
Blue sky laws. See "Law."
Bluehill, Colo. 727

Page
Bluestone Mining & Eng., Nev. .. 74, 105, 594
Boalich, E. S. Appreciation of R. W. Raymond 362
—Marketing mine prospect 601
Boericke, W. F. Cost of zinc mining, Wis... 564
—Re-treating zinc tailings *524
Boggs, Ariz. 637
Bohn, Colo. 727
Boiler tubes—Cleaning *1032
Boilers—Economics *1032, 1125
Boilers—Measuring gas temperature........ 608
—Steam economics 449, 561
Boleo, Cie. du.—Production 36, 294, 371, 510, 541, 728, 762, 917, 1092
Bolger, S. D. 812
Bolivia—Mining, 1918 115
—Wolfram mining *597
  Production, 1908-1917 597
Bolshevism 166, 403
—Editorials 29, 931
—What is it? 276
Bolt, Anchor, securing 15
Bonanza, Calif. 811
Bonardi, J. P. 850
Bonney, N. M. 170, 254
Bonnie Bell, Minn. 594, 1064
Bonus system, Copper Queen 169
—Mont. 885
Boo-Gra-Loo Mining, Ark. 339, 608
Boras Leasing, Ariz. 1103
Borax—Calif. 801
Borcherdt, W. O. Estimating screen efficiency *651
Bordeaux sulphur market........ 909
Boright, S. H., death 33
Boston & Montana Devel, Mont. 74, 214, 382, 426, 594, 1104, 1181
—Footage cost 829
Boston Elvins Lead, Mo........ 133
Boston-Hecla, N. M. ..170, 254, 728, 812, 854, 896, 1181
Boston-Pioche, Nev. 426
Boulder Ore Sampling Co., Colo........ 771
Bounds, N. M. 170
Bourkes, Ont. 170
Bowden vs. Gold Hunter 264
Bowen, N. L. 167
Bowles, O. Rock quarrying........ †335
Boy Scouts. Editorial 1098
Boyd, J. Sampling of dust........ *395
Boyer, T. W. 168
Bradburn, Utah 254
Braden Copper Co. 25, 114, *874
—Pangal power project........ *192
Bradley, F. D. Replacing Oliver-filter shafts 198
Bradley, O. U. 724
Bradley, W. W. Calif. Minerals, 1917........ †335
—Quicksilver, Calif. 703
Bradshaw Reduct., Ariz........ 293
Brady, Ariz. 637
Brakpan Mines, So. Afric........ 120
Braley, B. It can be done........ 804
Brandy City Mining, Calif. 72
Brass melting .... †506
Bray, Mich. 853
Brazil—Diamonds 756
—Gold export 877
—Iron 792
—Manganese 1902—1917 716
—Mining, 1918 117
Breaking rock, small mills 1141
Breaking up concrete 1041
Breathing apparatus, Permissible........ 745
Breitung & Co., Minn........ 73
Brewer, C. 674
Brewer, W. M. 662
Briggs, C. J., death 251
Briquetting plant, Ont. 509
Britannia Copper mine, B. C. 662
British. See "United Kingdom."
British America Nickel Corporation 76, 109
British Columbia Chamber of Mines 292, 380
British Columbia—Coal 110
—Copper 462
—Electric smelting of iron ore........ 224
—Gold 894, 1036
—Iron 292
  Electric smelting 224
—Labor 508, 753, 1063
—Land 508
—Magnetite 726
—Mine inspection 424
—Mineral production 1918 320
—Mining, 1918 110
—Northeast district 661
—Ore testing plant 34
—Platinum 409
  Source 303
—Smelting rates 212, 292, 380
—Transportation 550
—University 726
British Empire—Molybdenum 625
British import restrictions........ 715, 1055
British Malaya—Labor 473
Britton, H. E. V. 2
Broderick, T. M. Magmatic iron ore, Ariz. *151
Brodie, W. M. Petroleum in Ecuador........ *941
Broken Hill, Australia—Labor 902
Broken Hill Prop., Aus. 6, 122, 253, 463, 1179
Broken Hill South Silver Mining, Aus. ... 122
Bronze alloys—Melting by electricity ... 321
Brooks-Snyder, Colo. 213
Brotherton, Mich 510
Brougher Divide, Nev ... 426, 552, 854, 860
Brown, A. W. 1098

Page
Brown, G. C. 934
Brown-Head, Kan. 551
Brownbake Mine, Wash. 1022
Brownlie, D. 449
Bruere, H. 167
Bruere, R. 186
Bruhl, P. T. Lime as settling agent........ 1089
Brunton, F. K. 251
Brunton transit *620
Brush Creek, Calif. 895
Brush, E. Silver in 1918 41
Bryant, F. B. Cutting timber with jackhamer 758
—Spitting fuse in wet shaft 620
Buchanan, J. R. 378
Bucket, Orifice, for measuring water........ *580
Buckhorn, Ariz. 425
Bucking apparatus, Mechanical........ *641
Budd, R. 591
Budelman, H. D. 251
Buehler, H. A., Chats from zinc mines.... 388
Buffalo Hunter Mining & Milling, Colo. .. 73
Buffalo-Kirkland Ont........ 594
—Production 254, 340, 464, 552
Buffalo Oil & Gas, N. M. 896
Buildings, Standard *952
Bulgaria—Copper 273
Bulkheads on the Rand *538
Bully Hill Copper Mining, Calif. 72, 771
Bunker Hill & Sullivan, Ida. 54, 55, 73, 89, 236, 291, 337, 593, 893, 1181
—Mine ventilation 603
Burbidge, F. 210, 674
Burch, A. 238, 634
Burch, H. K. 1060
Burcham, W. D. Quicksilver, Texas, 1918.. 145
Burdick, C. A. 850, 891
Bureau of Mines 979, 1020
—Accountants wanted 801
—Editorial 28
—Engineers wanted 543
—Jones process 1179
—Metal situation 540
—Mine-dust sampling 950
—New buildings 929
—Oil conservation investigation 972
—Pittsburgh Experiment Station........ *899
—Salt Lake City meeting 929
—Utah station 423, 635
—War record 3
Bureau of Mining and Commerce, Colo. .. 725
Burger, Calif. 339
Burgess, J. A. 1060
Burgren, A. W. 336
Burma—Bamboo roads 11
Burma Corporation, Ltd.—Annual report.... 356
Burma Mines, Ltd. 426
—Operations *257, *274
—Sanitary engineering *289
Burma—Mining conditions........ *257, *274
Burnside Mines, Ont. 76, 254, 510, 552
Burr, F. F., Gems in Maine 911
Burr, W. A. 167
Burrage, R. H., 27th Engineers........ *731
Burrell, G. A. 290, 1177
Burroughs, A. H., Jr. 934
Burt, W. R., death 547
Burton-Munroe, Ont. 896
Business as usual. Editorial 672
Business for engineers 842
Business Men's Clearing House........ 838
Business opportunities in France........ 706
Business training for engineers........ 585
Bustamente, M. Petroleo en la Republica Mexicana .... †889
Butchart, W. A. 460
Butcher, P. E. 724
Butler, G. M. 1019, 1100
—Handbook of mineralogy .... †298
Butte & Platus, Calif. 892
Butte & Ramsdell, Mont. 1181
Butte & Superior Mining 464, 594, 811, 885, 937, 1064, 1104, 1181
—Annual report 799
—Clark Montana suit 508
—Minerals Separation case 97, 337, 617
  Decision 1013
    Text 1044
    Editorial 1057
—Production 170, 382, 510, 895
—"Profits" statement 244
—Quarterly report 15, 582, 1086
—vs. Clarke-Montana Realty Co........ 231
Butte Copper & Zinc 158, 811, 982
Butte district, 1918........ 49
Butte Kansas Mining, Mo. 1020
Butte—Labor. See "Montana."
Butte Main Range, Mont. 678
Butte Metal Mine Workers' Union........ 380

C

C. C. & B., Mo 170
C., J. M. Capital for small investors........ 537
Cable clamp, Mathews *191
Ca eras, F. G. 724
Cacharamba, Mex. 854
Cadmium in the war 909
Caetani, G. 2, 674
Cageway gate *451
Calaveras Copper, Calif. 425, 593
Caldo Mining, Utah 180
Caldwell Fall 1012
Caledonia Mining Co 34, 893
—Dividends 25, 285, 456, 626, 801, 1012
Caledonian M. & M., Colo 35, 463

Page
Calibration of base-metal thermocouples.. 442, 579, 707
California, Bismuth 587
—Borax 801
California Calaveras, Calif. 463
California—Cement 801
—Chromium 515
—Gems 531
—Industrial Accident Comm. 210, 229
—Labor 167, 979, 1173
—Law 379
—Magnesite 564
—Manganese 515
—Minerals, 1918 .... 587, 801
—Mining, 1918 103
California National Gold Mining........ 72
California—Petroleum 291, 379, 549, 725, 892, 979, 1011, 1061
  Oil fields report 808
  Ownership of lands 146
  Prices 1178
  Proved territory 587
  Review, 1918 146
  Simi Valley 913
California Placer, Calif. 593
California—Platinum 35
—Pyrites 801
—Quicksilver 703, 1020
  Review, 1918 56
—Tungsten 508
California University 423
—Bureau of Occupations 285
Callaway, S. D. 724
Callbreath, J. F. 238, 457
Callen, A. C. 674
Calliope Consol. Mining, Colo........ 73
Calloway, F. 716
Calumet & Ariz., Ariz. 293, 337, 339, 425, 770, 852, 893, 953
—Annual report 711
—Dividends 25, 626
—Production 169, 509, 677, 762, 917, 1092
Calumet & Hecla Mining Co. ..73, 169, 212, 253, 294, 300, 340, 462, 1062, 1103
—Dividend passed 636
—Dividends 25, 626
—Production 35, 213, 371, 381, 541 551, 727, 762, 879, 917, 937, 1092
Calumet & Jerome 253, 425, 551
Calumet Mining, N. M. 74
Calumet-New Mexico, N. M. 254
Cam economies 1125
Cameron, F. 934
Cameron, W. H. 507
Camp Bird, Colo........ 285
Camsell, C. 197
Canada—Advisory Council for Sci. & Indust. Research 212
—Asbestos 183
—Chrome 4
  Review, 1918 144
Canada Copper Corporation 75, 464, 896
—Interim report 270
—Production 321, 371, 541
—Tunnel driving, Copper Mountain *567
Canada.—Gold 509
—Imperial Munitions Board 212
—Industrial Relations Comm. 930, 963
—International relations 308
—Iron bounty 34, 338
—Land grants 212
—Law 306
—Metal importation 726, 1171
—Mineral production, 1918 618
Canada Mining Corp. 1048
Canada Oil & Venture Co., Wash. 854
Canada—Silver, price 665
Canadian Copper Co. 550
Canadian Kirkland, Ont........ 982
Canadian Mining Inst. 167, 807, 955
—Annual meeting 491
—B. C. Branch 922
—Ottawa Branch 934
—Papers 308
Canadian National Clay Pro. Assoc. 1019
Cananea. See "Greene Cananea."
Cananea Consol. Copper (See also "Greene") 214
Canby, R. C. Butte & Superior decision ..1013
Candelaria, Nev. 214, 552
Canisteo, Minn. 937
Cap-Rock, N. M. 170
Cape Copper Co. 352
Capital for small operators 537
Capital—Nature and uses in mining 780
—Editorial 802
Capitol Mining, Utah 1022
Car dumpers *991
—Automatic 1087
Car, New mine *1088
—Standardization *220
Caracristi, C. F. Z. Magnesite, Island of Margarita *645
—Mineral industry, Venezuela 438
Carbide lamp *278, *818
Carbon dioxide determination........ *709
Carbonate Hill, Ida. 853
Carbonero, Colo. 677
Carborundum Co. 1113
Cardenas, A. 967
Cardiff, Utah 170, 254, 678, 938, 982
Cardwell, W. 547
Cariboo, B. C., placer operations........ 1035
Caribou, Colo. 213, 339
Carlat Mining, Mo 678
Carleton, A. E. Iron ore in Celebes 741
Carlisle, H. C. 768
Carlotta-Pennsylvania, Calif. 895

Page
Carlyle, E. J. 807
Carnotite—U. S. 453
Carolina, Mo. 937
Caron process 102
Carpenter, J. A. 807
—Divide district *859
—State insurance, Nev. ...*985 Editorial, 1015
Carpenter, R. C., death 290
Carranza's oil land policy 871
Carrier, C. F. 669
Carrigan, M. J. 660
Carroll, F. 1100
Carroll, J. 880
Carruthers, J. A. Economies in mine power plant *1032
Carson Hill Gold Mines, Calif. 461
Carson Lake, Minn. 772
Cartridges 714
Cascade Silver, Mont. 74, 1104
Case hardening process, Shimer.... 602
Cash Boy, Nev. 214
Cashin, Colo. 339
Casler, E. T. 634
Caspario Stone Co., Md. 828
Cassiar Crown Copper, B. C. 214, 254
Casson, H. N. on J. R. Clynes 203
Castle Butte, Ariz. 771
Castle Dome, Ariz. 1021
Cates, L. S. 373, 1100
Cathodes—Moebius process *789
Cavanaugh vs. Corbin Copper Co. 519
Cavers, T. W., photo....*951
Celebes—Gold 1070
—Iron deposits 741
Cement—Calif. 801
—Rock quarrying for ....†335
Cementation, Francois process 120
—Mine shafts 199
Census—Mineral industry 882
Centennial Eureka, Utah 36, 254, 638, 938, 1064
Centennial, Mich.—Dividends 25
—Production....35, 213, 169, 381, 551, 727, 937
Center indicator *279
Central Alabama Coal & Iron Co. 71
Central America, Mining, 1918 113
Central Eureka, Calif. 213, 293, 425, 551, 727, 811, 1103
Centrifugal pumps—Air booster 757
Centrifugal separators, Mauss *862
Cerro de Pasco.... 214
—Dividends 25, 626
—Production 170, 371, 382, 510, 541, 762, 772, 917, 938, 1092
Cerro Gordo, Calif. 1021
Ceylon—Graphite 15, 627
Chamber of Commerce of U. S. 591, 935
—Anti-trust legislation 667
—Principles of industrial relations.... 754
—Soldier employment 911
Chamberlain, G. W. 1100
Champion, Calif. 637
Champion Copper Co., Colo. 168, 463
Champion, Mich. 879
—Dividends 285
Chaney, L. W. Safety movement in iron and steel ....†208
Change house—Internat. Nickel Co. *431
Change in Mexican policy. Editorial....1098
Channing, J. P 394, 586, 841
—Labor and reconstruction 200
Chapman, G. A. 850
Charcoal—Gold precipitation 93, 516
Charcoal Iron Co., Mich. 73
Charging precipitate device *1051
Charlton, D. E. A. 1060
—Mine physician 579
—Parting gold-silver prices 710
—Playing the game 334
—The 'andy man 459
Chase, F. D. 724
Chateaugay Ore & Iron, N. Y. 74
Chatham, Mich. 510
Chats from zinc mines 388
Cheap leaching of gold-ore tailings.... 226
Cheever, N. Y. 464
Chemical Alliance 240, 336
Chemical Warfare Service 761, 1050
Chemico-metallurgical industries Power in 479
Chemistry—Copper-smeltery slag *815
Chemistry, Everyman's ....†209
Chemists' Club 1060
Chenneour, R. J. 674
Chestatee Pyrites & Chemical, Ga. 73
—War minerals claim 716, 761, 927
Chester, Minn. 1064
Chicago Belle, Colo. 1103
Chicago-Boston, Ida. 253
Chicago Mine, Colombia 613
Chicago Pneumatic Tool Co. 807, 1061
Chief, Ariz. 771
Chief Consol. Mining Co., Utah 75, 148, 181, 214, 382, 638, 982, 1182
—Bd. of Equalization report 854
—Dividends 456, 728, 1012
—Production 294
—Quarterly report 970
Chihuahua, Mining in 871
Chile Copper Co. 113
—Production 371, 541, 552, 762, 917, 1092
—Quarterly report 416
Chile—Mining, 1918.... 113
—Nitrates 115
  Pampa *385
  Review, 1918 265
    Imports and exports 244
—Saltpeter 386
—Tacna-Arica controversy.... 114

Page
Chilean nitrate industry, 1918 265
Chillagoe Co., Australia 794
China—Antimony 273
—Gold, Yangtze River....*1069
—Iron 231
—Tin, exports 445
—Tungsten 273, 123
China's richest iron mine 231
Chino Copper Co.....36, 106, 158, 938
—Annual report 494, 797
—Dividends 25, 626
—Production 170, 340, 371, 541, 552, 762, 917, 1092
—Quarterly report 1085
—Views *1082
Chippewa Iron, Ky 637
Chloride Queen, Ariz. 253, 1021
Chloride Tunnel, Ariz. 1021
Choctaw Chief, Okla. 638
Christensen, A. O. Steam economics.... 707
Christie, L. R. Driers in ore-drying....1144
Chroman, Calif. 253
Chrome—Canada 4
  Review, 1918 144
Chrome ore in 1918 81
Chrome-ore situation 280
Chrome—Quebec 252
—South Africa 1080
—U. S. 202
  Review, 1918 81
  Situation 280
Chromite—Canada 618
—Quebec 698
—U. S. 718
Chromium—Calif. 515
—Rhodesia 177
Chronology of mining 284, 456, 669, 843, 1054
—1918 69
Churchill, Ont. 812
Chute gate *369
Cinnabar—Jackson Co., Ore. *787
Circle, Mo. 895
Cisco, Ore. 678
Cities Service Co., Tex. 677
City Deep, So. Africa 118, 340
Civil service positions 1050
Clapp, C. H. 1060
Clark, Minn. 853
Clark Montana Realty Co. 508
Clarke, E. A. S..... 33
Clarke, Justice. Flotation decision....1044
—Editorial 1057
Classification—Hydraulic vs. screen....1115
Classification of engineers 966
Clay price reduced 624
Clear Creek & Gilpin Ore, Colo. 213
Clendenin, J. 210
Cleveland Cliffs Iron Co., 73, 294, 594, 937, 1102, 1181
Clevenger, G. H. 33, 1177
Cliff, Mich. *299
Clifton-Morenci-Metcalf districts 211
Clifton Porcupine, Ont. 938
Climax Molybdenum Co., Colo. 73, 82, 154
Clips on starting sheets 191
Cloncurry, Australia 302
Closing down mine problems 630
Cloth screening 1114
Clynes, J. R. 203
Coahuila Lead & Zinc, Mo. 508
Coal—B. C. 110
—Canada 618
—Consumption, Electric stations.... 613
—Geology and economics by J. R. Finlay.. 945
—Gt. Br. 352
—Mine fatalities, 1918 954
—Paleozoic fields.... 948
—Preparation and utilization 664
—Pulverized 692
—Pulverizing mill *151
—Queensland 953
—Russia 1049
—U. S. 329
  Bituminous 329, 625
    Review, 1918 43
  Statistics 949
Coard mixer *643
Coates & Tweed, Minn. 74
Coats, J. F. 674
Cobalt—Canada 618
—Ont. 168, 1096
Cobalt, Ont., labor 1173
Cobalt silver ore smelting 263
Coeur d'Alene Antimony Mining Co. 73, 294
Coeur d'Alene district 211, 676, 1020, 1101
—Labor. See "Idaho."
—Production, 1917-1918 893
- -Review, 1918 55
Coghill, W. H., Experimental flotation flask 1090
Coke—U. S., 1918 .... 43, 329
Colburn, C. L..... 674
Colby, A. L. 634
Colcord, D. H. Water-power development..699
Cole-Goodwin, Ariz. 381
Cole, T. F. 290
Cole vs. D. C. & E. Mining Co. 8
Collaring machine, movable *621
Collins, Mineral enterprise in China 537
Collins, G. E. Mining, Colo., 1918.... 152
Collins, G. N., death 290
Colloid state from electrical standpoint.... 696
Colloidal metals 354
Colloids in flotation 99, 453
—Mauss separator *862
Collord, G. C. 934

Page
Colombia—Guamoco district *513, *609
—Labor 609
—Mining, 1918 117
Colorado—"Blue Sky" laws 168
Colorado Central Mining Co. 73
—Description of plant *397
Colorado Chemical Co. 1130
Colorado Consol., Utah 809
Colorado—Dredging operations 884
Colorado Engineering Council 1056, 1100
Colorado Fuel & Iron Co. 196
—Annual report 712
Colorado—Labor....337, 424, 769, 808, 893
  Import from Mexico 34
—Law 168, 424, 401
—Lead-zinc mill *397
—Licensing of Engineers 843
—Manganese 380
Colorado Metal Mining Assoc. 211
Colorado—Metal mining fund 424
—Mines and Mining Committee.... 168
  Mining, 1918 .... 104, 152
Colorado Pitchblende, Colo...213, 253, 667, 853
Colorado School of Mines 424, 1061
Colorado—Tungsten 424
Colorado, Utah 1564
Colorado Vanadium, Colo. 35, 1063
Colorado—War mineral producers 291
Colquhoun, J..... 167
—Tribute to J. Douglas 20
Columbus, Ida. 637
Columbus-Consol., Utah 180
Columbus Rexall, Utah 180, 214, 638, 854, 896, 1022
—Dividends 25
Colvocoresses, G. M..... 33
Combined Metals, Nev.... 938
Comet, Mont. 426, 937
Comins, W. H..... 934
Commerce and mining in Argentina. Editorial 628
Commerce Mining & Royalty, Okla. 145, 168, 593
Commercial, Ariz. 253
Commercial possibilities of oil shale....*217
Commons, J. R. Industrial goodwill....†723
Community Drilling Corp., Mo. 462
Community prospecting 726
Como Consolidated, Nev. 105
Compagnie du Boleo. See "Boleo."
Companhia Brazileria Diemantiera.... 756
Companhia Siderurgica Mineira, Brazil.... 371
Compasses 419
Compensation of engineers 966
Compensation to war mineral producers.... 625
Compensation vs. reëducation for cripples.. 474
Complex ore experimental treatment.... 913
Composite fuel 691
Compound air lift *436
Compressors, Air *1041
—Lubrication *392
Compton, J. 449
Comstock district, Calif. 635, 769, 979 1101
Concealed water pipe locating 867
Concentrate—Drying 100
—Jig Analyses, Okla.-Kan. 559
—Re-treatment 778
—Roasting and magnetic separation *1107
Concentration—Anaconda mill 1128
—Bunker Hill flow sheet 1147
—Economics of *775, 1146
—Empire table 453
—100-ton plant flow sheet 1143
—Iron 1171
  Editorial 721
  Mesabi *683
—Manganese ores 527
  Jones process 1179
—Selection of plant 1121
—Single vs. double deck tables 686
—Table covering 317
Concentrator—Idaho Continental 956
—Mine Lamotte, Mo. *775
—Quinn-Harrison *683
Concerning the mine prospect 376
Concessions, Mining, Siam 273
Concrete, Breaking up 1041
—Fence posts *796
—Impervious 242
—In mining. Editorial 1098
—Launder linings 880
—Underground works *1071
Concreting prospect drill holes 309
Condition of Bordeau sulphur market.... 909
Confidence Gold Mines, Calif.... 72
Congdon, F. T. 665
Congo Chief, Colo. 339
Congo, Compagnie Min. du.... 203
Congress Consol. Mines, Ariz. 213, 253, 593
Congress, Colo. 339
Congress in extra session. Editorial 931
Congress Mines, Ltd.—Annual report 396
—Dividends 456, 1012
—Production 254, 464, 552
Connecting Link Mining, Wis. 75
Conrad, H. V. Lubrication of air compressors *392
Conservation division 201
Consolidated Arizona Smelting..72, 90, 637, 981
—Annual report 1084
—Dividends 25
—Production 371, 541, 762, 917, 1092
Consolidated Copper Mines, Nev. ..36, 74, 214, 294, 464, 772
—Production 382

Page
Consolidated Interstate Callahan 423, 509, 727, 811, 893, 981, 1020
—Annual report 799
Editorial 630
—Statement 500
—Production 381
Consolidated Main Reef, So. Africa 880
Consolidated Mayflower, Nev. 36, 214, 291, 426, 1062
Consolidated Mining & Smelting Co. of Canada, 170, 197, 210, 214, 254, 382, 464, 552, 638, 662, 896, 938
—Annual report 314
—Dividends 285, 801
—Employees bond holders 677
—Smelting rates committee 212
—Trail Smeltery 34, 678, 753
Charges 922
Consolidated Nevada-Utah, Nev. 340
Consolidated Steel Corp. 167
Consolidated Virginia, Calif. 635, 769, 808, 1011, 1020
Consolidated Wilshire Mining, Calif. 72
Consolidating American engineering professions 13
Construction, New—1918 71
Consuls, Mining-engineer 882
Continental Silver, Calif. 937
Continuous twin-scoop loader *451
Contract system, Anaconda 851
Contracts, Informal 191
Control of ore-dressing operations 907
Converting Chinese white iron into foundry pig 475
Conveyor belts—Reducing wear 498
Conveyors—United Verde Exten. *151
Cook, R. A., death 251
Cooke, H. C. Geology of Montreal River 575
Coombs, R. 850
Cooper Union 138
Co-operation among small mines 367
Coöperation, Industrial 748
Co-operative mining, N. M. 678
Coördination of national employment 1050
Copper Age, Ariz. 937
Copper—Alaska 213, 894
—Ammonia leaching 1162
—Ampere efficiency in refining *743
—Ariz. 168
Deposits 689
Review, 1918 49
—Australia 738
1918 122
—B. C. 462
—Bulgaria 273
—Canada 618
Copper Canyon, Nev. 214
Copper Conference—Labor delegates 282, 326
Copper country mine inspectors *870
Copper—Determination in oxidized ores 335
—Determination of lead in 242
—Developments in. Editorial 331
—Economy in telephone 308
—France 844
—Govt. stocks, disposal 595
—Japan, exports 954
Copper King, Ariz. 169
Copper King, Ida. 426, 637, 1063
Copper Leaf, Utah 214, 594
Copper market. See "Copper—Price."
—Metallurgy, 1918 90
—Mich. 508, 676, 851, 897, 1020, 1062, 1102
Porphyry intrusions *299, 452
Review, 1918 50
Sales and production 973
—Mixed ores flotation 840
Copper Mountain, Tunnel driving *567
Copper—Nev., Yerington district 627
—Ontario 109, 1096
—Papua, Mining 448
—Price 595
Editorials 331
1918 48
1895-1918 352
—Production, by month 371, 541, 762, 917, 1092
Copper Queen Gold, Ariz. 71, 213, 293, 425, 810, 981, 1062
—Ariz. Binghamton suit 770
Copper Queen Consol. Mining, Ariz. 337, 423, 425
—Bonus system 169
—Heavy drilling *690, *700
Copper—Queensland 953
Copper Range, Mich. 340, 594, 853, 879
—Dividends 25
Copper—Refining Internat. Nickel Co. *429, *446
Copper refining works, List 46
Copper—Review, 1918 46
Copper-schist deposits, Ariz. 689
Copper situation 286, 844
—Slag, microscopic and chemical point of view *815
Editorial 848
—Research 1009
Copper smelting works, List 46
Copper—Titration with cyanide 242
—U. S. 542
Editorials 164, 376
List of smelteries 46
Market, 1918 48
Price. See "Copper Price."
Production, by months 371, 541, 762, 917, 1092
1918 371
Copper—U. S. (Ctd.)
Review, 1918 46
Situation 286, 844
Stocks 726
Imports and exports 240, 371, 372, 619, 762, 884, 917, 1031, 1092
—Venezuela 439
Mining 796
Copper World Exten., Wash. 75
Copper—World production 46
Cork-Province Mines, B. C. 75, 294
Cornell, I. H. 210
Cornell, R. L. 507
Corner guard *17
Cornwall—Tin mining 577
Corrosion, Pipe 480
Corundum—Canada 618
—U. S. 1918 911
Corwin, F. R., photo 951
Cost data handbook †723
Costa Rica—Mining 906
Costs—Copper leaching 1167
—Dredging tin, Siam 328
—Driving, Copper mountain 568
—Explosives 12
—Gold 1003
—Graphite, Alabama 195
—Homestake Mining 1145
—Iron mining 793
—Labor, Colombia 612
—Magnesite production, Margarita Island 647
—Mine footage, Boston and Mont. Devel. 829
—Mining, So. Africa 363
—Operating Colombia 613
—Pumping, Bunker Hill 479
—Roasting zinc ore 1111
—Smelting, electric, Iron, B. C. 224
—Supplies, Nipissing 1167
—Thawing water mains 604
—Zinc mining, Wis. 564
Cote, M. Power in chemico-metallurgical industries 479
Cotter, Ont. 464, 812
Cottrell, F. G. 334
—Perkin medal 202
Cottrell precipitator 1110
Cottrell process, Bolivia 116
Council of National Defence. Reconstruction Research Division 764
Courage to experiment. Editorial 720
Course of prices. Editorial 375
Coyne, A. F. 807
Crampton, T. H. M. Copper-schist deposits, Ariz. 689
Crane, P. E. 568
Cranes, Traveling—Auxiliary hoist 653
Cranston, R. E. 891
Crawford Mica, S. D. 1022
Credits to foreign purchasers 873
Crescent, Calif. 937
Cresson Consol., Colo. 509
—Dividends 25, 285, 406, 626, 801, 1012
Crews-MacFarlane, Ont. 294
Crimora Manganese Corp., Va. 75, 426
Cripples—Reëducation vs. compensation 474
Critic, Ariz. 425
Crocker, R. M. 634
Crockett Tunnel, Mont. 772
Croft, Minn. 637, 1021
Crouse, C. S. Calibration of base-metal thermocouples 442, 579, 707
Crowdus, J. W. 336
Crowe, T. E. 95
Crowell, B., photo *1
Crown Mines, So. Africa 363
—Shaft-sinking record 560
Crown Oil & Refining, Tex. 896, 938, 1022
Crown Point, Utah 36
Crown Reserve, Ont. 170, 854
Crown, Tex. 728
Crump, R., death 210
Cruse Consol., Mont. 638
Crusher, Rock, repairs 828, 1153
—60-inch gyratory *908
Crushing, fine, Ida. 1131
—Small mills 1141
Crystal, Calif. 35
Crystal Copper, Mont. 426, 811, 854, 1104
Crystals Goldsmith Co., Mont. 74
Cuba—Geological survey 764
—Manganese, Review, 1918 196
—Mining, 1918 111
Cubanite 377
Culbertson, W. S. International commissions 201
Cullen Renaud, Ont. 552
Cumming, J., death 336
Cummins, H. A. C. 736
Cunningham, C. 662
Cunningham, C. H. Petroleum in Mexico 1050
Curran, H. T. Examining the mine prospect *343
—Editorial 376
Current prices 173, 297, 467, 681, 857, 1067
Curves, Railway 530
Custer Peake, S. D. 1022
Cut-off in boilers 562
Cutler, B. S. Rehabilitation of Europe 800
Cutler-Hammer Mfg. Co. 316, *411, 695, 724
Cutting Mining, S. D. 75, 772, 896
Cutting, Oxy-acetylene 268
Cutting timber with jackhamer 758
Cuyuna Duluth, Minn. 981, 1021
Cuyuna Mille Lacs, Minn. 426, 464, 981
Cuyuna-Minneapolis, Iron, Minn. 73, 772
Cuyuna Sultana-Oneida Mines, Minn. 74
Cyanidation—Effect of air 522
—Flow sheet 1143
—Gold 226
—Lime as settling agent 1089
—Sodium sulphide in 95
Cyanide—Estimation of cyanogen in 710
—Fumigation *312
—Milling in 22
—Titration of copper 242
Cyanogen—Estimation in cyanide 710

D

Daily Arizona, Ariz. 293
Dakin, H. A. Disinfecting water 653
Daly, W. B. 1100
Daly West, Utah 179
—Dividends 285, 801
Dana, R. T. Handbook of cost data †723
Danger signals. Editorial 332
Dark Horse, S. D. 812
Data on installation of induction motors 764
Davidson Gold mines, Ont. 76, 464, 576, 594, 638, 812, 938, 1022
Davidson, W. H. 891
Davis-Daly Copper, Mont. 728, 811, 895, 937, 982
—Dividends 25
—Production 382
Davis, F. 891
Davis, J. E. 724
Davis, Mich. 772
Day, E. R. 980
Day interests 936
Day, J. J. 423, 534
De Arman, Kan. 551
De Beers, So. Africa 364
DeCamp, W. V. 422
DeKalb, C. 768
Deacon, Minn. 510
Dead Horse, Calif. 35
Deadwood, Colo. 811
Deadwood Lead & Zinc Mining, S. D. 75, 772
Dean, E. W. 902
Dean valve control *411
Death toll, 1918 43
Deep Blue Ridge Oil, Tex. 896
Deer Creek, Ida. 509
Deer Trail Mining, Utah 75
Defective mine drills 264
Defining "tailings" and "residues" 317
Del Mar, A. 167, 198, 203
Del Monte, Calif. 593
Del Norte Mining Corp., Calif. 593
Del Valle, R. A. 906
Denain & Anzin Steel Works, France 24
Denies acquisition of oil company 736
Denn-Arizona, Ariz. 381, 593, 1063
Denny Bros., Okla. 510
Denton, F. W. 591, 807
Denver, Calif. 213, 293
Denver Mining Bureau 337
Deoxidizing water 480
Depletion of mineral deposits and income tax 750
Deposits, Mineral, and income tax 751
Derivaux, R. C. 348
Derry Ranch Gold Dredging, Colo. 727, 884
Desert Power & Water Co., Ariz. 252
Design small metallurgical mills 1141
Design small zinc mill *1158
Desloge Lead Co., Mo. 133
Determination of available CaO in lime 739
Determination of lead in copper 242
Determination of molybdenum 242
Determining dissolved oxygen in water 241
Detonators, Blasting 666
Detroit Copper Mining, Ariz. 71, 894
Deutman, E. G. Roasting and magnetic separation, zinc *1107
Developing the mine prospect *343, 376
Development work 544
Developments in copper. Editorial 331
Devereux, W. B. 634
Devine, J. E. 982
Dewar, Sir J. 586
—Liquid oxygen 602
Dewey, Colo. 1063
Diamond-drill troubles *450
Diamonds—Brazil 756
—So. Africa 121
—U. S. 910
Diesel-engine plant 1123
Dietrich, W. F., Calibration of thermocouples 579
Differences in economic opinion. Editorial 28
Discharging water from mine plants 311
Diseases, Tropical †890
Disillusionment. Editorial 333
Disposal of nitrate stocks 413, 760
Distillate-engine plant 1123
Disinfecting water 653
Divide Annex, Nev. 638
Divide City, Nev. 638
Divide Consolidated, Nev. 426, 552, 854
Divide district, Nev. 549, 805
Descriptive article *859
Divide Exten., Nev. 426, 552, 854, 860
Dividends. See also names of companies 25, 285, 456, 626, 801, 1012
—1917-1918 127
Dixie Graphite, Ala. 550
Dixon, J. T., death 768
Dixon, Joseph, Crucible Co. 851
Dodd-Warren-Chapman, N. M. 678
Dodds Claims, Ont. 294
Doell, W. R. 634

Page
Doheny interests 146
Doing it now. Editorial 803
Dolly Varden Mining, B. C., 75, 462, 894, 980, 1020, 1102
Dolomite as refractory 648
Dome Extension, Ont 552, 812
Dome Lake Mining, Ont 76, 382, 464
Dome Mines Co., Ltd., Canada. 93, 214, 462, 594, 638, 728, 772
Dominion Reduction Co., Ont 1180
—Production 254
Dominion Steel Corp., N. S 76
Dondero, Calif. 593
Donkin & Stevens Co 507
Doolittle, C. H 674
Dormer, G. H 850
Dorr thickener—Froth removal 839
Douglas, J. Tribute 20
Douglas Mountain Copper, Colo 339
Douglas, W. 33, 850
—Copper production in Ariz 49
—Copper situation 844
Down Town Mines, Colo *1000
Downs, W. F. Alunite problem 388
Draeger. Oxygen Apparatus Co 290
Dragon Consolidated, Utah 254, 809
Dragoon Copper Lease, Ariz 677
Draper, F. W 3
Draper Mine, Minn 74
Drayer, C. E 1055
Dredging—Colo. 727, 884
—Costs, Siam 328
—1918 143
—Yuba No. 16 .... *915
—Yuba No. 18 752
Dressing of ores 100
Driers in ore drying 1144
—Lowden 100
—Sample *642
Drill holes, Concreting 309
Drill mounting, Jackhamer 758
Drill, Portable electric *873
Drilling—Blow of the drill bit *735
—Diamond drill troubles *450
—Editorial 766
—Making sharp drills effective 996
—Sacramento Hill, Ariz *690, *700
—Sprayer 965
—Tunnel driving, Copper mountain *567
Drills, Defective 264
—Stoping, Progress *964
Drinker, H. S 507
Driving belts, Paper 302
Driving—Costs, Copper Mountain 568
Droege, Ark. 35
Drucker, A. E 850
Drum Lummon Copper, B. C 75
Drummond, G. E., death 422
Dryfoos, H. R., death 460
Du Pont Chemical Co 1100
—Cost of explosives 12
Du Pont de Nemours Co 1075
Du Pont Powder Co 762
Dub. G. D. Preparation of crucible graphite .... †335
—"Skin-flotation," graphite 1052
Dudley, E. 807
Dufourcq, E. L. Career *929
—Death 768
Duluth Engineers' Club 210, 978
Duluth, Missabe & N R. R 74
Dumpers, Car *991
—Automatic *1087
Duncan, M. & M., N M 170
Dundee-Arizona, Ariz 35, 677, 853
Dunlap, O. A 378
Dunn, R. Mining in B. C 110
Duquesne, Ariz 637
Duro-Flake Graphite Co 453
Dust prevention 395
—Sampling mine air *395, 950
—Uses of respirators 472
Dutch East Indies—Gold 1070
—Iron 437
Dutch Guiana—Mining 963
Dutch-Sweeney-App, Calif 35, 461
Duties of engineers as citizens 619
Duties, Economic, of the engineer 184
Dutton, C. E. Ventilation for prospects *926
Dutton, F. Loco.-tractor transport system. 313
Dwight, A. S 2, 807, 891
Dwight & Lloyd sintering machine *744
Dyer, Rep 282
Dynamite—Lowering into holes *925

E

E., H. C. Reconstruction 200
Eagle & Blue Bell, Utah 464
—Annual report 666
—Dividends 626
Eagle Picher Lead, Okla .. 58, 145, 552, 851, 961
Earling, R. B 33
Early Indian raids in Mexico 477
East Butte Copper 464
—Dividends 25
—Production, 270, 340, 371, 510, 541, 762, 895, 917, 1092
East Divide, Nev 170, 426, 552, 854
East Divide Exten., Nev 938
East Eureka, Calif 637, 1180
East Kirk, Ont 1182
Eastern Milling, Que 76
Eastern Talc Co 126
Easton Car & Construction Co *228
Easton, S. A. Coeur d'Alene district, 1918. 55

Page
Easy Bird Mining, Calif 169, 593
Eaton, E. R 674
Eaton, S. F. Guamoco district, Colombia. *513, *609
—Editorial 631
Echo Silver-Lead Mining, Colo 771
Economic crime in tin. Editorial 287
Economic duties of the engineer 184
Economic Liaison Commission 624
Economic opinion, Differences. Editorial .. 28
Economics of coal 945
Economics of concentration *775, 1146
Economics, Teaching engineers 366
Economies in assaying 241
Economies in mill parts, So. Africa, report. 1125
Economies in mine power plant *1032
Economies in steam-boiler plants 449, 561
Economy Gold Mines, Mont 74
Economy, National. Editorial 1014
Ecuador—Manganese 794, 967
—Petroleum *941
Eddy, L. 290
—Ammonia leaching copper ores 1162
Edgar, Colo. 677
Edison medal award 953
Edith, Ark. 35, 213
Editorial Conference 713
—Papers 748
Edmunds, H. R 517
Edmondson, H. W 210, 422
Education and housing 865
Education, Engineering 564, 842
—Editorials 887
—Vocational. See "Vocational."
Edwards, A. J 167
Edwards Mining Co., Mo 212
Efanjay Gold Mining, B. C 76
Effect of air in cyanidation 522
Effect of mining patents 231
Efficiency. (Poem) 577
Eight-hour day defined 271
Eighty Five Mining, N. M. 74, 254, 340, 678, 728, 1022
El Dorado, Calif 981
El Oro, N. M 982
El Paso, Ariz 637
El Tiro, Ariz 293, 771, 1021
Elder Creek Chrome, Calif 72
Eldorado-Wisconsin, Calif. 895
Electric arc welding *743
Electric Furnace Assoc 675
Electric Furnace Co 210, 548, 1060
Electric furnaces. See "Furnaces."
Electric headlights on mine locomotives 741
Electric Point Mining, Wash 75, 426
—Dividends 801
Electric smelting of iron ore, B. C 224
Electric stations coal consumption 613
Electrical standpoint in colloid state 696
Electrical valve control *411
Electro-Metallurgical Co. 149
Electrochemical Industry Co. 190
Electrolytic copper refineries, N. A 47
Electrolytic refining, silver and gold *789
Electrolytic Zinc Co., Australia 5
Elevators—Repairs 1153
Elkhorn Queen, Mont 854
Elkoro, Nev 811
Ellingwood, C. O 978
Elliott, A. M., death 591
Elliott, Calif. 895
Elliott Kirkland, B. C 678
Ellis, H. I., death 336
Elm Orlu, Mont 508, 811, 1104
Elmer, W. W 674
Elson, H. J 675
Embargoes, Great Britain 1048
Emerald Isle Copper, Ariz 71
Emergency grouting with sulphur *279
Emery importation 928
Emery—U. S., 1918 911
Emma Copper, Utah 179
Emma Silver, Utah 1022
Emmons, W. H 592
—Anticlinal theory and quicksilver 916
—Geology of Yerington dist., Nev .... †1079
Empire concentrating table 453
Empire Copper, Ida 73, 237, 253
Empire Gas & Fuel, Tex 896, 982
Empire Mines & Investment, Calif 72
Empire Mines, Utah 809
Empire Pennsylvania, Calif 35
Empire State Mine & Reduct, Colo 463
Empire Line, Nev 812
Employees as stockholders 749
Employer's liability, Ariz 1178
Employment
—American Mining Congress 409
—Army officers 972
—Chemical Warfare Service 1050
—Engineers 244, 328, 502, 586, 749, 838
Employment Service 394, 437, 1050
Employment—Soldier and sailor 911
Emrich, C. T 290
Enemy trading list 670
Engels Copper Co., Calif 72, 425, 463, 509
Engineer and reconstruction 868
Engineer as citizen 616, 619
Engineer—Economic duties of 184
Engineer in politics. Editorial 418
Engineer in public life. Editorial 628
Engineer, Mexican situation 536
—Miner's carbide lamp 838
—Must the prospector go? 281
Engineer students' business training 585
Engineer units priority list 25

Page
Engineering a flight 976
Engineering and education 564, 842
Engineering Council
—Classification of engineers 966
—License Committee 312
—National Service Committee 262
—Public works department 586, 841
—Reconstruction Committees 394
Engineering education 564, 842
—Editorials 887
Engineering foundations 14
Engineering, Latin and Greek. Editorial .. 887
Engineering professions, Consolidating 13
Engineering Societies' Employment Bureau. 748
Engineering Societies' Library 14
Engineering Standards Assoc. See "American."
Engineers—Classification and compensation. 966
Engineers—Employment. 244, 328, 502, 586, 749, 838
Engineers honor Hoover 157
Engineers, Licensing 312, 843
Engineers, Mining, in the war *1
Engineers needed 626
Engineers' relation to public opinion 616, 619
Engineers represented in Washington 262
Engineers, Technical. Recognition 21
Engineers to aid reconstruction 488
Engineers to visit France 201
Engineers' Union of Butte 725
England. See "United Kingdom."
English Crown Spelter Co *307
English language law, Ariz 423, 635
Enos, H. C 547
Ensign-Bickford Co. Cost of explosives 12
Epnerson, C. S. Determination of molybdenum 242
Epping-Carpenter Pump Co 675
Erb, N. 212
Esperanza, Calif 35
Essen, Industrial situation 21
Estabrook Gold Dredging Co., 35, 811, 981, 1178
Estimating screen efficiency *651
Estimation of cyanogen in cyanide 710
Ethel mine, Wash. 1022
Eureka, B. C 254
Eureka Bullion, Utah 938
Eureka, Calif. 509
Eureka King, Utah 812
Eureka Lilly, Utah 678
Eureka Mines, Utah 938, 1022
Europe—Relief work 1047
European conditions. Editorial 1097
Evans, G. W 664
Evening Star, Mont 727
Evered, N. J 167
Examining the mine prospect *343, 376
Excelsior, Calif. 895
Excelsior Mining, Colo 73
Excessive areas in placer claims 359
Expanded-metal partitions *839
Experimental flotation flask *1090
Experimental treatment of complex ore 913
"Experience." About Spanish 578
Experiments. Editorial 720
Exploration work for soldiers 955
Explosives. See also "Blasting."
Explosives, Allocating surplus 761
—Cost 12
—Careless handling 24
—Liquid oxygen 657
—Safeguards. Editorial 1058
Exporters and passport regulations 738
Exposition of Chemical Industries 967
Express shipments, Mich. 851
Extralateral rights 549
Eye, C. M 1177

F

Faber du Four 88
Facts about mosquitoes 535
Fairbanks Gold Mining, Alaska 71
Fairchild, D. H. Empire concentrating table 453
Fake oil-stock promotion. Editorial 975
Falls Creek Mining, Ida 73
Farncombe Hill Gold Dredging, Colo 35
Farrant, J. C 378
Farrell, J. A 591
Farretta & Childress, Nev 170
Fatality and injury ratios 761
Feasibility of electric smelting in B. C 224
Federal aid for prospectors 998
—Editorial 1015
Federal Gold Mining, Calif 72
Federal income tax law. Editorial 417
Federal Lead, Mo 852
Federal Mining & Smelting 236, 294, 510
—Dividends 25, 626
Federal Reserve Board. Gold situation 163
Federal Trade Commission 97, 262
Feldspar—Canada 618
Feldtmann, W. R 516
Fence posts, Concrete *796
Feng Huang-Chan, China 231
Ferraris, E. Zinc problem in Italy 197
Ferroalloy questionnaire 540
Ferro-alloys in 1918 83
Ferromanganese—U. S., Import restrictions 670
Fertilizer—Nitrate 387
Fiddler Creek Gold, B. C 36
Fidelity, Ont. 1564
Field, T. F. Mother Lode mines 676
Fieldner, A. C 902
—Fusibility of coal .... †506
—Gas masks in sulphur-dioxide atmospheres. *693

Page
Fifty Gold Mines, Colo.... 339
Fight it out yourself.... 627
Fighting the Boche underground.... †284
Filters—Blackening of sand.... 1051
Financial problems, Post-war.... 713
Financing foreign enterprise.... 829
Fine crushing, Ida.... 1131
Finlay, J. R.... 167
—Capital in mining.... 780
  Editorial.... 802
—Geology and economics of coal.... 945
First National Copper, Calif.... 456
Fischer, A. H. Mining in Washington.... †889
Fisher, Irving. New price revolution.... 835
Fissures Explor. Co., Utah.... 180
Flake Graphite Co., N. S.... 147
Flask, Experimental flotation.... *1090
Flinn, A. D. Consolidating American engineering professions.... 13
Flint, W. G.... 547
Flocculation in flotation.... 365
Florence Divide, Nev.... 638
Florence Iron Co., Mich.... 63
Florence Mining & Smelting.... 75, 182
Florence Silver Mining, B. C. 340, 594, 678, 812, 1022
—Dividends.... 626, 801
Flotation—Acidity of pulp.... 1171
—Ariz. Hercules plant.... 1117
—Ball milling and.... 453, 708
—Butte & Superior decision.... 1013
—Colloids in.... 99, 453
—Drying concentrates.... 100
—Experimental flask.... *1090
—Flocculation in.... *365
—Froth remover.... *759, 839
—Galena.... 98
—Graphite.... 99
—Groch machine.... 97
—Hynes machine.... 97
—Michigan.... 34
—Mixed copper ores.... 840
—Notes on.... 1149
—Oils.... 1152
Flotation operator. Flotation queries.... 452
Flotation—Patent litigation. See "Minerals Separation."
—Pulp-level control.... *368
—Queries.... 452
—Ruth machine.... 97
—Selective.... 98
  Broken Hill.... 6
—Sub-aëration.... 497
—Sulphur.... 1124
—Test work.... 1160
—Tomboy Gold Mines.... 325
Flow sheet—Ariz. Hercules plant.... 1119, 1120
—Bunker Hill & Sullivan.... 1147
—Copper, ammonia leaching.... 1162
—Copper ore treatment.... 840
—Iron concentration, Mesabi.... 684, 686
—"Skin flotation," graphite.... 1052
—Small mills.... 1143
—Tungsten, Homestake.... 1159
—Zinc mill.... 1159
—Zinc separation.... 1108
Flue temperatures, Recording.... 566
Fluid ton. Tables.... 16
Fluorspar—Canada.... 618
—Ky.... 338
—U. S., 1918.... 196
Flux mine, Ariz.... 72, 981
Flynn, E. J.... 891
Flynn, F. N.... 210
—Photo.... *951
Foisey Claims, Ont.... 1064
Foley, F. B.... 902
Fohs, F. J.... 978
Folson, D. M. Nationalizing oil industry.. 364
—Oil-land development.... 329
Footage, Mine, costs. Boston & Mont. Devel.... 829
For Americanization. Editorial.... 333
Forbes Claims, Manitoba.... 728
Fordney bill. See "Potash."
Foreign Bond and Share Corp.... 829
Foreign mineral resources.... 267
Foreign mining.... 203
Foreign notes.... 371
Foreign purchasers—Credits.... 873
Foreign trade and mining. Editorial.... 847
Foreign Trade Committee.... 667
Foreign zinc-smelting capacities.... 227
Foreman, Problem of mine. Editorial.... 206
Forge, Prospector's.... *621
Fortuna, Calif.... 35, 771
Foster, L. B.... 674
Foster, Ont.... 594
Fowler, S. S.... 665
Fowles, C.... 854
France—Business opportunities.... 706
—Buying associations.... 22
—Conditions.... 563, 650
—Copper.... 844
—Destruction by Germans.... *318
—Export restrictions.... 1086
—German vandalism.... *232
—Iron.... 316
—Lead.... 844
  Imports.... 995
—Metals, imports.... 844
—Reconstruction.... 546, 716
—Spelter.... 922
—Zinc.... 922
Franco-American, Ariz.... 1103
Francois cementation process.... 120

Page
Frankfurter, F.... 165
Franklin Camp, B. C., platinum.... 409
Franklin Mining Co.... 294, 340, 464 1021
—Annual report.... 1041
—Production.... 179
Franklin, R. E., photo.... 615
Franklin, W. B.... 1060
Franz, J.... 759
Frasch sulphur method.... 555
Fraser, K. C., death.... 33
Free Coinage, Mont.... 727, 772, 854
Free Miners' League.... 944
Freehold, O. & G., Mo.... 727
Freeland, P. B.... 661
Freeman Lease, Tex.... 896
Freeport Sulphur, Tex.... 36, 1064, 1182
—vs. Union Sulphur.... 556
Freight rates.... 810
—Ariz.... 852, 953
—Atchison Topeka.... 882
—Bullion and copper.... 715
—Lake Superior.... 761
—Mich.... 338
—Minn.... 462
—Panama Canal.... 667
—Shipping.... 326
—Utah.... 291, 809, 936
French Amer. Banking Corp.... 935
Friedrich, A. V. Grouting in mine shafts.. 199
Fritz, J., medal.... 973
Froth removal from flotation cells.... *759
—Dorr thickener.... 839
Frozen ground—Thawing.... 527
Fuel, Composite.... 691
—Economizers.... 449, 561
—European situation.... 1094
Fuel oil, Calif.... 725
—Distribution.... 997
Fuller, C. E. Applied mechanics.... †506
Fume-dust collector.... 91
Fumigation, Cyanide.... *312
Function of sub-aërations in flotation.... 497
Furnace arm carriage.... *369
Furnaces—Air-volume regulation.... *654
—Basic refractory sources.... 648
—Electric, B. C.... 424
—Electric steel, Gt. Br.... 255
—Mercury.... *787
—Precipitate charging device.... *1051
—Rennerfelt.... 323
—Roasting, Wedge.... 1108
—Ruck zinc-distilling.... *307
—Sintering equipment and practice.... *744
—Underfeed firing.... 190
—Zinc-distillation, Mexico.... *361
Fuse, Safety—Use and abuse.... 229
Fuses—Legislation against.... 337
—Spitting in wet shaft.... 621
Future of Cloncurry.... 302
Future of Cornish Am. Mining.... 577
Future of geo-chemistry.... 644
Future of Mexican mining.... 239
Future of mining in Australia.... 738
Future of quicksilver, U. S.... 876

G

Gadsden, Ariz.... 381, 463, 593, 637, 677
Gage Mining, N. M.... 982
Gahl, R.... 591
Gale, H. S.... 243, 460
—Production of saltpeter.... *385
—Saltpeter in Guatemala.... *1025
Galena—Flotation.... 98
Galloway, J. D.... 661
Garde, A. C.... 665
Garfield Chemical, Utah.... 812
Garfield, H. A.... 807
Garfield Mining, Calif.... 1063
Garfield Smeltery, Utah.... 549
Garland, M. M.... 547
Garnet, N. C., and market for abrasive garnet.... 903
Gary, E. H.... 1177
Gary, E. H. Prosperity.... 803
—Steel prices.... 584
Gas mask in industry. Editorial.... 504
Gas masks in sulphur-dioxide atmospheres 003, 1003 (erratum) 801
—Uses and limitations.... 472
Gas, Natural, Wyo.... 995
Gas-reversing valve.... *498
Gas temperature—Measuring in boilers.... 608
Gaston, Calif.... 1103
Gate, Cageway.... *451
Gate, Manway.... 1087
Gauntlet Gold, Colo.... 35
Geary, W. P. Australia in 1918.... 121
Geisendorfer & Farmer, Calif.... 72
Gemini, Utah.... 382, 552
—Maine.... 911
General Briquetting Co.... 251
General Engineering Co.... 281
General Petroleum Corp.... 146
General Reduction, Colo.... 73
General review of mining.... 103
Geo-Chemistry, Future of.... 644
Geological Survey. See "Survey."
Geologists, State.... 68
Geology of coal.... 945
Geology of Montreal River district, No. Ont. 575
Geology of Yerington dist., Nev.... †1079
Geophone.... *872
Georgia Hill, Ariz.... 551, 593
Gephart, W. F.... 1095
Gepp, H. W.... 5

Page
German destruction—Belgium.... 476
—France.... *318
German East Africa—Mining.... 162
German indemnities.... 163
German labor market.... 736
German metal interests.... 532
German vandalism.... *232, 415
—Editorials.... 247
Germany—Chemical Trade, U. S.... 972
—Industrial future.... 25
—Influence in Mexico.... 204
—Iron.... 545
—Labor.... 736
—Metal interests in U. S.... 532
—Metals. Prices and supplies.... 134
—Periodicals.... 1094
—Potash.... 22
  Deposits.... 473
—Sulphuric acid.... 763
—Zinc.... 1111
Gertrude-Inez, Calif.... 293
"Get returned soldier home" campaign.... 911
Get the worth of your money.... 587
Giant Ledge, Ida.... 426
Gibbs, T. B. Transformers for induction motors.... 1076
Gibson, Ariz.... 293, 981
Gibson, B. C.... 294, 464
Gibson, T. W.... 491
—Graphite, Ont., 1918.... 196
—Mining in Ontario.... 108
Gibson, W.... 807
Gila Copper Sulphide, Ariz.... 381
Gila Monster, Ariz.... 853, 894
Gillett and Mexico. Editorial.... 1097
Gillett, H. W. Melting brass.... †506
Gillett, M.... 852
Gillette, H. P. Handbook of mechanical cost data.... †723
Gilman, F. L.... 724
Ginori-Conte, Prince.... 307
Giroux, G. T., death.... 33
Glen-Allen, Utah.... 1022
Globe Bauxite Co., Ark.... 1074
Globe Smeltery, Colo.... 851
Gloria, Ark.... 339, 425, *607, 771, 1103
Gloria Mining, Minn.... 74
Godbe, E. L., death.... 336
Godwa, Utah.... 938
Godson, T. E.... 492
Goethals, Geo.—John Fritz medal.... 973
—Editorial.... 977
Gogebic Range, Wis., maps.... 753
Gold—Alaska.... 56, 76
—Amalgamation.... 93
Gold and silver in 1919.... 1054
Gold—Australia.... 121, 293, 738
—Brazil, export.... 877
—B. C.... 894, 1036
—Canada.... 509, 618
—Charcoal precipitation.... 93, 51[illegible]
Gold Committee (Interior).... [illegible]
—Report.... 277
Gold Committee (Treasury).... 285, 371
—Report.... 371
Gold—Costs.... 1003
Gold Crown, Utah.... 1182
Gold—Cyanidation.... 226
Gold Dredge Placer, Calif.... 895
Gold—Dredging in 1918.... 143
  Yuba No. 16 dredge.... *915
  Yuba No. 18 dredge.... 752
Gold Dust, Ariz.... 853
Gold—Dutch East Indies.... 1070
Gold Dyke, Ariz.... 1021
Gold Explor. Co., Calif.... 937
Gold Fields of Venezuela, Ltd.... 439
Gold Fountain Mining, Calif.... 811
Gold—Gravity leaching.... 96
Gold—Gt. Br. Gold Production Comm.... 269
  Importation.... 277
Gold Hill, Ida.... 551
Gold Hunter, Ida.—Froth remover.... 839
—Pulp-level regulator.... *368
Gold in beach sand.... 267
Gold—India. In coinage.... 501
Gold King, Colo.... 339
Gold King Exten., Colo.... 169
Gold—Leaching, tailings.... 226
—Metallurgy.... 92
—Mobility.... 358
Gold Mountain, Nev.... *859
Gold—N. C.... 1022
—Ontario.... 108, 1096
Gold Point Consol. Mines, Calif.... 337
Gold—Position.... *1002
Gold Production Comm. (Gt. Br.) Report.. 269
Gold question.... 366
Gold Reef Divide, Nev.... 638
Gold Reef, Ont.... 1022
Gold—Refining, electrolytic.... *789
—Review, 1918.... 41
—Rhodesia.... 391
Gold Road Mines, Ariz.... 71
Gold Seam Divide, Nev.... 638
Gold—Shoshone County, Ida.... 725
Gold-silver prills, Parting.... 710
Gold situation.... 163
Gold—South Africa. Mining.... *469
  Conditions.... 918
  Review, 1918.... 702
—S. D., production 1917.... 714
Gold Standard Committee. See "Gold Committee."
Gold standard resumption.... 162
Gold—Transvaal, Production 1884-1918.... 118

Page
Gold U. S. See also "Gold Committee."
  Imports and exports 1003
  Labor and wages 877
  Production 1002, 1054
  Review, 1918 41
  Sun editorial.......... 8
—Wages and labor in mining 877
—Washing on the Yangtze *1069
—World production 41, *1002
—Venezuela 439
—Volatilization 839
Gold Zone, Nev..........170, 426, 552, 854, 860
Golden Age Mining & Reduct., Colo.......... 73
Golden Bell, Ariz. 169
Golden Center, Calif..........35, 981
—Roche Rock litigation.......... 808
Golden Cycle, Colo.—Dividends 25, 285, 456, 626, 801, 1012
Golden Rod M. & S., Okla.......... 145
Golden West, Calif. 381
Goldfield Consol., Nev.....170, 426, 783, 1182
Goldfield Devel., Nev..........461, 728
Goldfield Merger, Nev. 36
Goldfield, Nev., district *985
Goldschmidt Thermit Co.......... 149
Goldsmith Divide, Nev. 638
Goldwin, L. H. Automatic car dumper......*1087
Goodluck, Okla. 638
Goodwill Industrial ....†723
Goodwin, R. T.......... 934
Goodyear Tire & Rubber Co.......... 33
Gooseneck level regulator..........*639
Gordon, C. 674
Gordon, M. B. R.......... 724
Goshen Valley R. R., Utah.......... 638, 772
Gottsberger, B. B. 1177
Gould, H. W. 86
Government areas, South Africa ore reserve 993
Government operation 7
Government ownership 364, 780
—Telegraphs 155
Government tools for trade schools.......... 410
Government will sell rail stocks.......... 586
Gowans, W. F. 891
Grabill, C. A. 817
Grace, Minn. 895
Grace, W. R. & Co.......... 266
Graham, J. G.......... 768
Graham, R. A. 942
Graham, W.......... 636
Graig, A. Carbon dioxide determination...*709
Granby Consol. Mining & Smelting 75, 110, 158, 254, 338, 340, 510, 552, 638, 678, 894, 1063
—Dividends 456, 1012
—Production....321, 371, 382, 541, 594, 762, 917, 1092
Grand Central, Utah.......... 772
—Dividends 25, 801
Grand Island, Ariz. 35, 293, 551
Grand Pacific, Ariz. 339
Grandma, Nev. 170
Granite, Colo. 339
Granite-Poorman, B. C.......... 552
Graphite—Ala. 147, 453
  Costs 195
  List of companies.......... 306
  Review, 1918 194
—Analysis of ores.......... 709
—Canada 618
—Ceylon 15, 627
—Flotation 99
—N. Y. 281
  Review, 1918 148
—Ont. 147
  Review, 1918 196
—Review, 1918 147
—U. S. Review, 1918 147
  Sales, 1918 1172
Grass Valley Consol. Gold Mines, Calif..... 72
Grass Valley strike 1173
Grasselli Chemical Co. 58, 800, 961
Grate bar cleaner..........*744
Graton, L. C. 934
Graupner, A. E..........1019
Gray, J. W. 1060
Great Bend, Nev. 214
Great Butte Copper, Mont. 854
Great Cobar, Aus. 678
Great Eagle, N. M.......... 170
Great Metals M. & M., Wash..........75, 938
Great Ray Copper, Ariz. 894
Great Western, Ariz. 253, 592
Greater Consol. Mines, Utah.......... 594
Greater Miami, Ariz. 1021
Greece—Magnesite.......... 4
Green, M. 516
Green Monster, Ariz..........463, 1021
Greene Cananea Copper Co., Mex. (See also "Cananea") 112, 678, 896
—Dividends 456
—Production 170, 294, 371, 382, 510, 541, 762, 917, 1092
Greenlee County, Ariz. 423
Greenway, J. C..........167, 507, 634, 1060
Greenwood, H. W. Future of geo-chemistry. 644
Greenwood Smeltery, B. C.......... 770
Griffis, R. 289
Griffith, J. H. Investigation of wire rope.. 737
Griggs, C. C. 674
Grinding pebbles and tube-mill liners...... 745
Grindstones, Canada 618
Griswold, G. G. Electrolytic refining, silver and gold *789
Grizzlies—Minn. practice *684
Grizzly, Calif. 895
Groch flotation machine 97

Page
Grong Pyrites Mines, Norway.......... 190
Grouting *708
—Mine shafts 198
—With sulphur 279
Grund, A. R. 593
Guadalupe, Colo. 1181
Guamoco district, Colombia *513, *609
Guaranty Trust Co.......... 851
Guatemala—Mining, 1918.......... 116
—Saltpeter *1025
Guess, G. A. Copper slag research..........1009
Guest, I. S. Determining dissolved oxygen in water 241
Guggenheim, S. 210
Guggenheim interests 936
Gulf Coast Devel., Tex..........1181
Gulf Coast Oil, Texas 938
Gulf Pipe Line, Tex. 812
Gulf Production, Tex. 812, 982, 1064, 1104
Gum Oil Co., Tex..........1064
Gunsight Gold & Tungsten, Ariz.......... 213
Gypsum—Canada 618
—Price reduced 624
—U. S., 1918..........1098
Gyratory crusher, 60-inch..........*908

H

Haas, J. C. 547
Hackberry Silver Mining, Ariz...71, 425, 593, 727, 1021
Hager, D. Practical oil geology..........*506
Hager, W. E. 1021
Haig, Sir D. Praises engineers.......... 330
Haileybury School of Mines.......... 292
Hair driving belts.......... 490
Hall, R. D. 1060
Hall, W. H., photo.......... 615
Hall, W. J.......... 674
Hamilton, A. Women in lead industry....†890
Hamilton, A. McL. Career and death......*448
Hamilton, F. Quicksilver situation.......... 878
Hamlet, Calif. 811
Hammerich, P. 290
Hammond, J. H. Wages..........1013
Hampton, W. H.......... 167
Hanchett, L.......... 290
Hancock Consolidated 213, 340, 426, 1055, 1181
Hancock, H. R., death.......... 674
Hand of death. Editorial 377
Handy, R. S. Economics of concentration.1146
Haney vs. St. Regis Mining.......... 398
Hanna, L. C., death.......... 634
Hanna, W. J., death.......... 674
Hanover-Bessemer Mining, Nev. 36, 812
Hansen, G. T.......... 167
Hanson, Ole 330
Happenings in Mexico. Editorial 1014
Harder, E. C. Geology of east central Minn.†506
Hardinge Conical Mill Co.......... 892
Hardman, J. T. 741
Hardshell, Ariz.......... 637
Hardy, C. Tungsten ore market.......... 80
Hardy-Schultze law.......... 697
Harley, G. T. Shoveling..........*481, 520
—Editorial 545
Harney, Nev. 811, 854, 1104
Harold, Minn. 895
Harrington, D. 936
Harris, S. Cloncurry, Australia.......... 302
Harrison, P. G.......... 891
Hartford, Mich. 811
Hartman, M. L. Tungsten..........†506
Harvard shaft, Leadville, Colo..........*658
Harvey, Ark. 339, 637, 771
Harvie, R. 491
—Chrome mining in Canada.......... 144
Hasbrouck, Nev. 170
Hatchet Oil & Devel., N. M.......... 938
Hatton, Klein & Holmes.......... 807
Hauck Mfrg. Co.......... 925
Haulage—Monorail hoist 757
—Osceola 424
—Trackless trailer *228
—Tunnel, United Verde Exten.......... 770
—Tractors 705
Haultain, H. E. T..........768, 1177
Haury, P. S.......... 934
Havermale, H. 285
Havoc wrought by Germans in France....*318
—Editorial 332
Haynes-Stellite Co.......... 237
Hawkins, Minn. 340
Hay, P. S. 453
Hazen, H. L. Flotation test work..........1160
Headlights, on mine locomotives.......... 741
Heap-leaching, copper.......... 91
Hearst, P. A. Editorial.......... 719
Heaton-Hodges, Mo.......... 637
Heavy drilling, Sacramento Hill, Ariz. *690, *700
Hecla Mining Co. 55, 593, 604, 727, 893, 1181
—Annual meeting 725
—Annual report 635
—Dividends 25, 626
—vs. Asbury 441
Hedley, B. C.—Dividends 25, 626
Heinz, C. E. Metallurgy of Okla-Kan. district 558
Held for ransom in Mexico.......... 207
Helen Dorner, Ariz.......... 592
Helena, Mont. 594, 677, 772, 895, 937, 1021, 1064
Helium for ballooning 273
Helvetia Copper Co.......... 938
Hemet Magnesite, Calif..........1021, 1111

Page
Henderson, Senator C. B. See also "War Minerals Bill".......... 243
Henderson, C. W.......... 714
Hendrick, E. Everyman's chemistry..........†209
Hendricksen, M., death 167
Henry, W. S. 460
Hercules Mining, Ida. 253, 291, 809, 853, 893, 936
Herman, J. 851
Herrick, R. L. 378
Herzer, Calif. 637
Hess, Calif..........35, 55, 771
Hess, F. L..........1168
Hess, R. M. 1177
Hewes, L. J. 908
Hidden Treasure, Okla..........1022
Higgins, E. 290, 950
High Divide, Nev. 638
High Five Mining, Mo..........1020, 1179
Hightower, N. M. 678
Hill, C. W. Determination of lead in copper 242
Hill Gold Mines, Ont. 76
Hill, J. M. 1074
Hill, W. J. 591
Hillcrest, Minn. 772
Hilltop M. & S., Ariz..........35, 293, 1103
Hinds, H. Geology of Buchanan County..†335
Hines, W. D.......... 671
Hirshman, C. L.......... 891
Hobart, E. N.......... 634
Hobart, F., death 500
Hobbs vs. Amador & Sacramento Canal....1080
Hofman, H. O. Metallurgy of lead.......... 88
Hohenaur, Ont. 982
Hoist, Auxiliary, for traveling crane.......... 653
—Monorail 757
Hoist motor—Reversing switch *695
Hoist room, Penrose mine, Colo..........*1000
Hoisting—Investigation of wire rope.......... 737
—Licensing engineers, Nev.......... 560
—Editorial 589
—Records 281
—Rope accidents *435
Hoke, C. C. Monorail hoisting..........*757
Holbrook, E. A. 547, 891
Holderer, G. B.......... 850
Holley, C. E. Grouting with sulphur.......... 279
Hollinger Consol. Gold Mines, Ont..76, 108, 170, 462, 464, 728
Holmes, C. B.......... 624
Holmes, J. A.......... 899
Holmes, J. H., Jr..........1094
Homestake, S. D..........719, 772, 812, 1104
—Annual report 1085
—Costs 1145
—Dividends 25, 285, 456, 626, 801, 1012
—Production 1140
—Tungsten mill *1159
Homestead, Ariz. 425
Homestead Mines Co., Ore..........1101
Hongkong—Tin 445
Hood, O. P.......... 634
Hook, Safety..........*880
Hooper Bros., N. Y.......... 148
Hooper, H. E. Burmese bamboo roads.... 11
Hoosier Del Monte Mining, Nev.......... 74
Hoover, H. C..........159, 167, 356, 460, 505
—Belgian industrial situation.......... 24
—Engineers honor 157
—Gets Audiffred prize.......... 441
—Photo *1
Hoover, T. J.......... 869
Hopkins, Minn. 253
Horn Silver, Utah 25
Hornor, R. R. Gold in beach sand.......... 267
Horse Mountain Copper, Calif.......... 853
Hosey, Ariz. 35
Hotchkiss, W. O.......... 225
Houghton district, Mich.......... 292
House gets complaint on tin.......... 455
Housing—Ariz. 337
Housing—Notes on problem.......... 864
—"Public utility" societies.......... 911
How is Germany to pay?.......... 163
Howe, R. M. Basic refractories.......... 648
Howe Sound, E. C.—Dividends..........285, 801
Howie, A. S.......... 850
Hua Chang Iron Foundry.......... 435
Huang, C. T. Chineae white iron.......... 475
Hubbard, J. D..........1100
Hubbell, A. H..........634, 1060
Hudson Bay Mining, Ont..........464, 854
—Production 254, 464, 552
Huff Electrostatic Separator Co.......... 724
Hughes, F. C. Gold in Indian silver coinage 501
Hughes, Premier. Australian mining.......... 204
Hughes, V. H..........1177
Hulett automatic unloader..........*401
Hull-Rust, Minn. 1064
Humberstone, J. T.......... 266
Humboldt, Colo. 895
Humes, J.......... 422
Hunan. Antimony and tungsten.......... 273
Hunt, F.......... 967
Hunt, R. W.......... 167
Huntson, L. D. 203
Hurley, E. N. Potash restrictions.......... 161
Husted, F. H., death.......... 336
Hutcheson, W. L.......... 289
Hutchins, J. P.......... 336
Hyatt Steel Products, B. C.......... 770
Hynes flotation machine 97
Hypotheek, Ida. 772

Page

I

I. O. U. 523
Idaho—Bureau of Mines 769, 893
Idaho-Carbonate Hill, Ida. 35, 637
Idaho-Continental, Ida. 213, 236, 1181
—Concentrator *956
Idaho—Labor 549, 592, 809, 893, 980
—Law 34
—Lead 809, 1020
Idaho-Maryland Gold Mines, Calif. 35, 293, 637, 727
Idaho Mining Asso. 423
—Annual Convention 534
Idaho—Mining Bureau 372
Idaho Mining, Reduct & Transp., Ida. 73
Idaho—Mining, review, 1918 236
—Minerals, 1918 291
—Silver 1020
Idaho Univ. research fellowship 912
Illness, Prevention of 351
Illinois mining statutes .... †889
Illinois Univ. research work 355
Illinois Zinc Co. 592, 961
Illiteracy in U. S. Editorial 1176
Imperial Development, Okla. 170
Imperial Oil Co., Ont. 594, 677
Impervious concrete 242
Import license 667, 842
Import restrictions. Gt. Britain 1055
Importation—Need of policy 886
Impressions of Australia 5
Improved conditions, Western Mexico 837
Improvements on mining locations 999
Improving carbide lamp *278
Inclination of ladders 1081
Inclined-shaft timbering—alignment *349
Income tax. See Taxation.
Independence mill, Colo.—Sampling practice *641
Indemnities, German 163
Independence Placer Mining, Ida. 1062
Independence, Utah 772, 1182
Index Gold Mining, Calif. 72
Index, Mining 31, 249, 420, 632, 805, 1017
India—Gold in coinage 501
—Labor 391
—Monazite 523
—Sanitary engineering *389
—Zinc smelting 356
Indian Peninsula Mining, Ont. 76
Indicator, center *279
Induction motors—Data on installation 764
—Transformers 1076
Industrial Board—New campaign 499
—Price stabilization 717
Industrial Conference 713, 825
Industrial coöperation 748
Industrial disputes—Organization in settlement 825
Industrial goodwill .... †723
Industrial insurance, Nev. *985
—Editorial 1015
Industrial relations, Canada 962
Industrial relations—Principles of 754
Industrial representatives at capital 670
Industrial research 585
Industrial situation, Belgium 24
—Essen 21
Influenza. See "Spanish."
Informal contracts. See "Contracts."
Ingalls Iron, Ala. 771
Ingalls, W. R. 130, 203, 544, 547, 631, 669, 734, 868, 930, 1173
—Bismuth 102
—Economic duties of the engineer 184
—Foreign zinc-smelting capacities 227
—Metallurgy of zinc 87
—Professor and Anaconda 578
—Report of Assoc. of Twenty Seventh Engrs. 327
—R. W. Raymond *135
—Spelter statistics, 1918 958
Ingenieria Internacional. Editorials 28, 719
Ingersoll-Rand. Co. 1041
Innes, M. Metallurgy of quicksilver 86
—Quicksilver in Calif. 56
—Quicksilver situation 878
Inspectors, State mine 68
—Mich *870
Inspiration Consol. Copper Co.—Annual report 1086
—Dividends 285, 801
—Production 169, 339, 371, 509, 541, 762, 894, 917, 1092
—Tax litigation 676
Inspiration, Ont. 896
Institute of Chemistry 167
Institute of Metals, London 547
Institution of Mining & Metallurgy *597
Insulator, Section *279
Insurance. Industrial, Nev. *985, 1015
Insurance, Workmen's 338
Intermountain Copper Mining, Wash. 770
Interior Dept. Exposition 1011
International Commissions 201
International Dredging & Drainage, B. C. 1039
International Harvester Co. 62, 676
International Labor Commission 845
International Mining Convention 168, 626
—Opening meeting 660
International money 365
International Motor Co. 934
International Nickel Co. See also "Canadian Copper Co." 76, 108, 158, 340, 510, 861
—Dividends 25, 456, 626, 1012
—Refining works, Port Colborne *429, *446
—Turbo blower 557
International Ore Co. 239
—Views *360
International relationships, Canada's 308
International Smelting Co. 676
International Zinc Ore Co. 359
Interstate Callahan. See "Consolidated."
Interstate Iron, Minn. 74
Interstate Light & Power, Ill. 1110
Investigating war-mineral claims 540
Investigation of wire rope 737
Investments—Protection 932
Iowa Copper, Utah 812
Ireland, J. D. 891
Iron—Ala. 770, 792, 852, 980, 1063, 1179
  Situation 636, 963
—Algeria 834
Iron and steel. Review, 1918 60
Iron & Steel Institute, London 768
Iron—Ariz., magmatic ore *353
—Belgium 1070
Iron Blossom, Utah 285, 809
Iron—Brazil 792
—B. C. 292
—Electric smelting 224
—Canada, bounty 34, 338
Iron Cap, Ariz. 551, 593, 637
—Ariz. Commercial suit 462
—Injunction against 592
—Production 425
Iron—Celebes, deposits 741
—China 231
Iron City Mill, Colo. 853
Iron—Concentration 1171
—Converting Chinese white into foundry pig 475
—Costs 793
—Dutch East Indies 437
—France 316
—Germany 545
—Gt. Br. Imports and exports 359
Iron Hill, S. D. 1104
Iron—Italy 543, 954
Iron King, B. C. 36
Iron King, Utah 36, 214, 594, 728, 854, 896, 982, 1064
Iron—Luxemburg 195
Iron Mask, Mont. 678, 937, 1064
Iron—Mexico, Japanese interest 865
—Mich. 980, 1062, 1102, 1179
  Reserves 756
Iron mining, U. S., 1918 62
Iron—Minn 508, 636, 770, 893, 1102
  Mesabi Range *683
  Taxation 791
    Editorial 803
—N. Y. 792
—Ohio 549
—Ont. 1096
Iron-ore concentration, Mesabi *683
Iron ore deposits in Celebes 741
Iron ore in 1918 399
Iron-ore super-taxation, Minn. 791
Iron—Pittsburgh markets 60
—Price 886
  1918 61
  Lake Superior 885
—Russia 608
—Sweden 480, 1076
—U. K. 1012
—U. S.
  Jan.-Apr. 1919 927
  Mining, 1918 62
  Pig 202, 329, 488, 718, 885
    1918 60
  Pittsburgh markets 60
  Price 584, 717
    Editorial 671
  Review, 1918 .... 60, 399
  Steel prices lowered 584
  Surplus stocks 928
    Imports and exports 653
Irtysh, Russia 162
Irvin, D. F. Chilean interests, 1918
Irwin, D. D. 724
Isle Royale 212, 594
—Dividends 25, 626
—Production 35, 213, 381, 551, 727, 937
Italy—Iron 543, 954
—Zinc 197
Ivanhoe Mining, Wash. 75

J

Jackhamer, Cutting timber with 758
Jackhamer drill mounting *758
Jackling, D. C. 1100
Jackson county, Ore Cinnabar *787
Jackson, J. A., car dumpers 991
Jacobs Asbestos Co. 51
Janney W. H 1100
Japan—Metals. Imports and exports 954
—Mexican iron 865
—Zinc, 1917 967
Jarbidge Nevada Mining, Nev. 811
Jardine, J. B., death 547
Jaspar Stone Co. 745
Java—Billiton tin 1148
Jefferson, Okla. 254
Jeffries, Z. 283
Jenks, H. N. Sanitary engineering in tropics *389
Jennings, H. 277
Jennings, S. J. 414
Jerome-Bisbee, Ariz 35, 169, 381, 551
Jerome-Portland, Ariz. See "Jerome-Bisbee."
Jerome Verde, Ariz. .. 35, 293, 381, 551, 593, 677
Jig concentrates, analysis, Okla.-Kan. 559
Jigging, Hand *597
Jim Butler Tonopah Mining, Nev.—Annual report 799
—Production 36, 254, 294, 382, 510, 638, 678, 728, 811, 854, 895, 982
Jim Green. (Poem) 363
Joan Mining, Minn. 74
Johnson Devel., Ariz. 509, 677, 894
Johnson, H. H. 591
Johnson, J. E., Jr.—Career and death *668
—Editorial 671
Johnson, N. M. 36
Johnson, R. H. 251
Johnson, R. W. Metallurgy of Okla-Kan. district 558
Johnston, A. W. Geology of east central Minn. .... †506
Johnston, J. 934
Johnston, S. J. Molybdenum in British Empire 625
Johnston, W. A. Applied mechanics .... †506
Jones & Laughlin Ore Co. 63
Jones, B. H., death 850
Jones process 1179
Jones splitter *642
Jones, W. E. 1102
Joplin, district—Community, Drilling Corp. 292
—Lead and zinc, 1918 59
Joplin Separating Co., Mo. 936
Jualin Alaska Mines, Alaska 380, 894
Judge Mining & Smelting 179, 211, 461
—Annual report 955, 1084
—Dividends 801
Juhlin, C. E. 716
Jumbo, Mont. 1064
Junehomme, P. F. Flotation of sulphur 1124
Jumper, Calif. 937
Jupiter, Ont. 36

K

K. K. Mining & Milling, Colo. 73
Kast-Bever, Calif. 339
Kansas City-Nevada Consol. Min., Nev. 74, 382
Kansas—Metallurgy of district 558
—Zinc 1170
Katanga 92
—Production 214, 371, 510, 541, 594, 762, 772, 917, 1092
Katz, F. J. Garnet in N. C. 903
Katz, S. H. Gas masks in sulphur-dioxide atmospheres *693
Kay Copper, Ariz. 213
Kearsarge, Calif. 853, 1021
Keating, Mont. 678
Keene, A. F. 724, 1177
Keep up development. Editorial 544
Keep up the habit 493
Keith, A. 903
Keith, N. S. Effect of air in cyanidation .. 522
Keller, E. Mobility of gold 358
Kelley, C. F. 251, 634
Kelley, F. A. 251
Kellogg, A. E. Cinnabar, Jackson Co., Ore *787
Kelvin Sultana, Ariz. 425
Keltner, Okla. 678
Kemp, J. F. 492
Kennebec, Utah 1022
Kennecott Copper Corp. 292, 727
—Annual report 1031
—Dividends 25, 626
—Note issue 424
—Production 169, 381, 550, 937
Kennedy, Calif. 425, 727, 811
Kennedy, F. A. 934
—Iron-ore concentration, Mesabi *683
Kennedy-Van Saun Corp. 759
Kentucky—Fluorspar 338
Keora, Ont. 464
Kerr Lake Mining, Ont.—Dividends 25, 626
—Production 214, 254, 410, 464, 552
Kerr, W. A. 883
Ketchum, M. S. Structural engineers' handbook .... †890
Kew, W. S. W. 913
Keweenaw Copper, Mich. 340, 551
Key, A. C. Rand mining, 1918 702
Keystone, Colo. 811, 1021
Keystone Copper Mining Co. ... 509, 677, 1073
Kiddie, T. 815
King Brand, Kan. 593
King Copper, Ariz. 550
King Oil, Wash. 1022
King-Stanwood backer *643
Kinney, Minn 1064
Kirchen, J. G. 674
Kirk, M. P. 33
Kirkland Lake Gold Mining, Ont. 76, 1064
Kirkland Porphyry 214
Kirkpatrick, C. S. 1019
Kirkpatrick, Calif. 425, 593, 771
Kistler & Stephens, Wis. 1022
Kitselas Mountain Mining, B. C. 728
Kitson, H. W. 978
Kittilsby vs Vevelstad 698
Kleinsorge Chrome Mining, Calif. .... 7[illegible]
Knight interests, Utah 809
Knight Investment, Utah 254
Knight, J. 291, 938
Knob Hill, Wash. 340
Knopf, A. Geology of Yerington, Nev. .. †1079
Knowles, C. R. Life of wooden water tanks 600
Knowles, S. A. 422
Knox, H. H. 203
—Photo *486
—About Spanish 706
Kobold, Colo. 339

Page
Koenig, S. A. 675
Kohagen, W. F.......... 336
Kohie, Sir R.......... 364
Komat Leasing Co., Colo. 35, 169
Kootenay Light & Power, B. C.......... 661
Kreisinger, H. Measuring gas temperature 608
Krutschnitt, J., Jr.......... 674
Krynauw, A. H. Cementation 199
Kyshtim, Russia 162

L

La Clede, Okla.......... 382
La Cuauhtemoc M. & S., Mex.......... 510
La Grange Hydraulic Mine, Calif..........1103
La Motte, Mo. *775
La Rose, Ont..........170, 638, 728
—Production 254, 340, 464, 552
La Rue, Minn.......... 853
La Salle..........300, 879
—Production 36, 169, 213, 381, 727, 937
Labbe, C. Repair work in milling plants..1153
—Replacing Oliver-filter shafts.......... 365
Labor. See also "Welfare," "Housing," etc.
Labor and gold mining, So. Africa.......... 918
Labor and mining, 1918.......... 66
Labor and reconstruction.......... 200
Labor—Ariz....243, 291, 379, 423, 461, 509, 592, 944, 1020, 1101
  Wage schedule 1009
—Australia 6, 902
—Bonus system..........169, 885
—B. C..........508, 753, 1063
—British Malaya.......... 473
—Broken Hill 902
—Calif. 167, 979, 1173
—Colombia 609, 612
—Colo. 337, 424, 769, 808, 893
  Import from Mexico 34
—Copper conference delegation.......... 326
Labor covenant. Editorial.......... 766
Labor—Eight-hour day 271
—Germany 736
—Gold mining 877
—High wages 1013
—Idaho 549, 592, 809, 893, 980
—India 391
—Industrial coöperation 748
—Mich. 338, 380, 424, 462, 770, 893, 1179
—Minimum wage 827
—Minn. 252, 508
—Montana 337, 423, 979
—Nevada Co., Calif.......... 425
—Ont. 1102, 1173, 1179
—Organization in settlement of dispute.... 825
—Quebec 592
—Some views. Editorial 165
—South Africa 470, 918
—S. D. 770
—Texas 1102
—U. S. See also "Employment"..........245, 326
  Copper employee delegates.......... 282
  Editorials 503, 671
  Review, 1918 66
—Utah 461, 508, 549, 893, 936, 975, 1120, 1101
Lachmund, O. Tunnel driving *567
Lackawanna, Colo..........213, 339, 678
Lackawanna Mining & Reduction, Colo...... 73
Ladders, Inclination 1081
Laird, G. A. 290, 1100
—Publicity 912
Lake Graham Oil, Tex. 982
Lake Milling, Smelting & Refin., Mich.... 73
Lake shipping rates 761
Lake Shore, Ariz. 937
Lake Shore Mines, Ont.....36, 76, 170, 638, 772, 1182
—Dividends 25, 1012
Lake Superior. See also "Superior."
Lake Superior district *299, 338
Lake Superior Mining Inst..........1100
Lake Superior Safety Conference..........1012
Lake Superior transportation..........*400
Lamb, M. R. 547, 768
—Aftermath in Paris and London.......... 324
—British molybdenum and tungsten markets 670
—Business opportunities in France.......... 706
—London-Paris letter 650
—Lyons Fair 924
—More about Spanish 838
—News from Paris.......... 563
Lambe, L. M., death 547
Lamble, B. C. 491
Lamme, B. G. Edison medal award.......... 953
Lamp, Miners' carbide..........*278, *838
Lamp signals, Surveyor's..........*1087
Lanark Mining, B. C..........75, 214
Lance Creek, Wyo., oil and gas.......... 995
Land grants, Canada 212
Lane, K. W. Titration of copper.......... 242
Lane mill—Automatic feeder..........*759
Lang, J. H. Tin market, 1918.......... 65
Lang, S. S. Porpbyry intrusions, Mich... 452
Langley, A. G.......... 662
Lanigan, C. A.......... 210
Lanza, A. J. Prevention of illness....351, 373
Lashing timber *914
Lasky, B. H. 978
Last-Chance, Nev..........812, 896
Last Chance Mining, N. M...74, 254, 340, 728, 1022
Latest mine holocaust. Editorial..........1058
Latest Out, Ida. 237
Lathe, F. E. 815
Laughlin, G. F.......... 160
Launder linings 880
Laura, Minn. 727
Laurier Mining, Wash..........812, 938, 1022
Lauther, L. V. Safety corner guard..........*17
Lavelle Gold Mining, Ariz..........71, 213
Lavignino, G., death.......... 850
Lavitt, S. 165
Law—Ariz. 337, 423, 508, 635, 980, 1178
—B. C. 508
—Calif. 379
—Canada 306
—Colo. 168, 424, 461
Law decisions—Arizona employers' liability.1178
—Ariz. mineral locations.......... 906
—Defective mine drills 264
—Discharging water from plants.......... 311
—Effect of mining patents.......... 231
—Excessive areas in placer claims.......... 359
—Improvements on mining locations...... 999
—Mining partnership rights.......... 698
—Negligence toward mine drive.......... 441
—Negligent ladder system 606
—Negligently arranging machinery.......... 177
—Proving negligence of employer.......... 471
—Public highway leasing 1062
—Rights of surface owners.......... 519
—Safety devices in mines.......... 398
—Safety mining appliances.......... 8
—Tailings disposal..........1080
Law—Ida 34
—Mexico 954
—Minn. 592
—Mining rights 569
—Ont. 550, 636, 810
—Revision 761, 837
—Shaft operation 423
—Texas 292, 462, 810
—Uruguay 972
—Utah 380, 725, 893, 1179
—Washington 211
Lawrence Mining Co., N. M.......... 106
Lawrie, H. N. Position of gold..........*1002
Lay, J. G.......... 624
Layman Syndicate, Ariz. 853, 894
Le Roi No. 2, Ltd.......... 997
Lea-Courtenay Co.......... 591
Leaching, Ammonia, Copper 1162
—Costs 1167
—Gold 96
—Gold ore tailings.......... 226
—Heap, copper.......... 91
—House. Internat. Nickel Co..........*432
—Tank *1163
Lead—Canada 618
—Determination in copper 242
—Export duties 1169
—France 844
  Imports 995
—Gt. Br. Imports and exports.......... 359
—Idaho 809, 1020
—Japan, imports 954
—Joplin district, 1918.......... 5
—Market, 1918 52
—Metallurgy ....†208
  1918 88
—Milling *397
—Mo. 852
  S. E. district 132
—Monterey 801
—Ont. 1096
—Plating 698
—Price 1895-1918 352
  Joplin, 1918 59
  1918 52
Lead Producers' Committee. Editorial.... 457
Lead products, 1918 54
Lead—Queensland 953
—Review, 1918 52
—U. S. 542
  Editorials 457
  Prices 52
    Imports and exports....302, 372, 619, 884, 1031
Lead, white and oxides, 1918 54
Lead—World production 52
Leadville, Ariz. 593
Leadville, Colo. district 153, 769
—Strike 808
—Views *658
Leasing system, Utah
Leaver, E. S. 335
Ledoux, A. R..........373, 542
—Photo *486
Lee, R. L.......... 167
Leffingwell, E. Canning River Region....†889
Legal aspect tailings disposal..........1080
Legal Tender, Mont. 170, 728, 772, 854, 937, 1064
Lehi-Tintic, Utah 638, 896, 1022
Leighton, A. 872
Leighton, Mo. 262
Leith, C. K. 167, 634, 636
Leland, E. 1177
Leon Iron Co., Minn. 292
Leonard, R. W. 378, 660
Leonidas, Minn. 853
Leszynsky, Ariz. 253
Leroy, C. 807
Leroy, Ont. 1064
Lesher, C. E. 160
Lessons of the war 534
"Let the job stand." Editorial.......... 288
Lewis, J. O. 290
Lewis Mine Co., Colo.......... 73
Lewis, R. S. Shafting and belting..........1132
Lewis, W. C. McC. Colloid state from electrical standpoint 696
Lexington-Arizona, Ariz. 253
Li, K. C. Antimony, 1918.......... 64
Libertad Mill, Colombia *609
Liberty, Ariz.......... 637
Liberty Bell Gold Mining, Colo.......73, 153
Liberty Hill, Calif..........169, 593
Liberty Leasing, Colo..........35, 73
Liberty M. & M., Kan.......... 895
Liberty M. and R., Colo.......... 213
Liberty Mining, Minn.......... 74
Liberty Mining, Mont. 74, 895
Liberty Potash Co., Utah.......... 168
Licensing of engineers 312, 843
Licensing hoisting engineers, Nev.......... 560
—Editorial 589
Life of wooden water tanks.......... 600
Lime as settling agent 1089
Lime—Available CaO determination.......... 739
Limonite at Alta Lake, B. C. 197
Lincoln County, Nev. Mineral production 508
Lincoln, F. C. Prehistoric mining 866
Lincoln, Minn. 937
Lindgren, W. Tintic district.......... †763
Linking up isolated districts *313
Lintner, S. 290
Lion Hill Consol., Utah 812
Lipka, J. Graphical computation..........†889
Liquid oxygen explosives.......... 657
—Manufacture and use 602
Little Bill, Mo. 253
Little Bonanza, Calif.......... 981
Little Cottonwood Transp., Utah, 75, 594, 728, 772, 938, 1022
Little Giant, Colo. 73
Little Platte Lead & Zinc., Wis.......... 75
Lloyd-Crossley Strike, Mont..........594, 638
Lloyd, E. R. 909
Loader—Continuous Twin-scoop *451
Loading—Underground mechanical 990
Locations, Mining, Improvements.......... 999
Loco-tractor transport system *313
Locomotives, Mine—Headlights.......... 741
Loeb, W., Jr.......... 507
Loftus Blue Lead, Calif. 425
Log washer *685
Lomont, C. F. 290
London-Arizona, Ariz..........169, 381
London-Paris letter 650
Long Island R. R. 24
Longfellow, Colo. 727
Longyear, E. J. Co., Minn..........*957
Longyear, G. M. 1177
Lonnie Boy, Ark..........637 1103
Loon Lake Copper, Wash..........294, 382, 594
Lorimer Minerals, Wyo. 812
Loring, W. J.......... 461
Lost River Tin Mines, Wash..........1178
Loughlin, G. F. Oxidized zinc ores of Leadville ....†335
—Tintic district..........†763
Louis Creek Mining, B. C.......... 728
Louise, Utah 678
Louisiana Consolidated, Nev. 36
Loveman, M. H. 251
Lowering dynamite into holes *925
Lowden drier 100
Lowhee Creek, B. C. 1035
Lubrication of air compressors *392
—Oils 393
Lucas, F. E. 724
Lucke, P. V. 768
Luckley, G. P. Determination of lead in copper 242
Lucky Cross, Ont. 812
Lucky Four, B. C.......... 36
Lucky Jew Mining, Kan.......... 678
Lucky Mack, Ariz.......... 551
Lucky Six Mining, Wis. 75
Lucky Tiger Comb., Mex..........1012
Ludlow, E. 414
Ludtke, O. F.......... 934
Lugue, C. L. 906
Luleo, Manitoba.......... 214
Lunt, H. F..........1100
Luty, B. E. V. Pittsburgh iron markets.. 60
Luxemburg—Iron 195
Lynch, J. K. 238
Lynn Valley Copper-Gold, B. C.......... 36
Lyon, D. A..........225, 900, 1019
—Innovations in metallurgy of lead..........†208
Lyons Fair 924

M

MacArthur, J. Radium industry and reconstruction 605
MacBoyle, E..........378, 460
McCabe-Gladstone, Ariz.......... 253
McCallum, A. B. 590
McCaskey, H. D. 60
Macaulay, R. M. Source of placer platinum, B. C. 303
McClelland, J. F.......... 1019
McClure Hydroelectric plant 338
McConnell, J. 664
McConnell, R. E.......... 422
McCormack, J. H. Automatic feeder for Lane mill 759
McCormick, A. F., death 336
McCormick Chrome, Calif..........425, 771
MacCoy, F. 1177
—Setting anchor bolts with sulphur..........*708
McCracken Silver-Lead Mines, Ariz..72, 463, 727
McCrea-O'Neill, Ont. 464
McCrorken, E. P.......... 290
McCrystle, J. Mine tracks..........†208
McCullough, C. H. Jr.......... 33

Page
McCurdy, W. A. 850
McCurry custom mill, Ark .... •607
McDermott continuous twin scoop loader.. •451
McDonald, P. B. 1060
McDougall, A. U. S. Steel litigation 380
McDougall, D. H. 492, 547, 768
McDowell, J. S Basic refractories 648
MacGowan, J. K. 850
Macgregor, P. M., death 547
McGuire, J. E. 226
Machinery Mining, exports..715, 882, 974, 1171
Machinery salvage 455
McIntyre, Ont. 108, 812, 938
Mackall, K. W. Headlights on mine locomotives 741
MacKay, B. R. Placer operations, Cariboo, B. C. 1035
Mackay, C. H. Should government own telegraphs? 155
McKenna, R. C. 1169
McKenzie, C., death 807
Mackenzie, D. 891
Mackenzie, G. C. 491, 547, 807
Mackenzie, J. H. 78
McKenzie vs. Moore 906
McKinlav, W. B. 167
—International money 365
McKinley Darragh, Ont. 170, 294, 510, 1064
—Dividends 285
—Production 254
McKinley-Hension, Wis. 1022
McKinney Steel, Mich. 294, 981
McKinnis, C. 934
McLean, J. R. 724
McLeish, J. 491
—Canadian mineral production, 1918 618
Maclennan, F. W. 1176
McMillan, J. H. 422, 507
McMurtrie, D. C. Reeducation vs compensation 474
—Editorial 504
Macnamara, Nev. 382, 464, 552
—Production..36, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811, 854, 895, 982
MacNaughton, J. Superior copper industry, 1918 50
Maco Devel., N. Y. 812
McPherson, Congressman 1011
McWade, R. M. 1178
Macy, V. E. Organization in settlement of industrial disputes 825
Maddock, C. 942
Magic, Ida. 637
Magma Copper, Ariz. 425, 771, 810
—Annual report 969
—Dividends 285
—Production 35, 253, 371, 637, 541, 762, 917, 1092
Magma Chief 169
Magmatic iron ore. Ariz. .... •353
Magnate, Ariz. 293
Magnesite—Calif. 564
—Greece 4
Magnesite industry, 1918 131
Magnesite—Margarita Island .... •645
—Ore. 602
—Refractory use 648
—Sorting and washing plant 1111
—U. S. 131
    Embargo removed 1010
    Imports 485
—Venezuela, Margarita Island .... •645
Magnesium—U. S. Review, 1918 96
Magnetic separation zinc ores .... •1107
Magnetic separator, Wetherill .... †156
Magnetite—B. C. 726
Magnolia Gas & Products, Tex. 772
Maier, C. G. 1009
—Copper slag from microscopic point of view •815
    Editorial 848
Maine—Gems 911
Maintenance and repair. Editorial 846
Majestic mines, Utah 180, 1182
Majorca, Minn. 253, 772
Makeever Bros., Mexican conditions 708
Making sharp mills effective 996
Malaria and mosquitoes 389, 535
Malaria, Quinine in 348
Malay—Tin 997
Mallette, W. K. 210
Maloney, Calif. 293
Mammoth, Utah 382
Mammoth Copper, Calif. 35, 425, 509, 812
—Balaklala suit 883
—Production ..169, 371, 509, 541 762, 917, 1092
Mammoth Lease 509
"Manager in Mexico." Enlightening America 280
Mandy, Manitoba 36, 292
Mangan No. 1, Minn. 853
Manganese—Brazil, 1902—1917 716
—Calif. 515
—Canada 618
—Colo. 380
—Concentration 527
—Cuba, Review, 1918 196
—Ecuador 794, 976
—Jones concentration process 1179
—Mont., Philipsburg dist 973
Manganese ore, East Tenn. 149
Manganese ore in 1918 77
Manganese ore mining industry 962
Manganese ores, impure—Treatment 572
Manganese—Queensland 953
—So. Africa 304
—Tenn. 149
—Tunis 1076
Page
Manganese—Continued
—U. S. 542
    Production, 1918 444
    Protection unlikely 413
    Review, 1918 77
        Imports and exports 619, 884
—Vancouver 884
Manitoba—Mining, 1918 111
Manning, Van. H. 891
—Army gas masks 1008
Manson, E. F. 734
Manufacturing detonators 666
Manzanta, Calif. 339
Manway gate .... •1087
Map—B. C. Tulameen, Geological 304
—Colombia, Guacomo 610
—Gogebic Range, Wis. 753
—Margarita Island .... •645
—Mich. copper district 300
—N. C. Garnet 904
—Nevada, Rochester 734
—Wooden edge protector .... •621
Margarita Island, Magnesite .... •645
Marguerite, Ark. 425
Mariposa, Calif. 35
Mariposa Mining, Tex. 75, 145
Mark Mfrg. Co. .... •411
Market reports. Weekly feature. See also under names of metals, i. e.—"Copper—Prices."
Marketing the mine prospect 601
Marquette Range, Mich. 63
Marriott, H. F. 251
—Transvaal mining, 1918 118
Marsh, Ida 981
Marshall, S. B. 674
Martin Gold Mines, Que 638
Martin, H. E., death 33
Martyn, T. G. Economies in assaying 241
Mary McKinney Mining, Colo 73, 771
Maryland Glass Sand Co. 772
Masks, Gas. See "Gas Masks."
Mason Valley Mines, Nev. 36, 772
—Annual report 970
—Production......214, 371, 541, 638, 762, 917, 1092
Mass Consol. Mining 294, 340, 678
—Annual report 712
—Production 170
Masters, H. K. 1060
Material-Handling. Machinery Mfrs. Assoc. 378
Materials—Prices. See "Prices, Current."
Mathias, T. H. 378
Matson, B. V. 807
Mattes, Fused, and slag. Microscopy .... •815
Matthews' cable clamp .... •191
Matthews, W. D., death 1060
Mauss centrifugal separators .... •862
Max Mining Co., Tenn. 149
Maxton screen .... •760
Maxwell, H. B. 927
Mayer, E. Trade relationships 931
Mayflower. See "Consolidated Mayflower."
Mazapil Copper Co. 239
Measuring gas temperature in boilers 608
Measuring water—Orifice bucket .... •580
Mechanical handling of material .... •433
Meehan, F. X. 935
Meehan, M., death 768
Megraw, H. A. 210
—Design of metallurgical mills 1141
Meiklejohn, C. A. Available CaO in lime.. 739
Meinzer, O. E. 889
Melting, brass .... †506
Melting points 479
Melting silver, nickel, etc. by electricity 323
Merchant marine. See "Shipping."
Merchant Marine Committee 629
Mercury. See "Quicksilver."
Merge Rochester, Nev. mines 734
Merger Mines, Nev. 254
Merrimac Mining, Minn. 213
Merriss, M. H. Ampere efficiency in copper refining .... •743
Merritt, D. H., death 850
Merritt Devel., Minn. 74, 464, 510
Mesabi Range, Minn. 62
—Iron ore concentration .... •683
Metal & Thermit Corp. 1061
Metal Export Co. of America 850
Metal situation reviewed 540
Metal statistics .... †889
Metalene Oriole Mining, Wash. 75
Metallurgical accounting. Editorial 887
Metallurgical Society of America 547
Metallurgist. Standardization of salaries 706
Metallurgists needed 626
Metallurgy. See also "Cyanidation," "Amalgamation," etc.
Metallurgy of copper 90
—Gold and silver 92
—Lead 88
—Okla-Kan. district 558
—Quicksilver 86, 1075
—Zinc 87
Metalo 242
Metals. See also names of metals.
Metals, Base Price chart 1916-1918 44
    Calibration of thermocouples .442, 579, 707
—Colloidal 364
Metals Exploration Co 293, 337
Metals, Government sale 372
—Prices, 1895-1918 352
—Chart, 1916-1918 45
Metals Products Assoc., Tex. 75
Meteor, B. C. 214
Page
Mexican mining camp photos .... •18, •19
Mexican mining in 1918 112
Mexican problem 832
Mexican question. Editorial 1175
Mexican situation 536
—Editorial 545
Mexico—Anarchy in 219
—British bank in 165
—Chihuahua district 871
—Claims against government 800
—Conditions 280, 330, 464, 530, 536, 541, 708, 779, 832, 835, 837, 938, 963, 1007
    "Big Bend" 923
—Early Indian raids 477
—Editorials 207, 545, 846, 1014, 1098, 1175
—Finances 416
Mexico from within 530
Mexico—German influence 204
—Iron Japanese interest 865
Mexico Mines of El Oro 626
—Mining, Future of 239
—Mining in, today .... •175
—Mining, 1918 112
—Oil concessions not transferable 954
—Our Balkan problem 154
—Petroleum 1050
    Carranza's policy 871
    Law 954
    Situation 219
—Potash 906
—Protection of Amer. rights 327
—Recent events 541
—Silver 477
—Tin smelting .... •264
—Zinc smelting 359
Meyer, H. C. Uncommon ores 124, 453
Meyer, R. A. 674
Miami Copper Co. 71, 1021
—Capital account 782
—Dividends 456, 1012
—Production 169, 339, 371, 509, 541, 762, 917, 1092
Miami district, Okla. 145
Miami Wonder Mining 254
—Profit sharing 636
Mica—Canada 618
Mica in 1918 123
Mica—Screening 1112
—U. S. 123
Michigan—Copper 508, 676, 851, 879, 1020, 1062, 1102
    Porphyry intrusions .... •299, 452
    Review, 1918 50
    Sales and production 973
Michigan Copper Mining Co.....551, 678, 811, 981, 1021
Michigan—Flotation 34
—Iron 980, 1179
    Reserves 756
—Labor 338, 380, 424, 462, 770, 893, 1179
—Map. Copper district 300
—Mine inspectors .... •870
Michigan-Utah. Utah 179, 728, 1022
Microscopy—Copper-smelting slag .... •815
Middle Golconda, Ariz. 771
Middle Yuba Power, Calif. 293
Middlings—Recrushing 778
Midvale Minerals, Utah 464, 638
Midway Irrigation Co., Utah 211
Midwest Engine Co. Mine pump 325
Midwestern Refining Co. 972
Mikado shaft, Leadville, Colo. .... •659
Miles, J. H. Thawing ground 527
Milford-Magnolia, Utah 982
Mill City Mining Co. 285
Mill part economies, So. Africa 1125
Mill power plant selection 1121
Miller, B. L. Mineral deposits of So. Amer. .... †890
Miller, G. 608
Miller Independence Mining, Ont...76, 294, 382, 464, 1064
Miller, J. H. 291
Miller, Minn. 727, 772
Miller, S. Engineer's relation to public opinion 616, 619
Miller, T. C. 1073
Miller, W. W. 1073
Milliken Standard building system .... •952
Milling—Control of operations 907
Milling in cyanide 22
Milling methods—Colo. Central Mining... •397
—New Cornelia 398
—San Juan, Colo. .... •1129
Milling plants—Repair work 1153
Milling progress. Editorial 1174
Mills, E. B. 539
Mills, Small metallurgical 1141
Milton, M. C. Diamond-drill troubles.... •450
Minaker-Kirkland 638
Mine cageway gate .... •451
Mine cars. See "Cars."
Mine-dust sampling .... •395, 950
Mine foreman problem. Editorial 206
Mine Inspectors, Mich. .... •870
—State 68
Mine La Motte, Mo. 133
Mine motor starters 316
Mine Owners' Assoc. B. C. 252
Mine physician 579
—Editorial 545
Mine prospect, Marketing 601
Mine reconstruction in France 716
Mine section insulator .... •279
Mine surveyor's lamp signals .... •1087
Mine ventilation in Coeur d'Alenes 603

Page
Miner. Co-operation among small mines.. 367
Mineral deposits and income tax.......... 751
Mineral enterprise in China 537
Mineral geographers examination.......... 584
Mineral Hill, Ariz. 771
Mineral industry census 882
Mineral industry in Venezuela 438
Mineral land, Wis. 219
Mineral Point Zinc Co...58, 592, 961, 1022, 1107
Mineral production of B. C., 1918.......... 320
Mineral Products Co., Colo. 73
Mineral Products Corp., Utah..........75, 182
Minerals Separation Ltd.—Butte & Superior case 97, 337, 617
  Decision 1013
    Text 1044
    Editorial 1057
Minerals—Specific gravity tables..........1145
Miners built good bridges 163
Miner's carbide lamp..........*278, 838
Miner's solace. Editorial 672
Miners—Vocational training.......423, 893, 980
Mines and Mining Committee 1010
Mines Co. of America 254
Mines—Taxation. See "Taxation."
Minimum wage 827
Mining accountants wanted 801
Mining and Geological Exposition.......... 883
Mining and Metall. Soc. of Amer.....203, 978
—Mexican resolution *1175
—N. Y. Section 843, 5
—Officers *488
—Papers *184
Mining as an investment.......... 663
Mining—Australia 794, 845
—B. C., 1918.......... 110
—Burma *259, *274
—Capital in 780
—Chihuahua 871
Mining chronology....284, 456, 669, 843, 1054
—1918 69
Mining—Colo. in 1918 152
Mining concessions, Siam.......... ... 273
Mining conditions in South Africa....... 363
Mining Convention, B. C. See "International."
Mining Corporation of Canada..76, 772, 812, 896
—Annual report 970
—Dividends 25, 626
Mining—Costa Rica 906
Mining costs, So. Africa 363
    Wis. 564
Mining—Cuba, 1918 111
Mining dividends. See "Dividends."
Mining—Dutch Guiana 963
—Eastern Australia 490
Mining-engineer consuls 882
Mining engineering societies, Officers......*487
Mining engineers in the war.......... *1
Mining—Foreign trade and.......... 847
—German East Africa 162
—Idaho, 1918 236
Mining index 31, 249, 420, 632, 805, 1017
Mining industry in Utah.......... 626
Mining industry's post-war problems.......... 719
Mining machinery. See "Machinery."
Mining—Manitoba, 1918 111
Mining manual, 1919..........†890
Mining—Mexico today *175
—Ontario, 1918 108
—Open pit, Mesabi..........*400
Mining partnership rights.......... 698
Mining patents 231
Mining—Prehistoric times 866
Mining rights, Peculiar 569
—Shoveling *481, 520
Mining stocks in 1918 158
Mining—U. S. Review, 1918.......... 103
—Utah, 1918.......... 178
—Venezuela 944, 1056
Minnesota—Auditors' report.......... 338
—Compensation law 592
Minnesota Geological Survey 592
Minnesota—Iron 508, 636, 770, 893, 1102
  Mesabi Range 683
  Taxation 791
    Editorial 803
  Shipments 936
Minnesota Joint Engineering Bd. 290
Minnesota—Labor 252, 508
—Peat 809
Minnietta, Calif. 937
Minor economies in assaying 241
Mint. Annual report ....†208
Mint, Director of. Melting silver, etc., by electricity 323
Misfires in blasting 229
Missabi Mountain, Minn..........637, 1064
Missouri—Lead 852
  S. E. district 132
—Zinc 1170
Mitke, C. A. Standardized methods. Editorial 29
Mobility of gold 358
Modder B., So. Africa.......... 703
Modoc, Colo. 727
Moebius refining process..........*789
Moffitt, F. H. Upper Chitina Valley, Alaska.†506
Mogollon Mines, N. M. 36
Mogul Mining—S. D. 75
Mohawk, Mich 340, 426, 510, 551, 853, 1104
—Dividends 456, 1012
—Production 772, 1062, 1181
Mohawk Divide, Nev. 638
Molybdenite—Canada 618
—Norway 162
—Ont. 1096

Page
Molybdenum—British Empire 625
—Determination 242
—Gt. Britain 625, 670
Molybdenum ore market 83
Molybdenum ores in 1918 82
Molybdenum—Price 83
Molybdenum Products Co., Colo..........73, 82
Molybdenum—U. S. Price.......... 83
  Review, 1918 82
—Use in war 501
—World production 488
Monarch Mining & Power, Mont...170, 594, 772, 854, 895, 937
Monazite, India 523
Mond Nickel Co., Ont.......... 109
Monell, A.......... 290
Money, International 365
Money Lode, Mont..........170, 594, 772
Monitor Belmont, Nev. 214
Monitor, B. C. 36
Monocable boisting *757
Monorail hoist *757
Monroe, J. P.......... 373
Montana-Bingham 382, 812
Montana-Idaho Copper, Ida. *956
Montana—Labor 337, 423, 979
—Manganese, Philipsburg dist. 973
Montana Tonopah—Production 36, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811, 854, 895, 982
Montana—Mining, 1918 105
—Silver, Philipsburg dist.......... 973
Monte Christo, Ark. 35
Monte Rico, N. M. 896
Montebello oil field, Calif.......... 725
Monterey—Lead 801
Montezuma, Ark 381
Montgomery, H. S.......... 191
Montgomery, O. C. 251
Montreal Kirkland, Ont. 1022
Montreal Metallurgical Assoc. 934
Montreal River, Ont., Geology.......... 575
Mooney, J. D. 891
Moore, A. 86
Moore, C. C., death 674
Moore, F. C. 934
Moore-Letson, Ariz. 981
Moore, P. N. 540, 667
Moore, R. B. 807
Morandi, Calif. 1103
Morgan, Calif. 293, 461, 771
Morning Glory, Ariz..........509, 637, 894
Morning Star, Ark. 425
Morris, H. C. 226, 624
Morris, Minn. 853
Morse Bros. Machinery Co.......... 291
Morthland, S. Army gas masks 1008
Moses, F. G. Colloids.......... 453
Mosquito control 289, 535
Mother Lode Copper Mines, Alaska....107, 635
Mother Lode Coalition Mines, Alaska...... 635
Mother Lode mines, Calif. 676
Motor starters 316
Motor vehicles. Government sale..........624, 952
Motors, Induction—Data on installation.... 764
—Transformers 1076
Motter, W., Jr. 33
Mount Bischoff Tin Mining Co.......... 5
—Semi-annual report 865
Mount Blaine Oil Shale Products, Colo..... 73
Mount Boppy Gold Mining, Aus..........1179
Mount Gaines Gold Mining, Calif.......... 72
Mount Lyell Mining & R. R. Co......123, 325
Mount Morgan Gold Mining 1179
—Semi-annual report 496
Mount Read & Roseberry Mines, Tas....... 306
Mount Washington Mine, Mont.......... 638
Mountain Chief, B. C. 214
Mountain Copper, Calif.......72, 294, 463, 677
Mountain Lily, Calif. 463
Mountain Top Mining, Colo. ...73, 1102, *1129
Mountaineer, Calif. 853
Movable collaring machine 6
Mowry, Ariz. 637
Must the prospector go?..........8, 281
Mudd, H. S. 225
Murillo, S. G. 894
Mushrush, Ariz. 85
Myers, C. A. 591
Myers-Whaley Co. 990

N

Nabob Consol., Ida. 294, 853, 1063
Nacozari Consol., Mexico 552
Namtu. See "Burma."
Naildriver, Utah 510
Napoleon Copper, Calif. 72
Naramore, C. 290
Nash Engineering Co. 1100
National Assoc. for Protection Amer. Rights in Mexico 327
National Assoc. of Corporation Schools...... 591
National Assoc. of Potash Producers....676, 725
National Copper, Ida. 213, 294, 593, 811, 853, 1063
National economy. Editorial 1014
National Foreign Trade Convention....591, 931
National Gold Mines, Calif. 895
National Indust. Conference Bd..........1175
  Eight-hour-day 271
National Lead Co., Mo. 133
National Mining, Ont. 594, 1022
National Museum 972
National Potash Corp. 75
National Research Council.......... 24

Page
National Safety Council 674
—Papers *220
National Steel Products, Ala.......... 71
National Tin Corp, S. D..........896, 1064
National Zinc Co 58, 961
National Zinc Separating Co..........*1107
Nationalizing oil industry.......... 364
Natomas Company, Calif. 551
—Annual report 635
Natural and synthetic nitrate.......... 410
Nature of capital in mining 780
Neale, J 591
Nearing, S. 186
Necrology, 1918 43
Need of a policy. Editorial.......... 886
Need of prevention. Editorial 504
Neel, C. B. Chrome ore situation.......... 280
Negaunee, Mich. 36
Negligence of employer, Proving.......... 471
Negligence toward mine driver.......... 441
Negligent ladder system 606
Negligently arranging machinery.......... 177
Negroes in unions 1099
Neiswender, C. E. 336
Nelson, Ariz. 981
Nelson, Calif. 727
Nelson M. & D., B. C.......... 638
Nenzel Crown Point Mining, Nev.....423, 734
Netherlands India, Iron.......... 741
Neustaedter, A. Inclined-shaft timbering..*349
Neutralizing acid mine water.......... 478
Nevada. See also "Divide."
Nevada-Calif. Power Co., Nev.......... 74
Nevada Consol. Copper..........170, 254, 638
—Annual report..........798, 1085
—Dividends 25, 626
—Insurance 987
—Production ..340, 371, 541, 552, 762, 917, 1092
—Quarterly report 968
Nevada—Copper, Yerington district.......... 627
Nevada County, Calif.—Labor.......... 425
Nevada Douglas, Nev. 382
Nevada-Humboldt Tungsten, Nev.......74, 285
Nevada Mine Lsg. and Holding, Calif. 213
Nevada—Mining, 1918 105
—Non-metallic minerals 423
Nevada Packard, Nev.......... 214
Nevada Rand, Nev. 214
Nevada—State insurance *985
—Yerington district ....†1079
Nevada Wonder Mining, Nev. Annual report 142
—Dividends 1012
New Arcadian, Mich. 301
New Baltic 301, 772
New Caledonia—Mineral exports 348
New Callao Mining Co. 439
New Comstock, Ariz. 637
New construction, 1918 71
New Cornelia Copper, Ariz. 72, 191, 339, 727, 894
—Annual report 711
—Fire 980
—Milling practice 398
—Production 169, 371, 509, 541, 677, 762, 917, 1092
New Era, Colo. 339
New gas-reversing valve *498
New Guadalupe, Calif. 294
New Guinea. See "Papua."
New Hazelton Gold and Cobalt Mines, B. C. 913
New Idria. Quicksilver mining. 56, 86, 169, 339, 937
—Annual report 970
—Dividends 285
New Jersey Zinc Co..........507, 961
—Dividends 456, 1012
—New building 322
New lead-zinc mill, Colo..........*397
New Mexico Calumet Mining, N. M.......... 811
New Mexico—Mining, 1918.......... 106
New mine car..........*1088
New Modder, So. Africa.......... 703
New Modderfontein Gold Mining, So. Africa 120
New price revolution.......... 835
New publications........208, 335, 506, 723, 889
New Quincy, Utah.......... 36
New State areas, So. Africa.......... 120
New system of thawing ground.......... 527
N. Y. & Honduras Rosario—Dividends.285, 801
N. Y. Business Publishers' Assoc. Industrial Conference 713, 825
New York, Calif.......... 727
N. Y.—Graphite 281
  Review, 1918 148
—Iron 792
New York Montana Testing & Engrg.......... 728
Newbury, S. S.......... 838
Newkirk Smelter Co., Mo.......... 508
Newland, D. H. Graphite mining, N. Y... 148
Newport, Mich..........895, 981
Newton, C. E..........1177
Newton, C. W..........891, 1020
Newton, E. Concentration of manganese... 527
—Impure manganese ore treatment.......... 572
Newport, Mich. 772
News from Paris 563
Nicholas, A. D.......... 167
Nicholls, W., death.......... 290
Nicholson, J. Leaching of gold-ore tailings 226
Nickel—Canada 618
—Melting by electricity.......... 323
—Ont. 1096
—Refining, Int. Nickel Co..........*429, *446
Nickels, J. M. Bibliography of N. A. geology ....†208
Nicklas, Nev. 214
Nicoya Mining, Costa Rica.......... 906

Page
Nicu Steel Corp., Ont. 594
Night Hawk Leasing, Ariz. 1103
Nipissing Mining Co. 214, 382, 852, 982
—Annual report 917
—Cost of supplies 1167
—Dividends 285, 801
—Production 170, 254, 340
Nitrate of potassium. See "Saltpeter."
Nitrate of soda storage 201
Nitrates—Chile 115
—Pampa *385
—Review, 1918 265
Imports and exports 244
—Fertilizer 387
—Govt. stock, disposition 413, 764, 800, 927
—Natural and synthetic 410
—Recovery 266
—U. S. 585
Disposal of stocks 413, 764, 800, 927
Importation 927
Research work 624
No work, no food. Editorial 29
Noble Electric, Calif. 677
Nogales district, Sonora 883
Nolan-Bell Oil, Tex. 1064
Nomenclature of sodium compounds 710
Norcross Chemical Co. 73
Norcross, F. S. 568, 586, 591
—Photo 615
Norman, S. 664
Norrie-Aurora, Mich. 853
Norris, R. V. 414
North Broken Hill Co., Australia 122
North Butte 294, 464, 678, 811, 982
—Production 426, 895
North Carolina—Garnet 903
—Gold 1022
North Hubbard, Calif. 771
North Midas Copper—Alaska 71
North Range Iron, Minn. 510, 1021
North Star, Ariz. 551
North Star, Ark. 213, 463
North Star Mines, Calif. 35, 72, 811
—Strike 1173
Northern Minnesota Ore, Minn. 73, 293
Northland, Minn. 464
Northport Smelter Co., Wash. 75
Northrup, E. F. 669
Northwest Magnesite Co., Wash. 75, 131
Norway—Molybdenite 162
—Pyrites 190
Notes on flotation 1149
Notes on housing 864
Notes on ore dressing 100
Notes on screening practice 1112
Notes on water-power development 699
Nova Scotia Steel & Coal Co. 340
Nunn, L. L. 211

O

O'Brien, Ont—Production 254, 464, 552
O'Hara, V. W. Bordeaux sulphur market. 900
O Lo-Lim Copper, Wash. 728, 1182
O'Neale, M. L. 33
O'Neil, J. J. 409
Oaks, N. M. 36
Obituary, 1918 4
"Observer." Mexican problem 83[illegible]
Occurrence of gold in sulphide ore 923
Ocoee Copper, Tenn. 36
Octave Mines, Ariz. 72
Octo, N. M. 340, 728, 982, 1181
Odds that favor. Editorial 975
Odgers, Mich. 853
Officer, H. G. 33
Officers of mining engineering societies *487
Ohio Copper Co. 75, 181, 594, 728, 812
—Bd. of Equalization report 854
—Production 552
—Iron 549
Ohio Oil Co. 812, 972
Oil. See also "Petroleum."
Oil conservation, Wyo. 972
Oil, Fuel, Calif. 725
Oil, Fuel, distribution *997
Oil in Simi Valley, So. Calif. 913
Oil land development 320
Oil-Lands Leasing Bill 413
Oil shale. See also "Petroleum."
Oil shale, Commercial possibilities *217
Oil Shale Mining Co., Colo. 219
Oil-stock fakes 844, 975
Oiling. See "Lubrication."
Oils, Separating mixed 71[illegible]
Oklahoma. See also "Miami."
Oklahoma—Metallurgy of district 558
—School of Mines 726
—Zinc 1170
Oko Lead & Zinc, Okla. 510
Old Dominion 953
—Annual report 970
—Dividends 25
—Production 169, 339, 371, 509, 541, 762, 917, 1092
—Pumping equipment 1
Old Emma Mines, Utah 638
Old Eureka, Calif. 213, 293, 425, 551, 637, 676, 1103
Old Hachita, N. M. 854
Old Hickory, Ida. 381, 637, 727
Oliver Continuous Filter Co. 724
Oliver-filter shafts, Replacing 198, 365
Oliver Iron Mining Co. 62, 73, 74, 464, 592, 594, 684, 721, 811, 980, 981, 1107
—Lawsuits 29[illegible]
Oliver Quartz Co., N. C. 982
Olson, C. R. 934
Omaha Iron, Minn. 74, 1064
Omaha Lead & Zinc, Okla. 1181
Omega Hydraulic, Calif. 981
On reconquered soil 441
Onahman Iron, Minn. 74, 294, 727
Oneida Mines Corp., Minn. 74, 426, 727, 927
Onion Placer, Calif. 853
Ontario—Cobalt 168
—Copper 109
—Geology, Northern 575
—Gold 108, 1096
—Graphite 14[illegible]
Review, 1918 196
Ontario-Kirkland 426, 552, 812
Ontario—Labor 1102, 1173, 1179
—Law 550, 636, 810
—Minerals 1096
—Mining, 1918 108
—Petroleum 936
—Silver 108
Ontario Silver, Utah 285, 938
Ontario—Transportation 550
Open cut mining—Thawers *925
—Mesabi *2100
Open market for steel. Editorial 886
Operating—Costs, Colombia 613
Operations at Zinc Camp, Ark. *607
Operations of Texas Gulf Sulphur Co. *555
Ophir, Calif. 635, 769, 1020
Ophir, Ont. 254, 294, 594, 772, 808, 812, 1064
Opohongo, Utah 1064
Opteca Mine, Honduras 36
Orange, Mo. 678
Orchard, J. C. 226
Ordnance scrap sale 625
Ore, Complex—Experimental Treatment 913
Ore dressing and metallurgy. Weekly feature 411
Ore dressing notes 100
Ore-dressing operations control 907
Ore drying 1144
Ore-pulp sampler, Automatic *412
Ore testing plant, B. C. 34
Oregon—Cinnabar 787
—Mining, 1918 106
Organization in the settlement of industrial disputes 825
Oriental Consol. 382, 426, 552, 854, 1182
—January report 772
—Production 170
Orifice bucket for measuring water *580
Original Mayflower, Nev. 55
Oroville Dredging, Calif—Dividends 285, 626
Orr, C. T. 1095
Osage, Mo. 426
Osborn, C. C. 909
Osceola Consol. Mining 300, 879
—Annual report 712
—Dividends 25, 626
—Haulage 424
—Production 36, 170, 213, 381, 551, 937
Osgood, T. W. 1019
Osmiridium, Tasmania 293
Osterheld, T. W., death 674
Otisse, Ont. 36, 170, 576
Ouray Consol. M. & R., Colo. 1131
Ouray Custom Milling, Colo. 73
Outline flotation test work 1160
Overbeck, R. M. 506
Owens, T. M. 891, 934
Owl Chrome, Calif. 593
Oxford, Ont. 638
Oxygen-apparatus—Uses and limitations 472
Oxygen, Liquid, explosives 65[illegible]
—Manufacture and use 602
Oxyliquit 654
Oxides of lead, 1918 review 5[illegible]
Oxwelding and cutting 208
Oxy-acetylene welding 268
Oxygen, Dissolved, in water—Determination 241
Ozark, Ark. 895
Ozark Wonder, Ark. 895

P

Pabst, Mich. 510
Pacific Coast Borax Co. 1[illegible]5
Pacific Coast Gold Mines, Calif. 72, 461
Pacific Dredge, Calif. 811
Pacific Great Eastern R. R. 550
Pacific Tungsten, Nev. 74, 105, 285
Pacific, Utah 382
Page, L. W., death 210
Paleozoic coal fields 948
Palisade, Calif. 35, 727
Palladium—Prices, 1918 44
—U. S., 1918 124
Palmer, W. S. Gold occurrence in sulphide ore 923
Pan-American Industrial Congress †807, 717, 1010
Panama Canal freighting 667
Paper driving belts 3[illegible]
Papua—Copper mining 44[illegible]
—Petroleum 293
Papua—Development 922
Paragon Hitchcock, Ont. 461
Park City district 179
Park City—Labor 893, 110[illegible]
Shipments 294, 382, 510, 594, 638, 678, 812, 896
Park Utah, Utah 812
Parker Chrome Co., Calif. 72
Parker, D. J. 901
Parkhurst, F. A. Symbols †506
Parmelee, H. C. 492, 544
Parnell, Calif. 853
Parrish vs Richardson 606
Parsons, A. B. Operation of Burma mines. *257, *274
Parsons, F. W. 1019
Parting gold-silver prills 710
Partitions—Expanded-metal 839
Passport regulations 738
Pat Baker, Ark. 381
Patent Office Society 974
Patents—Licensing 202
—Mining 231
—New. Weekly feature.
Patterson, S. B., death 591
Patricia Mine, Ont. 76
Patriotism 493
Pattison, M., death 167
Paul, J. W. 901
Payne, N. B., & Co. 653
Peabody Consol., Ark. 253
Peace Conference gets mineral data 540
Peace effects, Australian mines 11
Pearce, J. B. 336
Pearce, J. W. 460
Pearl, H. I. 167, 634
Peat 945
—Minn. 809
Pebbles, Grinding, and tube-mill liners 745
Pebbles, Tube mill 100
Peculiar mining rights 569
Peddar, T. C. 267
Peele, R. Compressed air plant †723
—Hoisting records 281
Peerless Queen, Mont. 638
Peiyang Iron Works 435
Penarrova, Soc. Min. et Metall. de 203
Penn Mining Co., Calif. 104
Penn Iron, Mich. 340
Penn-Wyoming Copper Co. 291
Pennington, Mich. 895
Pennington, Minn. 853
Penrose mine, Colo. *1000
Penyon Syndicate 266
Percival, J. A. 423
Periodicals, German 1094
Perkin medal 202
Perkins Gulch, B. C. 1036
Perlman, S. V., Efficiency 577
Permanent center indicator *279
Permissible self-contained mine-rescue apparatus 745
Perry, O. B. 2, 591
—Photo 61
Peru Zinc Co. 59[illegible]
Peters, F. S. 210
Peterson Lake Silver Cobalt 76, 254, 896, 1064
Petroleum in Argentine 95[illegible]
—Ariz. 1055
—California 291, 379, 549, 725, 892, 979, 1011, 1061
Ownership of lands 146
Prices 1178
Proved territory 587
Review, 1918 146
Simi Valley 913
—Canada 618
—Ecuador *941
—Gr. Britain 1020
Petroleum institute 1095
Petroleum—Mexico 1050
Carranza's policy 871
Law 954
Situation 219
—Oil shale as source *217
—Ont. 936
—Papua 293, 922
—Tex. 936, 1022, 1031
—U. S. 370, 543
Development 329
Feb. and March, 1918, 1919 909
1918 181
Oil shale possibilities *217
Review, 1918 43
Imports and exports 909
—Utah 337
—Venezuela 440, 737
—Wash. 980
—Wyo. 0[illegible]
Pett, I. 626
Phalen, W. C. 226
Phelps Dodge Corp. See also "Copper Queen," etc. 91, 425, 637, 893, 953
—Annual report 797
—Dividends 285, 801
—Production 169, 339, 371, 509, 541, 762, 917, 1092
—Sacramento Hill *690, *700
—Wage schedule 1009
Phillipsburg Mining, Mont. 74
Philipsburg, Mont., dist. 973
Phoenix, Mich. *300
Phosphate Export Co. 463
Phosphate rock industry, 1918 1148
Phthisis, Miners' 93
Physician, Mine 545, 579
Picard, H. K. Sub-aëration in flotation 497
Picard, H. K. 251
Picher Hospital 1063
Pickands, Mather & Co. 62, 74, 338, 594
Pick, A. W. 891
Pickett, A. R. Flocculation in flotation *365
Picric-acid plant sale 842
Piedras Verdes, Mex. 854
Piez, C. 289
Pigott, C. 1010
Pigsties on the Rand *538
Pilling, G. P. 934

Page
Pilot, Minn. 678, 1064
Pine Creek Tungsten, Calif..........72, 727
Pineroot claims, Man. 464
Pioche district, Nev. 464, 852
Pipe corrosion 480
Pipes, Concealed water, Locating........ 867
Pit River Power, Calif.................. 169
Pitmans, Rock-breaker 579
Pittsburg-Gold Flat, Calif.............. 425
Pittsburg Zinc Co., Mo.................. 508
Pittsburgh Bureau of Mines. Experiment Station *899
Pittsburgh iron and steel markets....... 60
Pittsburgh-Jerome, Ariz 169, 551
Pittsburgh-Lorrain Synd., Ont........... 76
Pittsburgh-Utah 382
Placer claims—Excessive areas........... 359
Placer County Chrome, Calif............. 72
Placer operations, Cariboo, B. C........1035
Placer platinum source, B. C............ 303
Plate, H. R............................. 507
Platinum—Beach sand 267
—B. C. 409
Source 303
—California 35
—Canada 618
—Price 76
1895-1918 352
—Review, 1918 76
—Russia 161
Platoro-Summitville, Colo., district..... 999
Platt, J. M. 167
Playas, N. M............................ 1022
Playin' the game. (Poem)................ 334
Plea for common honesty................. 162
Plenaurum, Ont. 36, 214
Plumbago. See "Graphite."
Plutus, Utah 464, 728, 938
Plymouth Consol., Calif. 169
—Dividends 285
Pocahontas Copper Queen, Ariz........... 72
Poetry.
—'Andy man 459
—Efficiency 577
—Jim Green 363
—Playin' the game 334
—Will it come to this?.................. 794
Poland—Mining situation................. 245
Politics, Engineers in. Editorials....418, 891
Pool facts on minerals.................. 282
Porch, E. L. Jr. Rustler Springs sulphur deposits ....†208
Porcupine Crown, Ont. 254, 294
Porphyry Consol., Ariz. 1063
Porphry Dike Gold Mining, Mont.......... 74
Porphyry intrusions, Michigan copper district *299, 452
Porphyry Mining, Ariz. 894, 1021
Portable electric drill *873
Porteus, J. P. 674
Portland cement, 1918 316
Portland Gold Mining, Colo.........637, 811
—Annual report 623
—Dividends 285, 801
—Independence mill *641
Position of gold *1002
Position of low grade zinc mines. Editorial 588
Post-war financial problems 713
Post-war problems. Editorial 719
Post-war readjustments in mineral statistics. 454
Poston, R. H. Concreting prospect drill holes *309
—Cage protector for maps *621
—Simple mine cageway gate...............*451
—Surveyor's lamp signals................*1087
Potash—Alsace 585, 989, 1093
Potash bill. See "Potash, U. S."
Potash—Germany 22
Deposits 473
Potash Imports License Bill. See "Potash, U. S."
Potash—Mexico 906
—Recovery from alunite 388
—Spain 728
—U. S. 202, 1011
Embargo removed 1010
Fordney bill 1093
Imports License Bill 161, 243, 413, 437, 455, 499, 585
House Committee hearings 1168
Independence possible 370
1918 125
—Utah 182
—Wyoming 168
Potassium nitrate. See Saltpeter.
Potentiometer 443
Potomac Copper, Mont. 382, 854, 1104
Powder River Dredging, Colo............. 73
Powdered Coal Eng. & Equipment Co....... 336
Power in chemico-metallurgical industries.. 479
Power plant economies *1032
Power-plant requirements 647
Power plant selection 1121
Prairie Oil & Gas, Tex..................1104
Pratt, G. L. 716
Pratt, N. P. War minerals claim......... 716
Precipitate—Charging device *1051
Precipitation of gold by charcoal 516
Precipitator, Cottrell 1110
Prehistoric mining 866
Premier Mine, Okla. 168
Preston, Minn. 510
Preston Peak district, Calif............ 593
Preumont, G. F. J. Wolfram mining, Bolivia *597
—Editorial 629
Prevention of illness among employees... 351

Page
Price-fixing—Editorials 205, 377
Price stabilization 717
Prices. See also names of metals, market report, weekly, etc.
—Base metals, 1916-1918 44
—Current 173, 297, 467, 681, 857, 1067
—Editorials 375
—Metals, 1916-1918 45
1895-1918 352
—New revolution 835
Prices, yesterday, today and tomorrow.... 713
Prills, Parting gold-silver 710
Primos Chemical Co. ..73, 154, 339, 464, 811, 1063, 1130
Primrose, Calif. 895
Prince Consol. M & S., Nev.....852, 854, 1104
Principles of industrial relations 754
Principles of taxation 574
Priority list engineer units 25
Probert, F. H. 716
Problem of the mine foreman. Editorial.... 206
Problem of treating impure manganese...... 572
Production and uses of saltpeter.........*385
Professions and readjustment............ 933
Professor and Anaconda 578
Profit sharing 636
Progress in milling—Editorial 1174
Progress of readjustment 246
Progress of stoping drills..............*964
Prohibition 672
Promontorio, Mex. 938
Promotion of friendly relations with Europe 1047
Promotion of industrial research........ 585
Proper drilling methods. Editorial...... 766
Property rights 34
Proserpine, B. C. 1182
Prospect drill holes, Concreting........*309
Prospect, mine—Examining *343, 376
—Marketing 601
Prospecting *343, 376, 664
—Publicity 912
Prospector, Must he go?...............8, 281
—Federal aid 998, 1015
Prospectors washtub forge...............*621
Prospects—Ventilation *926
Prosperity impending. Editorial......... 803
Prosperity—Let's go...............802, 846
Protecting American rights in Mexico.... 327
Protection against reversed phases......*2[illegible]
Protection for small shipper. Editorial.... 765
Protection for manganese 413
Prouty, W. F. Alabama graphite, 1918.... 194
—Graphite, Ala. 306
Prouty, W. L. Chute gate *369
Providence Mines Co., Nev.. 852
Providence Mining & Engineering Co....... 207
Providencia Mining & Milling, Mexico.....*18
Proving negligence of employer.......... 471
Prussian, Colo. 853
Publi opinion and engineers 616, 619
"Public Utility" housing societies...... 912
Public Works department 586, 811
Publications, New......208, 335, 506, 723, 889
Publicity for mining districts.......... 912
—Prospecting 912
Pulley, Idle, Rock breaker..............*581
Pulp-level control *368
Pulp sampler, Automatic.................*412
Pump, mine. Midwest Engine Co........... 325
Pumping—Costs, Bunker Hill 479
Pumping equipment, Old Dominion 12
Pumps, Centrifugal—air booster 757
—Compound air lift *43
Pumps—Randfontein Gold mining........... 600
Purington, C. W......................... 378
Pyle, L. R. 634
Pyrites—Canada 618
—Calif. 801
—Norway 190
—U. S., 1918............................ 130
Importation 201
Imports and exports...............884, 1035

Q

Quaker Hill, Calif. 169
Quarry safety rules ....†208
Quartz—Canada 618
Quebec, Asbestos 252
Mills *1042
Mining *570
1918 587
Views *830
Quebec Asbestos and Chrome Co. 144
Quebec—Chrome 252, 698
—Labor 592
—Magnesite *602
Quebradas Mines, Guatemala 116
Queen Bess Mines, B. C. 75, 662
Queen Copper Co., Ariz 425, 811
Queen Esther, Kan. 253
Queen Leasing, Utah 340
Queensland—Minerals, 1918 953
Quesnel Hydraulic Gold Mining, B. C.....1038
Quicksilver. See also "Cinnabar."
Quicksilver—Anticlinal theory *916
—Calif. 56, *703, 1020
—Market, 1918 44
—Metallurgy 86, 1075
—Oregon *787
—Ores 1034
—Price, 1895-1918 352
—Texas. Review, 1918 145
—U. S. 1172
Future 876, 878
Market review, 1918 44
—Uses 988

Quilp Gold, Wash. 214, 638, 938
Quincy-Hancock Consol. 1055
Quincy Mining, Mich. 73, 294, 340, 770, 1021, 1055, 1102, 1181
—Annual report 1086
—Dividends 25, 626
—Steam shovel experiments 424
Quinine in malaria 348
Quinn, C. K. 978
Quinn-Harrison, Minn.—Concentrator *683
—General view *688
Quintera, Mexico 896

R

R. & S. Molybdenum, N. M................ 36
Rabb, E. M., death...................... 251
Radium industry and reconstruction...... 605
Radium Ore Sampling, Colo............... 73
Radium—U. S., 1918...................... 134
Rail stocks to be sold.................. 586
Railroad Administration................. 717
Railroads. See also "Transportation."
Railroads and steel prices. Editorial...... 671
Railroads, U. S. Government ownership..1015
Railway and Power Equipment Co.......... 675
Railway curves for mines................ 539
Railway problem. Editorial 375
Railway situation. Editorial............ 287
Rainbow Mining, Texas 146
Rainier Mercury Co., Ore.............74, 106
Ralston, O. C........................... 516
—Innovations in metallurgy of lead.......†208
Rambler-Cariboo, B. C..............510, 622
—Report 623
Rambosson, J. 166
Ramsdell Copper, Mont. 811
Rand, C. F. 373
Rand. See also "South Africa."
Rand gold mining........................ 469
Rand Mines, Ltd. So. Africa............. 739
—Bulkheads *538
Rand mining in 1918 702
Randfontein Central Gold Mining, So. Afric. 600
Randolph, Colo. 551
Ransome, F. L. Metallurgy of quicksilver 1075
—Quicksilver ores 1034
—Quicksilver, U. S.................876, 878
—Uses of mercury........................ 988
Rapid carbon dioxide determination.......*709
Rare Minerals Co., S. D.............74, 106
Rateau-Battu-Smoot Eng. Corp. 654
Rathenau, W. Germany's industrial future.. 25
Rattle, W., Jr., death................... 290
Raw materials, International commissions.. 201
Rawhide, Calif. 981
Ray Broken Hills, Ariz. 213, 425, 1063, 1103, 1180
Ray Consolidated Copper, Ariz. 72, 253, 463, 771, 953
—Annual report 494, 1085
—Dividends 25, 626
—Production 169, 339, 371, 541, 551, 762, 917, 1092
—Quarterly report 969
Ray Hercules Copper, Ariz............... 72
Ray Jefferson Mining, Ida............... 980
Ray Silver Lead......................... 253
Raymond, R. M. Standardization of mine cars *220
—Editorial 246
Raymond, R. W.: a memoir................*135
—Appreciation 362
Read, T. T. 373
Ready Bullion, Alaska 107
Reardon, D., death...................... 422
Recent improvements in sintering equipment*744
Recognition of technical engineers...... 21
Reconstruction—Belgium 546
—Canada 726
—Economic duties of engineer............ 184
—Editorials.......246, 247, 332, 333, 630, 719
—Engineer and reconstruction............ 868
—Engineering education 887
—Engineers to aid....................... 488
—Europe 800
—Exploration work for soldiers.......... 955
—France 546, 716
—Government information 764
—High wages necessary...................1013
—Industrial conference 713
—Industrial coöperation................. 748
—Labor and 200
—New price revolution................... 835
—Principles of industrial relations..... 754
—Professions 933
—Radium industry........................ 605
—Reëducation vs. compensation........... 474
—Salvage of war equipment............... 418
—State committees 394
—Suggestion from Mexico 200
—Teaching soldiers mining............... 763
—Vanderlip on 1097
Recording flue temperatures............. 566
Red Chief Mining & Milling, Ariz........ 72
Red Cloud, Ariz....................425, 771
Red Rose, Okla. 728
Red Top, Ariz........................... 425
Redfield—Conservation work 201
Redskin, Okla. 678
Reduction works—accidents...............1111
Reece, C. F............................. 634
Reed, V. Z., death...................... 807
Reëducation versus compensation for cripples 474
Reets, E. R............................. 674
Refining—Cobalt silver ore.............. 263

Page
Refining copper—Ampere efficiency........•743
Refining. Electrolytic—Silver and gold...•789
Refining—Internat. Nickel works, Port Colborne ....•429, •446
Refractories, Basic—Sources................ 648
—Gt. Br. 501
Regarding mine physician 579
Rehabilitation of cripples. Editorial...... 504
Rehabilitation of Europe.................... 800
Reid, Calif....................................... 593
Relaxation of British embargoes..........1048
Remington Arms-Union Metallic Cartridge Co. 714
Rennerfelt furnace 323
Repair work in milling plants..............1153
Repairing frame for steel tapes............•539
Replacing Oliver-filter shafts............198, 365
Replacing transmission belt ....•497
Replogle, J. L.................................. 210
Reports—Standardization 887
Republic, Ariz.................................. 937
Republic, B. C.................................. 638
Republic Iron & Steel, Ala........636, 771, 852
Republic, Mich.................................1102
Republic Mining & Mfrg.........36, 1075, 1104
Republic Production, Texas................. 938
Requa, M. L.....................................1060
Res ue apparatus, Permissible.............. 745
Rescue—Production.........36, 294, 772, 854
Rescue Truck ....•900
Rescue work—Geophone 872
Research 586
Research bill 24
Research fellowship, Ida..................... 912
"Researcher" 590
Residue—Definition 317
Resolute Mining, Colo........................ 853
Respirators—Uses and limitations......... 472
Rest periods in work. Editorial..........1174
Resume gold standard........................ 162
Resuscitation device..........................•528
Retorting—Sulphur 1124
Re-treating zinc tailings, Wis...............•524
Return of the Twenty-Seventh. Editorial.. 588
Reva Gold, Colo................................ 35
Revenue bill amended......................... 22
Reversed phases—Protection................ •21
Reversing switch for hoist motor..........•695
Review of War Committee of Tech. Societies 9
Revising mining laws.................761, 837
Rex Consol., Ida........................811, 981
Rex, Man. 76, 111
—Production 170
Reynders, J. V. W.............................. 373
Rheem, W. S., death.......................... 807
Rhodes, A. E. Melting brass...............†506
Rhodes-Manchester, Ark. 637, 1103
Rhodesia—Chromium 177
—Gold 391
Riasunti, C. E. Metallurgia generale......†506
Rice, C. T. Froth removal from flotation cells ....•759, 839
—Pulp-level control...........................•368
—Sampling practice. Independence mill....•641
—Straightener made from air pump........ 190
Rice, G. G. 419
Rice, G. S. 201
Richards, A. H.................................. 934
Richards, F. Blow of the drill bit..........•735
Richards Oil Synd., S. D.....................1179
Richardson, H. K. Gold washing on Yangtze ....•1069
Richfield, Calif., district..................... 979
Richmond, Colo................................. 551
Richmond, Ida 35, 425
Rickard, E. European relief.................1047
Rickard, T. A. Mining as an investment.. 663
Ricketts & Co................................... 708
Ricketts, L. D..........................290, 1060
Rico Exploration, Ari............425, 637, 727
Riddell-Dawson grate.........................•744
Ridgway, A......................................1056
Rigg, G. 5
Right of Way, Ont.............................. 594
Rights, Mining, Peculiar...................... 560
Rights of surface owners..................... 519
Rio Tinto Co., Ltd.—Annual report........ 786
Rise in cost of zinc mining, Wis........... 564
Rising Hope, Ariz. 551
Ristedt, E. J. Federal aid for prospectors 998
—Editorial 1015
Ro-Tap screen..................................•644
Road building in mining districts. Editorial 977
Roads, Bamboo—Burma...................... 11
Roanoke Ore & Iron, Va...................... 75
Roasting and magnetic separation, Zinc ores•1107
Roasting—Copper 90
—Zinc 87
Robbins, L. R 33
Robertson, W. F................................ 660
Robertson, W. H................................ 502
Robin, A. J...................................... 422
Robinson, H M 934
Rochester Combined Mines, Nev.. 74, 170, 734
Rochester l la Fina, Nev..............254, 734
Rochester Merger Mines, Nev 734
Rochester Mines Co., Nev.....340, 423, 734
Rochester Nevada Silver Mining Co 734
Rock-breaker, Idle pulley.....................•580
—Pitmans 579
Rock breaking, small mills 1141
Rock crusher [illegible] ....•828
Rock, W F 894
Rocky Mountain Club 367, 505
—Dinner 2
—Editorial 3

Page
Rolls—Repairs 1154
Ronnow, Nev.................................... 340
Roosevelt Tunnel, Colo....................... 811
Rope, Hoisting—accidents................... 435
Rope, Wire, investigation.................... 737
Rose, Sir T. K. Volatilization of gold..... 839
Rosenburg & Co...............................1100
Rosenstamm, S. S., death................... 634
Rosetta Divide, Nev........................... 638
Ross, A. C. 593
Round Mountain Mining Co.................1172
Round Valley Tungsten, Calif............... 72
Rowe, Minn. 213, 426, 1021
Roxana Petroleum, Tex....................... 896
Royal, Calif. 593
Royal Mine, Okla............................... 893
Royalties, Mo............................636, 894
Royce, W. 591
Royse, H. W..................................... 449
Ruby, Colo. 339
Ruby Silver, Ariz............................... 637
Ruck zinc-distilling furnace ....•307
Ruhl, O. Zinc industry, Mo., Ark., Kan., and Okla. 1170
Runner, J. J. Uses of tungsten.............†506
Rural-Buckeye, Ariz.....................593, 1103
Russia. See also "Siberia."
—Bolshevism 166
—Coal 1049
—Editorials 165, 417
—Iron 608
—Platinum 161
Russia today 402
Ruth flotation machine 97
Ruth, J. P., Jr. Notes on flotation......1149
Ryan, J. D....................................... 978
Ryan Petroleum Co., Tex....................1064
Rye, E. J.. 942
Rye Patch Mines, Nev........................ 340

S

Saam, J. 547
Sabin, C. H..................................... 873
Sabina Mining and Milling, Ida............1062
Safe cyanide fumigation...................... 312
Safety—Anti-fuse legislation............... 337
—Calif. Industrial Accident Comm......... 211
—Corner guard .... •17
—Devices obligatory.......................... 398
—Editorials 502, 1058
—Gas masks ....•693, 1008
—Improved hook ....•880
—Inclinations of ladders.....................1081
—Mining appliances..........................8, 398
—Permissible self-contained breathing apparatus 745
—Resuscitation device........................•528
—Standard mine cars ....•220
—Use and abuse of safety fuse............ 229
—Uses of respirators and masks........... 472
Safety Conference, Lake Superior.........1012
Safety devices in mines.....................8, 398
Sagamore, Minn. 294, 1021
Sailor Flat, Calif............................... 169
St. Germaine, R................................ 934
St. James, Ida.................................. 35
St. Joseph Lead Co., Mo....132, 294, 381, 852
—Annual report 622
—Dividends 25, 626
St. Lawrence Copper, Mont.................. 254
St. Louis Smelting & Refin.................. 36
—"Chat" dump ....•776
St. Nicholas Zinc Co., N. Y................. 75
St. Regis, Mo.................................. 253
Salaries—Standardization 458, 706
Saline Valley Salt, Calif..................... 72
Salinger, H...................................... 634
Salisbury, Mich................................ 36
Salmon-Bear River, B. C..................... 594
Salmon, G. J.................................... 226
Salmon, V. G. Practical surveying........†208
Salt—Canada 618
Salt Lake Chem. Co............................ 182
Salt River Valley Water Users Assoc.....1101
Saltchuck Mine, Alaska 71
Saltpeter—Chile 386
—Guatemala ....•1025
—Production and uses........................•385
—U. S. Imports 386
Salvage of machinery......................... 455
Salvage of war equipment. Editorial...... 418
Sampling, Ore 263
Sampling of dust in mine air........•395, 950
Sampling practice, Independence mill......•641
San Juan, Colo., milling.....................•1129
San Manuel, Mex.............................. 938
San Xavier Exten., Ariz...................... 937
Sand, Blackening, in filters................1051
Sanders, W. M. Salvage of machinery.... 455
Sanitary engineering in tropics............•389
Santa Fe, Calif................................. 337
Santa Gertrudis, Ltd.—Annual report...... 15
—Dividends 285
Santa Margarita Chrome, Calif............ 72
Sargent, Minn. 93
Satterley, J. 768
Sauer, F. Venezuelan petroleum........... 734
Savage, J. A 634
Savage, J. A. & Co...........................1179
Save and then save. Editorial.............. 720
Sceptre Mines & Mills, Colo................ 73
Schacht, W. H 807
Scheelite—Utah 182
S huet Oil Co. Tex............................ 896

Page
Schumacher, Ont........................594, 896
Schwerin, M....................................1019
Scott, H. E. Making sharp drills effective.. 996
—Editorial 1015
Scratch All, Mont.............................. 637
Screens—Conical trommel.................. 685
—Estimating efficiency ....•651
—Maxton wet-pulp............................•760
—Mechanical 644
—Ro-Tap ....•644
—Vibratory 1114
—Small mills 1144
Screening practice 1112
Seabrook, C. R. 167
Seals & Co., Okla. 510
Searls, F. 1177
Sebenius, J. M................................. 251
Secret Mining, Utah..........................1022
Section insulator ....•279
Seeber, R. R.................................... 167
Selection of mill power plant...............1121
Selective flotation. See "Flotation."
Selenium—U. S., 1918........................ 124
Self closing mainway gate..................•1087
Seligman, E. R. A.............................. 751
—Principles of taxation...................... 574
Sellards, E. H. 1177
Sellers, Minn. 678
Sells Mine, Utah.............75, 179, 552, 67
Seltzer, A. J.................................... 634
Selvig, W. A.................................... 902
Semaphore system, Underground...........•538
Semet Solvay Coke, Indiana................. 992
Seneca Mining, Mich..73, 213, 253, 294, 340, 426, 551, 853, 981, 1179
—Shaft 34, 168
Separating mixed oils......................... 710
Separation, Magnetic, zinc ores...........•1107
Separators, Mauss centrifugal..............•862
—Wetherill magnetic ....•1156
Setting anchor bolts with sulphur..........•708
Shafroth, Ex-Senator 499
Shaft, Deep, Village Deep, So. Africa...... 322
—Inclined, timbering.........................•349
—Negligent ladder system................... 606
Shaft operation law, Nev..................... 423
—Sinking record 560
—Spitting fuse in wet......................... 621
Shafting and belting..........................1132
Shafts, Mine—Grouting in................... 199
Shale, Oil. See "Petroleum."
Shanks, D. W................................... 978
Shannon Copper, Ariz....................35, 593
—Production 169 371
Sharp vs. Athletic M. & S. Co............... 177
Sharpless, F. F. Chrome ore in 1918...... 81
—Conditions in Sonora, Mex...............1007
—Labor and reconstruction.................. 200
—Labor, 1918 66
—Mining engineers in the war.............. •1
—Photo ....•486
—Revision of mining laws.................... 837
Sharwood, A. J., death....................... 934
Shasta-Belmont, Calif......................... 771
Shattuck-Arizona Copper, Ariz. 71, 253, 463, 550, 1103
—Annual report 712
—Dividends 285, 801
—Production.........169, 371, 381, 509, 541, 762, 771, 917, 937, 1002
—Quarterly report 968
Shawmut, Calif. 593
Sheepranch, Calif. 981
Shelby Chemical Co., Ala.................... 71
Sheldon, G. R., death........................ 460
Shell Oil & Transport, Ont................... 463
Shell Transport and Trading Co............ 212
Shenango Furnace Co. 338, 853
Sherlock, C. C. Discharging water from mining plants 311
—Legal aspect of tailings disposal.........1080
—Peculiar mining rights...................... 569
Sherman, Ida.............................253, 294
Sherry, H. K.................................... 934
Sherwin, J. W.................................. 251
Shimer, P. W................................... 602
Shimer case hardening process............. 602
Shipbuilding, U. S............................. 288
Shipping—Amer. merchant marine......... 629
Shipping, Available. Editorial.............. 848
Shipping freight rates........................ 326
Shiras Mine, Minn............................. 170
Shiras, T. Bauxite mining, Ark.............•1074
Shop wagon ....•1087
Shoshone County, Ida.—Gold............... 725
Should the government own telegraphs?.... 155
Shoveling ....•481, 520, 545
Siam—Mining concessions 273
Sias, J. M.......................................1100
Siberia—Mining situation 162
—Silver 204
—Zinc 204
Sidney Copper, Calif 637
Siebenthal, C. E. Cadmium.................. 909
Sierra Asbestos Co., Calif.................51, 72
Signalling Underground semaphore.......•538
Signals, Surveyor's lamp. 1087
Sill, R. T 634
Sillnau, L., death............................... 422
Silver—Amalgamation 93
Silver Bell, B. C 464
Silver Bell Explor., Ariz...................... 637
Silver Belt, Ariz.........................253, 853
Silver—Canada 618
Price 665
Silver-Cliff, Ont 896

Page
Silver Dike Tungsten, Nev.... 74
Silver-Fox, Okla. 938
Silver Gem, Colo.... 339
Silver—Ida. 1020
Silver King Coalition, Utah....179, 254, 382, 510, 896, 1022, 1104
Silver King, Colo.... 35
Silver King Consol. Mining, Utah. 75, 179, 254, 340, 382, 678, 666, 812
Silver King Divide, Nev.... 638
Silver King Mining Co., Mont.... 510
Silver King of Ariz. Mining Co. 72, 169, 339, 771, 937
Silver-lead smeltery 89
Silver-lead smelting works of N. A.... 53
Silver—Melting by electricity.... 323
—Metallurgy 92
—Mexico 477
—Philipsburg dist. 973
—Ontario 108, 1096
—Price 897, 933
  1918 42
  1895-1918 352
Silver Reef, Calif.... 593
Silver Reef Consol., Utah.... 678
Silver—Refining, electrolytic *789
Silver—Review, 1918.... 41
Silver Shield, Utah.... 678
Silver—Siberia 204
—Smelting cobalt ore 263
Silver Standard, B. C....36, 75, 214
—U. S. Production, 1919....1054
Silver Virgin Co., Ariz.... 937
Silversmith, B. C....36, 464, 594
Silverton Experiment Station.... 725
Silverton, Colo., district....1131
Simi Valley, Calif. Petroleum.... 913
Simon Lead Mines, Nev....170, 594, 938
Simonds, H. E., death.... 210
Sinclair Gulf, Tex....1104
Sinclair Oil & Gas., Okla.... 938
Sincock, H., death.... 507
Sines, G. H. Recognition of technical engineers 21
Sintering equipment and practice....*744
Sisson, F. H. Post-war financial problems.. 713
Situation in zinc. Editorial.... 205
Sixteen To One, Calif.... 294
Skeels, F. H.... 763
Skelton Mining, Okla.... 145
"Skin-flotation" graphite ores....1052
Skinner, Consol.... 277
Skinner, W. R. Mining manual....†890
Skoda Works, Bohemia 146
Slag, Copper, Microscopic and chemical point of view *815
Slag—Microscopic analysis *815
Slate Creek Hydraulic, Calif.... 35
Slaughter, W. F.... 591
Slide, Colo. 853
Sloan, W. 660
Sloan, W. A....1177
Sloane, D. 167
Slocan Star, B. C.... 662
Sloss-Sheffield Steel & Iron, Ala.... 71
Small air compressors....*1041
Smelters Steel Co.... 424
Smeltery—United Verde Exten....*150
Smeltery Slag—Microscopy and chemistry..*815
Smelting. See also "Metallurgy."
Smelting charges, B. C.... 292
Smelting—Cobalt silver ore.... 263
Smelting, Electric, of iron, B. C.... 224
Smelting plant, State, Ariz.... 252
Smelting tin ore, Mexico.... 264
Smith, A., death.... 768
Smith, C. C. Flocculation in flotation....*365
Smith, C. J.... 591
Smith, D. C.... 591
Smith, F. G. D. death.... 336
Smith, F. M.... 1019
Smith, G. O....972, 1168
—Alsacian potash....1093
Smith, H. DeW.... 167
Smith-Howard Bill.... 24
Smith, J. P. Stanford School of Mines..*869
Smith, T. O. Safe cyanide fumigation....*312
Smoot, C. H. Air-volume regulation in furnaces *654
Smuggler, Colo....213, 727, 1129
Smuggler-Union 1181
Snowstorm Mines, Mont.... 551
Snyder, H. G....1022
Soapstone—U. S., 1918.... 126
Société de Hauts Furnaces de Nouméa.... 348
Society of Chem. Ind.... 934
—Perkin medal 202
Society of Industrial Engr.... 290
Soda ash, U. S, 1918....1056
Sodium compounds, nomenclature.... 710
Sodium nitrate. See Nitrate.
Sodium sulphide in cyanidation.... 95
Söhnlein, M. G. F. American tin-slag analysis 576
Soldier employment.... 911
Soldiers, Disabled—Vocational education.... 844
Soldiers' pay 162
Sonora, Mex. conditions....1007
Soper, E. K....1019
Sorting plant, magnesite....1111
Source of placer platinum, B. C.... 303
Sources of basic refractories.... 648
South Africa—See also "Transvaal," "Rhodesia," etc.
—Chrome 1080
—Diamonds 121

Page
South Africa—Continued
—Gold
  Mining conditions....*469, 918
  Review, 1918.... 702
—Labor 470, 918
—Manganese 394
—Metallurgical review, 1918 93
—Mining conditions 363, 852
—Mining in 1918.... 702
"South African." Rand gold mining....*469
South America—Mineral deposits....†890
South America, Mining, 1918.... 113
  Views *874
South American Gold & Platinum Co....1182
South Chandler, Minn.... 637
South Dakota—Gold Production, 1917.... 714
—Labor 770
—Minerals, 1918 908
—Mining, 1918 106
South Hecla, Utah 179, 594, 812, 982, 1022
—Annual report 382
South Ray Copper, Ariz....894, 1179
South Star Co., Calif....1063, 1103
Southeastern Missouri lead district.... 132
Southern Manganese Corp., Tenn.... 149
Southern Pyrites Ore Co.... 800
Southern Utah Power Co.... 211
Southport Miners' Federation.... 352
Southeastern Graphite, Tex.... 75
Southwestern Society of Engrs....1055
Sovereign, Ont....812, 1022, 1182
Spain—Engineer's Commission.... 527
—Minerals, 1917 203
—Potash 728
Spanish influenza 380
—Alaska 381
—Minn. 252
Spanish language. Utility of..198, 578, 706, 838
—Editorial 588
Spearhead Gold, Nev.... 36
Spearhead, Mont.... 254
Specific gravity table....1145
Speiss, Desilvering 263
Speller, F. N. Deoxidizing water.... 480
Spelter. See also "Zinc."
Spelter statistics, 1918.... 958
Spencer, A. C.... 299
Spiegeleisen, U. S. Import restrictions.... 670
Spitting fuse in wet shaft.... 620
Splitter, Jones *642
Spokane Copper, Wash.... 594
Spokane Engineering Soc.... 535
Spokane Lead, S. D.... 75
Spokane Metals Recovery, Ida.... 73
Spring Mines, So. Africa.... 119
Spur, Calif. 981
Spurr, J. E....667, 850, 1177
Squier, W. H.... 210
Stafford, A. W. *760
Stairways, Inclination....1081
Standard, B. C.... 662
Standard buildings *952
Standard Chemical, Colo.... 213
Standard Lead & Zinc, Okla....1182
Standard Minerals Co., Ariz.... 71
Standard Oil Co....146, 379
Standard Oil Co., Calif.... 885
Standard Oil Co. of N. J.... 980
Standard Silver Lead, B. C.... 464
Standard Tungsten Co.... 285
Standardization—Amer. Engr. Standards Assoc. 1091
—Mine cars *220
—Editorial 246
—Reports 887
—Salaries 706
  Editorial 458
—Shoveling *481, 520
Standardized methods. Editorial 29
Stanford School of Mines....*869
Stange Mine, Va.... 75
Stanley, Colo....1063
Stansfield, A.... 491
—Electric Smelting of iron ore, B. C.... 224
Star of the West Mining, Mont.... 896
Stargo Synd., Ariz....894, 981
Starkey, F. A.... 212
Starters, Motor.... 316
Starting sheets, Clips.... 191
State geological officials.... 68
State industrial insurance, Nev....*985
State Mines, Minn.... 853
State Reconstruction Committees.... 394
Statistics, Post-war readjustments in collecting 454
Staunton, W. F. Engineer and reconstruction 868
Steam-boiler economizers 449
Steam economics....561, 707
Steam plant requirements.... 647
Steel. See also "Iron."
Steel Company of Canada.... 76
Steel—Electric furnaces, Gt. Br.... 235
Steel—Open market.... 886
Steel prices lowered 584
Steel prices and railroads. Editorial.... 671
Steidle, E.... 934
Steinman, W. H., death.... 547
Steinmetz, C. P. Industrial coöperation.. 713, 720, 748
Stella, Nev. 895
Stem economies 1125
Stemwinder, Mont. 728, 772, 1064
Stepanoff, L.... 724
Stephen, M. J.... 942
Stettinius, E. R.... 715

Page
Stevenson, C.... 460
Stevenson, Minn. 811
Stewart, J. 336
Stewart, J. B. Cuban manganese, 1918.... 196
Stewart, L., death 978
Stewart, R. H.... 167
Stimson, H. L.... 973
Stitt, E. R. Tropical diseases....†890
Stobie, J., death.... 460
Stock sales, Ariz.... 980
Stocks, Fake. Editorial....1059
Stocks, Mining in 1918.... 158
Stone, G. C.... 591
—Impressions of Australia.... 5
Stone, R. W.... 160
Stoping drills, Progress....*964
Storage bins, Steel....*1575
Storm in Texas oil fields....1031
Stout, H. H.... 978
Stouts Gulch, B. C....1035
Stowell, G. E....1019
Straightener made from air pump.... 190
Straits Trading Co.... 445
Strauss, A. 371
Street, A. L. H. See "Law decisions."
Stripping methods, Ariz....*690, *700
Strontium—U. S., 1918.... 124
Stuart, W. H.... 850
Study of shoveling....*481
Stull, R. S.... 147
Stump, Ariz. 35
Sub-aëration in flotation.... 497
Suborich vs. Alaska United Gold.... 471
Success, Ida. 35, 426, 551, 593, 1063
Sullivan, Ariz. 677
Sullivan Machinery Co....1100
Sulphide Copper, Ariz.... 593
Sulphide in slag 817
Sulphide ore—Gold occurrence.... 923
Sulphur—Bordeaux market 909
Sulphur Committee, War Ind. Bd.... 72
Sulphur dioxide atmosphere—Use of gas masks *693
Sulphur—Flotation and retorting....1124
—Frasch extraction method.... 555
—Grouting with 279, *708
—Setting anchor bolts....*708
—Texas *555
—U. S., 1918.... 130
  Distributing govt. stock....204, 800
Sulphuric acid—Germany.... 763
—U. S. 130, 960
Sultan Mine, Nev.... 74
Sumatra, Gold 1070
Summerfield & Elges, Nev.... 170
Summitt, S. D....896, 1104
Sundt, F. A.... 815
Sunlock Mining, B. C.... 75
Sunnyside Mine, Colo.... 851
Sunset Copper, Wash....938, 1022
Sunset, Ida. 253
Sunset M. & Devel., Nev.... 254
Sun, N. Y. Mexico.... 154
—Must the prospector go?.... 8
—Government operation 7
—Rocky Mountain Club Dinner.... 27
—Some views of labor. Editorial.... 165
Sunnyside Mining & Milling, Colo.... 73
Sunset M. & D., Nev.... 552
Sunshine, Ida. 426
Superior & Boston, Ariz....339, 593
—Annual report 583
Superior Mining, Utah.... 294
—Production ..36, 170, 213, 381, 551, 727, 937
Supplies—Prices. See "Prices."
Surface owners' rights.... 519
Surprise, B. C.... 662
Survey, Geological—Annual report....†335
—Antimony data 502
—Bastin heads division 160
—Foreign mineral resources.... 267
—Grinding pebbles and tube mill liners.... 745
—Mineral data in Paris....1093
—Mineral resources, 1918.... 971
—Portland cement, 1918.... 316
—Potash independence possible.... 370
—War record 3
—Yerington district, Nev.... 627
Surveyor's lamp signals....*1087
Sutherland Divide, Nev....426, 552, 854, 896
Swain, G. F. Engineering. education.... 564
Swan, C. B....1100
Swansea Consol. Gold & Copper, Ariz..72, 809
Sweden—Iron 480, 1076
—Metals importation 202
Sweetser, A. L.... 167
—Anchor bolt securing 15
Sydney Export Co., N. S. W.... 741
Syndicate Aleman, Venezuela.... 439
Syracuse Smelting Works.... 167

T

Table covering, Concentration.... 317
Tacna-Arica controversy.... 114
Taft, H. H. German potash deposits.... 473
Tailings, Definition.... 317
—Disposal, Legal aspect 1080
—Okla.-Kan. district 558
—Zinc, Re-treating *524
Taking the bull by the horns. Editorial.... 630
Talc.—Canada 618
—U. S., 1918.... 126
Talkeetna Mountains, Alaska—Minerals.... 971
Tamarack & Custer Consol., Ida..236, 253, 291, 510, 551, 809, 853, 893, 936, 1021

Page
Tamping bag use 602
Tanks, Leaching *1163
—Water, Life of wooden 600
Tanner, W. G. 36
Tapes, Steel, Repairing frame *539
Tar Baby, Utah 1064
Tae Kiln, Ark. 771
Tarbox Mining, Mont. 74, 594, 1103
Tariff. See also names of metals.
—Editorials 886
—Revision 928
Task ahead. Editorial 627
Tasmania—Minerals, 1918 966
—Mines, Secretary, Report .... †506
—Osmiridium 293
Tasmanian Gold Mining Co. 122
Taxation—Alaska 761
—Ariz. 423, 885, 936
—Arkansas 424
—Calif. 979
—Ecuador 943
—Michigan mine valuation list 936
—Mines 664, 780
—Minnesota 252, 508, 676, 725, 791, 809
—Principles 574
—U. S. 23, 168, 449
  Depletion of mineral deposits 750
  Editorials 417
  Tariff revision 928
—Utah 178, 291, 337, 379, 461, 549, 635, 676, 725, 809
Taylor Engineering Co., B. C. 1102
Taylor, H. F. 591
Teaching discharged soldiers mining 763
Teaching engineers economics 366
Teaching mining in mines. Editorial 766
Technical organization in industry. Editorial 247
Technicians in govt. service *225
Teck Hughes 294, 464, 638, 982, 1022
Teknik Club 378
Telegraphs—Government ownership 155
Telephones—Copper economy 308
Telluride Power Co. 211
Temiskaming Mining Co. 170, 462, 728, 938
Temiskaming North. Ont. R. R. Commission .... †889
Temperature—Bunker Hill mines 603
Temperature control—Calibration of base-metal thermocouples 442
Temperature—Gas in boilers 608
Temperatures, Flue, Recording 566
Temperatures, Standard 479
Tennessee Coal, Iron & R. R. Co. 63, 71, 726, 810, 963
Tennesse Copper and Chemical Corp. 798
Tennessee—Manganese 149
Tennessee Manganese Co. 1124
Terrill, A. C. 1177
Terry, J. T., Jr. 634
Tertiary Gravel Co., B. C. 75
Tertiary Mining, B. C. 1038
Test work, Flotation 1160
Texas & Pacific R. R. 936
Texas Chief Oil & Gas 1064
Texas Co., Tex. 982, 1022, 1064, 1104, 1182
Texas Gulf Sulphur Co. 340, 550, 638, 728
—Operations and properties *555
Texas—Labor 1102
—Law 292, 462, 810
—Petroleum 936, 1022, 1031
Texas Petroleum Refiners' Assoc. 728
Texas—Quicksilver. Review, 1918 145
—Sulphur *555
Thawers at mines *925
Thawing ground 527
Thawing water mains, Cost 604
Thayer, B. B. Butte district 49
Thelma Jane, Okla. 170
Theory of precipitation of gold by charcoal 516
Thermit repairs, rock crusher *828
Thermocouples, Base-metal—Calibration 442, 579, 707
Thetford Mines, Quebec *57, *831, *1043
Thickener, Dorr. Froth removal 839
Thomas Furnace Co. 770
Thomas Iron Co., N. J. 74
Thomas, J. H. Wealth 919
Thomas, K. B. 167
Thompson, D. Indian raids in Mexico 477
Thompson, J. W. Current decisions on mines and mining .... †889
Thompson, W. B. 248
Thomson, F. A. 423
  Teaching discharged soldiers mining 763
Thorium—U. S., 1918 124
Thornton, N. M., death 460
Three Kings, Utah 179, 464
Three R., Ariz. 35
Three Sevens Gold Mines, Calif. 637
Thrift and investment protection 932
Throndson, H. M. 759
Throndson Metal Saving, Ida. 73
Thunderbolt, Ariz. 509
Tice, C. L. Pocket transit sights *620
Tiebaghi Co., New Caledonia 349
Tiger, Okla. 1022
Tightner, Calif. 339
Tilden, Mich. 1063
Tillson, B. F. 373
Timber—Cutting with Jackhamer 758
—Lashing *914
Timbering—Concrete underground bins *1071
—Inclined-shaft *349
—Nev. *914
Timberlake, C. B. 1011

Page
Time limits for analyses 241
Tin—Banca 954
—China Export 445
—Cornwall, Mining 577
—Gt. Br. Imports and exports 359
—Japan, imports 954
—Java 1148
—Malay 997
—Mexico, smelting *264
—Price, 1918 65
  1895-1918 352
—Queensland 953
Tin-slag, American 576
Tin—U. S. 542
  Editorials 287
  Export restrictions 24
  House gets complaint 455
  Importation 1169, 1011
    Imports and exports 480, 884, 1031
Tin, Yunnan—Hongkong 445
Tintic Central—Utah 254
Tintic district 180
Tintic Drain Tunnel 214, 854, 938
Tintic Milling, Utah 638, 938, 1062
Tintic Paymaster, Utah 510
Tintic Standard, Utah 180, 214, 340, 510, 594, 678, 772, 938, 1182
—Dividends 626
Tintic Union, Utah 1022
Tintic, Utah,—district 763
Tippecanoe, Colo. 853
Tissot gas mask *693, 801
Titanium—U. S., 1918 125
Titration of copper with cyanide 242
Tobacco prohibition 672
Tobelmann, H. A. 191
Tom Reed Gold Mining, Ariz.—Dividends 25
—vs. United Eastern Mining 549, 936
Tomboy Gold Mines Co. 381, 1129
—Adopts flotation 325
Ton, Fluid. Tables 16
Tongkah Harbour Tin Dredging Co. 328
Tonopah Belmont Devel. 72, 552
—Annual report 799
—Dividends 801
—Production 36, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811 854, 895, 982
Tonopah Divide Mining 252, 426, 552, *746, 854, 860
—Production 36, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811, 854, 895, 892
Tonopah Dividend Nev. 426, 552, 854, 860
Tonopah Exten. Mining 170, 382, 426, 552
—Annual report 969
—Dividends 285, 801
—Production 36, 254, 294, 382, 464, 638, 678, 728, 772, 811, 854, 895, 982
Tonopah Hasbrouck 426, 552, 896, 1181
Tonopah Kawich, Nev. 340
Tonopah Mining 552
—Dividends 801
—Production 36, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811, 854, 895, 982
Tonopah Western 426
Tools for trade schools 410
Tough, F. L. Methods of shutting off water .... †208, †335
Tough Oakes, Ont. 254, 594, 896, 1064
Townsend Bill 1015
Trackless trailer *228
Tractors in ore haulage 705
Trade relationships. Editorial 931
Trail, Colo. 811
Trail smeltery. See "Consolidated Mining."
Trailer, Trackless *228
Transatlantic freight. Editorial 1098
Transformers for induction motors 1076
Transit, Brunton *620
Transportation, Aerial. Editorial 766
—Alaska 445
—Ariz. 1020
—B. C. 550
—Colo. 851, 1020
—Ecuador *941
  Editorials 977
—Express shipments 851
—Lake Superior *400
—Loco-tractor system *313
—Mexico 177
—Mines 809
—Ont. 424, 550
—Utah 549
Transvaal Chamber of Commerce 918
Transvaal Chamber of Mines 852
Transvaal—Gold production 1884-1918 118
—Mining, 1918 118
Trapshooting clubs and lead 290
Trask & Caffer, Calif. 853
Traveling cranes—Auxiliary hoist 653
Traylor Engineering & Mfg. Co. *908
Treatment of Bolshevism. Editorial 931
Trench, Ariz. 381
Trenton-Georgia, Ariz. 463
Trethewey Silver-Cobalt, Ont. 76
—Annual statement 464
—Dividends 285
Tri-State Mine Safety and Sanitation Assoc 677
Tri-State Operator's Assoc 292
Triangle, Okla. 552
Tribune, Mexico 154
—Ole Hanson 330
Tribute to J. Douglas 20
Trilby, Colo. 340
Trimountain, Mich. 879
Trommel screen, Conical 685
Tropical diseases *800

Page
Trouble with rock-breaker pitmans 579
Trounce, H. D. 634
Tropics—Sanitary engineering *389
Troy Arizona, Ariz. 169, 771, 894
Truckee-Carson project, Nev. 505
True Fissure, Mont. 638
Trust legislation. Editorial 765
Tube-mill liners and grinding pebbles 745
Tube mills 100
—Repairs 1155
Tuberculosis, Miner's 936
Tudhope Electric Metals, B. C. 510
Tulameen, B. C., Source of placer platinum 303
Tulsa-Pittsburg, Mo. 594
Tungsten—Calif. 508
—China 123, 273
—Colo. 424
Tungsten-Comet, Nev. 340
Tungsten Comm. See "War Indust. Bd."
Tungsten—Gt. Britain 670
Tungsten industry in 1918 78
Tungsten market. Editorial 629
Tungsten—Homestake flow sheet 1159
Tungsten Mines Co., Calif. 72
Tungsten ore market 80
Tungsten—Price 80
Tungsten Reed, Ariz. 425
Tungsten—U. S. 542
  Market. Editorial 629
  Price 80
  Production, 1918 285
  Review, 1918 78
  Tariff 1011, 1094, 1168
  Imports 80, 480
Tunis—Manganese 1076
Tunnel driving, Copper Mountain *567
Tuolumne Copper, Mont. 214, 594, 811, 982, 1104, 1181
—Productions 340, 510
Tuolumne Superior, Calif. 381
Turbo blower, Internat. Nickel 557
Turbo-blower unit *881
Turner, S. 1060
Twenty-Seventh Engineers 25, 163, 204, 245, 286, 372, 416, 456, 501, 543, 625
—Association, Treas. report 930
—Editorials 588
—Lieut. Burrage's article *731
—Medals 1173
—Minn. members return 930
—Norcross commands 586
—Report of Association 327
—Return *614
Twin Buttes Exten., Ariz. 293
Typhoid and water supply 390
Tyrrell, J. B. 768
—Early Indian raids in Mexico 477

U

Udden, J. A. 1100
—Anticlinal theory .... †916
Uintah Basin, Utah 1061
Umpleby, J. B. 160, 540, 891
—European situation 1094
Uncia, Bolivia 115
Uncommon ores and metals 124
Underfeed firing 190
Underground mechanical loading 990
Underground semaphore system *538
Underwriters', Okla. 678
Unevida Gold Mining Co. 211
Union, Calif. 509
Union Consolidated, Nev. 36
Union Metal Mines, Mo. 1102
Union Miniere. See "Katanga."
Union Natural Gas Co. 1064
Union Oil Co., Calif. 146, 979
Union Sulphur Co. 510
—vs. Freeport Sulphur 556
Unionism. See "Labor."
Unionist—an opportunity. Editorial 503
Unionville, Nev. 340
United America, Ariz. 1063
United Arizona 213, 853
United Bingham, Utah 510
United Copper, Wash. 382, 464, 510, 594, 726
—Scale of wages 214
United Eastern, Ariz. 637, 771, 1103
—Dividends 25, 285, 456, 626, 801, 1012
—vs. Tom Reed Gold Mining 549, 936
United Engineering Society 14
United Filters Corp. 934
United Kingdom—Coal miners 352
—Electric steel furnaces 235
—Gold. Production Committee 269
  Importation 277
—Extra regulations 1048, 1092
—Import restrictions 715, 1055, 1073
  Iron 1012
—Metal stocks 215, 729, 897, 1105
—Metals, Imports and exports 359
  1918 56
—Molybdenum 670
—Petroleum 1020
—Refractories 501
—Tungsten 670
—Zinc, Import restrictions 1073
United Mine Workers of America 676
United States (Productions and other matter.) See also "Survey, Geological," "Bureau of Mines," etc.
—Antimony 502, 542
  Imports and exports 619, 884, 1031
—Arsenic regulations 23
  Review, 1918 86

Page
United States—Continued
—Carnotite 453
—Chemical trade, German 972
—Chrome 202
  Review, 1918 81
  Situation 280
—Chromite 718
—Coal.
  Anthracite restrictions 329
  Bituminous 625
    Production, 1918 329
    Review, 1918 43
  Statistics 949
—Coke, 1918 329
  Review, 1918 43
—Copper 542
  Editorials 164
  List of smelteries 46
  Market, 1918 48
  Price. See "Copper, Price."
  Production by months 371, 541, 762, 917, 1092
    1918 371
  Review, 1918 46
  Situation 286, 844
  Stocks 726
    Import and exports 240, 371, 372, 541, 619, 762, 884, 917, 1031, 1092
—Corundum, 1918 911
—Diamonds 910
—Emery, 1918 911
—Employment Service 394
—Ferro-alloys. Review, 1918 83
—Ferromanganese. Import restrictions 670
—Fluorspar, 1918 196
—German metal interests 532
—Gold. See also "Gold Committee."
  Labor and wages 877
  Production 1002, 1054
  Review, 1918 41
  Sun editorial 8
    Imports and exports 1003
—Graphite
  Review, 1918 147
  Sales, 1918 1172
—Gypsum, 1918 1098
—Iron
  Jan.-Apr. 1919 927
  Mining, 1918 62
  Pig 202, 329, 488, 718, 885
    1918 60
  Pittsburgh markets 60
  Price 584, 717
    Editorial 671
  Review, 1918 60, 399
  Steel prices lowered 584
  Surplus stocks 928
    Imports and exports 653
—Labor. See also "Employment" 245, 326
  Copper employee delegates 282
  Editorials 503, 671
  Review, 1918 66
—Lead 542
  Editorials 457
  Prices 52
  Imports and exports, 302, 372, 619, 884, 1031
—Magnesite, 1918 131
  Embargo removed 1010
  Imports 485
—Magnesium. Review, 1918 96
—Manganese 542
  Production, 1918 444
  Protection unlikely 413
  Review, 1918 77
  Imports and exports 619, 884
—Metals. Editorials 333
  Production 1916-1918 39
  Sale of govt. stock 372
—Mica 123
—Minerals 282
  Foreign trade committee 972
  Resources 971
—Mining machinery export 764, 882, 1171
—Mining. Review, 1918 103
—Molybdenum
  Price 83
  Review, 1918 82
—Nitrates 585
  Disposal of stocks 413, 764, 800, 927
  Importation 927
  Research work 624
—Palladium, 1918 124
—Petroleum 370, 543
  Development 329
  Feb.-March, 1918, 1919 909
  1918 183
  Oil shale possibilities *217
  Review, 1918 43
  Imports and exports 909
—Phosphate rock, 1918 1148
—Potash 202, 1011
  Embargo removed 1010
  Fordney bill 1093
  Imports License Bill 161, 243, 413, 437, 455, 499, 585
    House Committee Hearing 1168
  Independence possible 370
  1918 125
—Pyrites, 1918 130
  Importation 201
    Imports and exports 884, 1035
—Quicksilver 1172
  Future 876, 878
  Market review, 1918 44

United States—Continued
—Radium, 1918 134
—Saltpeter imports 386
—Selenium, 1918 124
—Silver. Production, 1919 1054
—Soapstone, 1918 126
—Spelter statistics, 1918 958
—Soda ash, 1918 1056
—Spiegeleisen. Import restrictions 670
—Strontium, 1918 124
—Sulphur, 1918 130
  Distributing govt. stock 204
—Sulphuric acid 960
—Sulphuric acid, 1918 130
—Talc, 1918 126
—Tariff Commission 962
—Taxation. See "Taxation."
—Thorium, 1918 124
—Tin 542
  Editorials 287
  Export restrictions 24
  House gets complaint 455
  Importation 1011, 1169
    Imports and exports 480, 884, 1031
—Titanium, 1918 125
—Tungsten 542
  Price 80
    Editorial 629
  Production, 1918 285
  Review, 1918 78
  Tariff 1094, 1011, 1168
  Imports and exports 80, 480
—Uranium, 1918 125, 134
—Vanadium. Review, 1918 149
—Zinc 542
  Editorials 205, 588
  Market, 1918 58
  Review, 1918 57
  Smelting capacity 58, 961
  Statistics, 1918 958
  Tariff 282, 636, 1011
  Imports and exports, 57, 302, 372, 619, 884, 1031
—Zirconium, 1918 125
U. S. Assay office 994
U. S. Chamber of Commerce. See "Chamber."
U. S. Copper Co 36, 812
U. S. Copper Products Co 548
U. S. Employment Service 437
U. S. Manganese Corp 74, 426
U. S. Smelting Co 58, 145, 551, 961
U. S. Smelting. Ref. & Min 158
—Annual report 798
—Balaklava suit 883
—Dividends 285, 801
—Mammoth smeltery 979
U. S. Spruce Prod. Corp 245
U. S. Steel Corporation 62
—Annual report 704
  Editorial 721
—Decline in orders 761
—MacDougal litigation 380
—Pensions 338
U. S. Steel Products Co 813, 855
U. S. Vanadium Devel 72, 894, 1180
U. S. Zinc Co 58, 961
United Verde Copper, Ariz. 72, 213, 253, 381, 423, 810, 980, 1062, 1103
—Dividends 456
—Expansion of plant 337
—Production 762, 772, 917, 1092
United Verde Exten., Ariz. 35, 72, 90, 213, 423, 549, 593, 637, 677, 783, 810, 894, 953, 980
—Annual report 495
—Dividends 456, 1012
—Haulage tunnel 770
—Production 371, 541, 762, 771, 917, 1092
—Smelting *150, *151
United Zinc Smelting Corp 58, 961
Unwatering—Compound air lift *436
Uranium—U. S., 1918 125, 134
Uren, E. C 547
Urquhart, L. Russia today 402
Uruguay—Law 972
—Mining, 1918 117
Use and abuse of safety fuse 229
Use of concrete underground *1071
Use of headlights on locomotives 741
Use of tamping bags 602
Uses and limitations of respirators 472
Uses of mercury 988
Utah Apex, Utah 181, 464, 855
—Utah Consol. litigation 379
Utah Consol 181, 211, 854
—Dividends 25
—Utah Apex litigation 379
Utah Copper Co. 168, 181, 340, 379, 812, 938
—Annual report 797
—Copper situation 379
—Dividends 25, 626
—Production 170, 371, 541, 552, 762, 917, 1092
—Quarterly statement 495
—Tax suit 769
Utah Iron & Steel, Utah 896
Utah—Labor 461, 508, 549, 936, 893, 975, 1020, 1101
—Law 380, 725, 1179
Utah Lsg. 340
Utah—Leasing systems 769
Utah Metal & Tunnel Co 211, 552
Utah mine, Utah 75
Utah—Mining 168
  1918 178
  Operators' Committee 626

Page
Utah Ore Sampling Co 181
Utah—Petroleum 337
—Potash 182
Utah Power & Light Co 549
Utah-Salduro, Utah 728
Utah—Scheelite 182
Utah Society of Engineers 336, 422
Utah State Industrial Comm 423
Utah Sulphur, Utah 294
Ute Oil Co., Mo 218
Utica, Calif 293
Utica, Minn 594
Utilizing volcano steam 307

V

Vail, T. N. Copper economy 308
Valley Forge, Mont 170
Valuation of mines 785
Valve control, Electrical *411
Valve, Gas-reversing *498
Van Arsdale, G. D 1009
—Copper slag from microscopic point of view *815
  Editorial 848
Van Barneveld. See "Barneveld."
VanDruff, R. E 1019
Van Dyke, Ariz 593
Van Ryn Deep, So. Afric 703
Van Winkle, C. T. Ball-milling and flotation 708
Vanadium in 1918 149
Vancouver Assay Office 34
Vancouver Chamber of Mines. See "British Columbia."
Vancouver—Manganese 884
Vanderlip, F. A. European conditions 1097
—Editorial 630
Vedder, G. C. American methods in foreign trade †335
Venezuela—Copper 439
  Mining 796
—Gold 439
—Magnesite, Margarita Island *645
—Mineral industry 438
—Mining 944, 1056
—Petroleum 440, 734
Ventilation—Coeur d'Alenes 603
—Prospects *926
Vera Cruz Leasing, N. M 36, 74
Verde Combination, Ariz. 35, 169, 381, 463, 509, 853
Verde Hub, Ariz 425
Verde Inspiration, Ariz 72
Verde Squaw, Ariz 425
Vibratory screen 1114
Victor, A. F 1100
Victor, Colo. 35
Victoria, Colo 727, 895
Victoria Copper Mining Co., Mich 294
—Annual report 583
Victoria Mines, N. M 982
Victoria-Nevada, Nev 1104
Victoria Divide, Mont 678
Victory Liberty Loan 523, 535, 573, 627, 714
—Editorials 628, 721, 765, 803, 845
Victory, Okla 938
Villa, F. 204, 963
Village Deep, So. Afric *471
—Deep shaft 322
Vindicator Consol. Gold Mining, Colo. 73, 893
—Annual report 583
—Dividends 285
Vinegar Hill, Kan 727
Vinegar Hill Zinc, Wis 75
Vipond-North Thompson 340, 464
Virginia-Louise, Nev 340, 426, 811, 1021
Virginia, N. M 982
Vivian, D. L 768
Vocational education 423, 844, 893, 980
Vogelstein & Co 532
Volatilization, Gold 839
Volcano steam utilization 307

W

Wachusetts, Kan 593
Wadsworth, F. M. Efficiency in use of oil fuel †335
Wage, Minimum 827
Wages. See also "Labor."
Wages and labor in gold mining 877
Wages, Bisbee, Ariz 1009
—United Copper 214
Wagner, R. E. Electric arc welding *743
Wagon, Shop *1087
Wahlberg, N. A. Section insulator *279
Wakefield, E. C 464
Waldron, Ariz 637
Walker, A. L. Metallurgy of copper 90
Walker, Calif. 937
Walker, W. H 669
Wall, H. 367
Wall Street Copper, Nev 214
Wallace, R. C 674
—Mining in Manitoba 111
Wallaroo & Moonta Mining & Smelting, Aus.—Annual report 845, 969
—Concrete underground works *1071
Wallers, Sir E. A. Labor and gold 918
Walsh, J. J. Physics of mine ventilation †889
Wanjukoff, W. A 817
Wano Mining & Milling, Colo 73
War Committee of Tech. Societies 9
War Contracts Bill 282

Page
War Dept.—Nitrate of soda storage 201
—Sale of metals 372, 625
War Industries Bd.
—Economic crime in the 287
—Sulphur Committee 12
—Tungsten Committee 547
War materials sales 927
War Minerals Investigation Committees •225
War Minerals Relief Bill 160, 201, 292, 370, 454
—Editorials 164
—Relief delayed 161
War-minerals producers compensation 625
War-Minerals Relief Commission 499, 540, 584, 670, 1094
—Chestatee Pyrites claim 761
—Claims [illegible], 841, 882, 971, 1010, 1053, 1125
—Editorial 503
—Hearings 927
—Pratt claim 716
—Regulations 624, 625
War Saving Stamps 577, 587
War Topics
—Aftermath in Paris and London 324
—Aluminum and the war 228
—Cadmium in the war 909
—Fighting the Boche underground †285
—How is Germany to pay? 163
—Mining engineers in war •1
—Plea for honesty 162
War Trade Board 326
—Austrian trade 715
—Black lists withdrawn 842
—British import restrictions 715
—Bureaus consolidated 928
—Emery importation 928
—Enemy trading list 670
—Export conservation list 207
—Import license 842
—New import license 667
—Nitrate importation 927
—Potash and magnesite embargoes 1010
—Sweden to receive metals 202
—Tin imports 1169
Waring and Williams, Mo. 214
Warns of oil-stock fakes 844
Warriner, R. C. 560
Warriner, S. D. 414
Wartenweiler, F. Concrete launder linings 880
Wasapika, Ont. 294
Washing plants, Batesville field, 1918 72
—Magnesite 1111
Washington Award 157
"Washington, G." About Spanish 198, 578
Washington—Petroleum 980
Washoe Smeltery. See "Anaconda."
Water—Determination of dissolved oxygen 241
—Discharging, from mining plants 311
—Disinfecting 653
Water mains, Thawing cost 604
Water measuring, Orifice bucket •580
Water, Mine, Neutralizing 478
Water-power development 699
Water prevention—Concreting drill holes •309
Water tanks, Life of wooden 600
Watkins, E. 716
Watson, A. A. 1019
Watson, E. R. 167
Watt, A. P. 210
Watt, A. P. Economics of concentration •775, 1146
—Ball milling and flotation 453
Watterson et al vs. Cruse 999
Wayland, R. G. 807
Wealth 919
Weather forecasting and aëronautics 245
Webb, C. D. 507
Webb, Minn. 678
Wedge furnace 1109
Weed, W. H. 345, 807
Weeks, F. B. 167
Weights and measures conference 753
Weld, C. M. 226, 807
Welding—Electric arc •743
—Oxy-acetylene 268
—Repairs to rock crusher •828
Welfare—Dust prevention •395
—Housing problem 864
—Insurance scheme Shenango Furnace Co. 338
—Mine physician 545
—Miner's phthisis 936
—Prevention of illness 351
—Sanitary engineering in tropics •389
—So. Africa 120
—State insurance, N •985, 1015
Wellington, Colo. 213
—Dividends 285
Wellman-Seaver-Morgan Co. 33, 460, 498
Wells, A. E. 226
Wells, B. 31
—Address to Amer. Mining Congress 489
Wells, R. C. Cyanogen in cyanide 710
—Nomenclature of sodium compounds 710
Wendt, G. L. 378
West Chapin, Mich. 853
West Columbia, Tex. 896
West End Consol—Dividends 456
—Production 16, 254, 294, 382, 464, 510, 638, 678, 728, 772, 811, 854, 895, 982
West Hunter, Ida. 811
West Side, Colo. 119
West Texas Sulphur Co. 550
Page
Western Chem. Mfrg. Co. 1053
Western Colorado Power Co. 677, 1129
Western Devel. Co., Calif. 593
—Dividends 25
Western Magnesite, Calif. 72, 339
Western Mexico—Improved conditions 837
Western Mining, Colo. •659
Western Nevada, Nev. 36
Western Ore Co., Calif. 72, 169
Western Society of Engineers 157
Western Talc., Wash. 552
Western Tunnel, Colo. 169
Western Utah Copper Co. 75, 382, 638, 982
Western Utah Mining 594
Westervelt, W. L. 225
Westinghouse, Electric 591, 935, 1061
—Memorial scholarship 967
—Protection against reversed phases 21
Weston, E. M. Bulkheads on Rand •538
—Mauss separator •862
—Mining conditions in Africa 363
Editorial 504
Wet-pulp screening device •760
Wetherill magnetic separator •1156
Wettstein, J. R. Lead products 54
Wharton Steel Co., N. J. 74, 728, 772, 982
What about copper? Editorial 164
What is Bolshevism? 276
Wheat bills 458
Wheeler Condenser & Eng. Co. 251
Wheeler, H. A. 934
—S. E. Missouri lead district 132
White, A. G. 225, 1168
White Caps Mining, Nev. 74
White, D. 225
White, L. C. 674
White lead and oxides, 1918 54
White, O. V. 1019
White Pine Exten. Copper, Mich. 73
—Production 36, 213, 381, 551, 727, 937
White Reserve, Ont. 728
Whitehead, R. L., death 210
Whitemarsh Mining, Minn. 74
Whiterock Magnesite, Calif. 853
Whiteside, A. M. 660
Whiting, F. D. 636
Whitlach Gold, Mont. 638, 1064
Whitney, C. W. 547
Wiard, E. S. 1177
Wicks, F. R. 336
Wilfley, C. R., milling in San Juan 1129
Will it come to this? 794
Willes, C. F. 1009
Williams, H. H. 592
Willis, C. F. Housing problem 864
Willison, Sir J. 492
Wilson, A. W. G. 306
—Canada's international relations 308
Wilson, C. M. 422
Wimmler, N. L. 850
Winchell, A. N. 787
Winchell, H. V. 373, 414, 492, 837
—Photo •486
Windbigler, C. 678
Wire rope investigation 737
Wirth, C. 850
Wisconsin—Mineral land 219
—Zinc 592
1918 133
Mining costs 564
Wisconsin Zinc Co., Wis. 75, 592, 1107
Wiser, O. 33
Witherbee, Sherman & Co. 1171
Witwatersrand gold mining •469
Wohlwill gold refining plant •789
Wolf, H. J. 33, 102
—Commercial possibilities of oil shale •217
Wolf lamp 278
Wolf Silver, B. C. 462
Wolf Tongue Mining Co. 285
Wolflin, H. M. 934
Wolfram—Bolivia Mining •597
Production, 1908-1917 597
Wolfram mining in Bolivia •597
Wolfram—Queensland 953
Wolframite—Screening 1112
Wolverine, Mich. 510
—Dividends 285, 801
—Production 551, 772
Wommack & Co., Mo. 594
Woodbridge, D. E. 634
—Iron ore taxation, Minn. 791
Editorial 803
Woodbridge, Minn. 982
Woodbury, L. S., death 33, 167
Wooden edge map protector •621
Wooden water tanks, Life 600
Woodlawn, Utah 812
Woods, T. S. Porphyry intrusions, Mich. •299, 452
Woodward Iron, Ala. 771, •957
—Shaft No. 4 726
Worcester, S. A. Steam economics 561, 707
—Editorial 590
Workers' manual, Minn. 809
Workers' right to choose. Editorial 671
Workmen's compensation, Minn. 462, 592
—Utah 380
Working adjustments, Wetherill magnetic separator •1156
World's Fair, Ariz. 72, 894
Wotherspoon, W. J. International Nickel Co. refining works •429, •446
—Turbo-blower unit 881
Page
Wright, C. A. Zinc ores in Missouri district †506
Wright-Hargraves Mining, Ont. 76, 678, 728
Wright, L. T. 815
Wright, S. B. Smelting of cobalt silver ore 263
Wright Manganese, Calif. 1103
Wynne, Sir T. R. 356
Wyoming Gas 995
—Petroleum 995
—Potash 168

Y

Yak Mining Milling & Tunnel, Colo. •658
Yanez Leon, J.M. Yacimientos carboniferos de las Provincias de Pallasca †723
Yangtze, Gold washing on •1069
Yawkey, W. H., death 507
Yeatman, P. 547, 1095
Yellow Aster, Calif. 1021
Yellow Bird, Ariz. 1021, 1103
Yellow Bird, Colo. 509
Yellow Jacket Mines, Colo. 73
Yellow Pine Mining, Nev. 638
—Dividends 25
Yerington, Nev., district †627, †1079
Yerkes, R. M. 373
Yoakum, B. F. 938
York, Minn. 853
Young America Mine, Wash. 75
Young, G. J. 365
—Control of ore-dressing operations 907
—Power plants selection 1121
—Tungsten industry 78
—Working adjustments, Wetherill magnetic separator •1156
Young Gold, Ariz. 425
Yuba Consol., Calif. 551
—No. 16 dredge •915
—No. 18 dredge 752
Yuba Manufacturing Co. 752, •915
Yucca Tungsten Mining, Ariz. 72
Yukon Gold Co. 55, 143, 1103
—Annual report 863
—vs. Adams 359
Yuma Consol., Ariz. 894
Yunnan tin, Hongkong 445

Z

Z. Z. "Big Bend" situation 923
Zalinski, E. R. Mining in Utah, 1918 178
Zenith, Minn. 1104
Ziegler, V. 807
Zimmerman Steel Co., Iowa 73
Zinc—Arkansas 212
Zinc camp •607
—Building construction use •322
—Burning 88
Zinc camp, Ark.—operations 607
Zinc—Canada 618
—Condenser machine •760
—Distillation 87
—Distillation furnace, Mexico •361
—Flue sheet, mill 1159
—France 922
—Germany 1111
—Gr. Britain. Import restrictions 1073
Imports and exports 359
Zinc Hill Mining, Wis. 75
Zinc—India, Smelting 356
Zinc industry of Mo., Ark. and Okla. 1170
Zinc—Italy 197
—Japan, 1917 967
—Joplin district, 1918 59
—Magnetic separator •1107
Zinc market, 1918 58
Zinc—metallurgy, 1918 87
—Mexico, Smelting 359
—Milling •397
Zinc mining, Wis. 133
Zinc—Mo., Ark. and Okla. 1170
—Position of low grade mines 588
—Precipitation 94
—Price 962
1918 58
1895-1918 352
Joplin, 1918 59
Zinc problem in Italy 197
Zinc—Re-treating tailings, Wis. •524
—Review, 1918 57
—Roasting 87, •1107
—Ruck distilling furnace •307
—Siberia 204
—Small mill •1158
—Smelting. Foreign capacities 227
—Smelting in India 356
—Tariff 282
—U. S. 542
Editorials 205, 588
Market, 1918 58
Review, 1918 57
Smelting capacity 58, 96
Statistics, 1918 958
Tariff 282, 636, 1011
Imports and exports 57, 302, 372, 619, 884, 1031
—Wis. 592
1918 133
Mining costs 564
Zirconium—U. S., 1918 125
Zonia, Ariz. 169

Engineering and Mining Journal

January 4, 1919

Volume 107 Number 1

HERBERT C. HOOVER

BENEDICT CROWELL

Mining Engineers in the War

By F. F. SHARPLESS

The achievements of H. C. Hoover at the outbreak of the war are summarized, and tribute is paid to the success of his work as Food Controller in more recent times. Mining engineers have been prominent in every branch of war endeavor, and a great number of them have earned national if not international distinction. In the United States, they have been chosen to fill posts of vast responsibility, and have invariably achieved success. The war activities of the Government bureaus staffed by mining engineers and geologists have resulted in the solution of many problems in connection with the supply of raw material. The prominent American mining engineering societies have furnished a great number of men; and both the profession and its individual members are to be congratulated on their excellent work in matters of national importance.

UPON the declaration of war between Germany and the Allies, the chaotic situation produced among the tourist population, which we may now recall with some mirth, developed almost over night. London found herself the rather unwilling harborer of many a shipwrecked traveler, men and women without home, food, shelter, or friends, and with nothing in their pockets that resembled real money. Willing as they were, the American consulates and the Embassy found themselves overwhelmed with the care of a disorganized horde of scared women and brainless men. Our Ambassador, in this emergency, thought of an American, well known in London for his capacity and executive ability. He called up H. C. Hoover and asked if he would lend his assistance. He would; and within a few hours Hoover had organized a force, the members of which were busy in financing and moving, in orderly manner, this crowd of lost or strayed Americans.

Hoover was a mining engineer; his relief organization was chiefly of engineers, most of them mining engineers. They were selected not *because* they were mining engineers; they were selected because they had had experiences fitting them for handling any sort of unexpected human, physical, or financial trouble. Many of them had themselves been stranded, lost in darkest Africa, near death's door in half a dozen places, and had tackled and handled successfully much worse situations than the feeding and shipping of a lot of stray sheep in a place where there was plenty of food and lots of shipping. Hoover's assistants were chosen for their ability; it only happened that they were nearly all mining engineers.

This work having been finished so successfully, it was only a short time until another big organization problem presented itself, one of vast proportion and of complications scarcely conceivable at its inception—the relief of the Belgians. Without a moment's question, this stupendous task fell to Hoover, the mining engineer—a task involving problems of commerce, finance, and diplomacy all conducted under most unfavorable conditions. Again Hoover called for suitable help, and again he found it largely among the mining engineers, men who had met unexpected situations and acquitted themselves with credit. An English critic of the work describes it as "the formation of the largest and most successful grocery business in the world, and it was done in less than six months." This success in Belgium was in no way due to official support from the United States. Indeed, not only were moral and financial support lacking from our Government, but the members of the commission were instructed to get out of the country, instructions that were reluctantly and slowly followed.

Harry E. V. Britton, one of the English founders of the Pilgrim Society, paid tribute to the ability and integrity of mining engineers when he remarked of their work in Belgium: "Your flag has guarded more relief than the philanthropy of the whole world ever dreamed it would be asked to supply. Under the Stars and Stripes a distressed civilian army greater than the combined militant armies of France and Germany is being kept alive. You have pierced the lines of all armies, broken all blockades, and gained the first really decisive victory of the war."

One thing that ought not to be lost sight of is the fact that Germany, after we had entered the war, asked Hoover and his American engineers to continue in charge of the work of Belgian relief, in so great esteem did it hold these gentlemen.

CONTROL OF AMERICAN AND ALLIED FOOD SUPPLY IN HANDS OF MINING ENGINEERS

The work of this group did not stop in Belgium; their task grew even greater. With our entry into the war their problem became that of teaching 110 millions of Americans how to eat, so that twice as many millions abroad might not suffer. On Apr. 7, 1917, it suddenly grew from the complete rationing of 10 millions to the education and assistance of 300 million souls. In the group that Hoover drew around him for this work more mining engineers of prominence are found: Edgar Rickard as Hoover's right-hand man, C. W. Merrill as the head of the Chemical Division, Mark Requa of the Oil Division—all are distinguished mining engineers. But we need not dwell on the wonderful accomplishments of the Food Administration: they are fully known to the American public. Hoover leaves it to take up an even bigger work; the rationing of all Europe as well as America. The *Evening Post* of a recent date publishes an article entitled "Hoover in Retrospect." It summarizes the situation in closing with this paragraph: "The American people have come to the point where they would trust him with almost any kind of administration job."

Before this war was started, the Germans knew, and it was not long before the Allies recognized the fact, that this was to be a war of engineers, a war in which production would occupy the attention of a far greater number of persons behind the lines than were engaged in the actual battle, and the mining engineer was perhaps the first to recognize the fact that the occupation of the Belgian and French coal and iron fields was to give their possessor a tremendous advantage in the conflict. He saw his work cut out for him not only in the mines far to the rear, where metals and fuel were produced, but he soon learned that he was also needed right in the very front lines. The building of trenches, and their destruction, have fallen largely to his lot, particularly their destruction from beneath. It has been his business to quietly work his way to a point beneath the enemy, and, there placing his explosive, blow trench and defenders into eternity. This was not a one-sided game; both played it; and every man engaged in the work knew that the deathly quiet around him was no security; that at any minute a mine might be sprung and his whole company be wiped out of existence. It is one of the most useful, dangerous, and nerve-racking occupations that a soldier may engage in.

THE TUNNELING OF THE COL DI LANA

It was Gelasio Caetani, an Italian by birth but an American mining engineer by education and profession, who, in three months, tunneled and blew up the famous Col di Lana, an impregnable natural fortress in the Dolomite Alps, held long by the Austrians and at great cost to the Italian besiegers. His countrymen suffering severely, and, failing to take and keep it, Caetani undertook to and did blow out of existence a natural fortress four acres in area. While he was working on this job there were days at a time when over 2000 enemy shells per hour were dropped upon this area, no larger than a city block.

Steps were taken for the formation of a volunteer regiment of engineers in New York on Apr. 3, 1917. Arthur Dwight, who later received his commission as Major, was active in the enlistment of this organization, which later became the 11th Engineers. Many of its members, officers and privates, are members of the American Institute of Mining Engineers. It was a part of the first body of troops sent to the other side, and particularly distinguished itself on the French front during the withdrawal from Cambrai. Busily occupied in railway construction, its members suddenly became aware that the Germans were upon them. Abandoning picks and shovels, and finding guns, it suddenly became a fighting regiment which held its own, the equal of any infantry.

O. B. Perry, later Lieutenant-Colonel Perry, and his associated engineers, are responsible for the formation of that splendid body of men designated as the 27th Engineers, a regiment of miners and mining men, nearly all the officers and many of the privates being mining engineers.

Not only in the Engineering Corps do we find the mining engineers, but they have been received gladly into every branch of the service. We find them as officers in the Ordnance Department, in the infantry, the signal corps, and the flying corps, and again as civilians holding important offices at Washington.

One of the first and one of the most important steps taken in connection with our participation in the war was the formation of the Naval Consulting Board by Secretary Daniels. The board was composed of 25 of the most distinguished scientists and engineers in the country. For some time in advance of our entry into the struggle, its various committees had done much in the way of organization and were hard at work on various problems while we were still discussing preparedness. W. L. Saunders, its chairman, who is responsible for much of its good work, is an ex-president of the American Institute of Mining Engineers. Lawrence Addicks, B. B. Thayer, David Brunton, and Joseph Richards, active members of the board, are distinguished in the professions of mining and metallurgy.

ENGINEERING SOCIETIES VOLUNTEER FOR SERVICE

Soon after we were informed that a state of war existed, our engineering societies. knowing that they and their members could be of material assistance to the Government in many lines, volunteered their services. The Mining and Metallurgical Society of America, the American Institute of Mining Engineers, and, later, the War Committee of Technical Societies all begged for opportunity of service for themselves and for their members. Recognition from Washington was slow. Lack of organization there and ignorance of the tremendous work in hand prevented early acceptance of the versatile attainments of mining engineers. But things gradually changed, and later we found them not only on the Food and Fuel administrations and on the Naval Consulting Board, but as distinguished members of the War Industries Board, Tax Review, Shipping and Export boards, and of the War Minerals Committee and in the Agricultural Department.

Among the well-known engineers in Washington we note Yeatman, Jennings, Spurr, Potter, Rogers, Thomson, Arnold, Chase, Liddell, Lindsley, Mein, and many more hitherto known only as mining engineers. No more important position was held by a civilian than that occupied by John D. Ryan, until recently Second Assistant Secretary of War and head of the Air Production Board. Though not strictly a mining engineer, Mr. Ryan is so intimately associated with mining and engineering that the profession may rightly lay claim to him, and take pride in the work that he did in bringing order out of the chaos in the Air Production Division.

ACHIEVEMENTS OF THE BUREAU OF MINES AND U. S. GEOLOGICAL SURVEY

Congress, the departments, boards, and committees have called upon the Bureau of Mines for help, and the Bureau has given it or has turned to the mining engineers of the country and made liberal use of their voluntary service. In our gas problems it was the Bureau of Mines, with its laboratories, chemists, and engineers, that was prepared and first attacked a subject about which our military authorities knew little or nothing 18 months ago. Likewise the U. S. Geological Survey, with its large staff of trained geologists and engineers, has been of great assistance to the Government in connection with raw-material problems.

Mining engineers have played a very important part and a very vital part in the matter of supplying the Government with its requirements of iron, copper, lead, zinc, chromium, and other necessary metals. In this connection we usually think of the important part that the great metal companies have taken in supplying adequate quantities of metal while operating under the greatest difficulties, not only increasing their production but often developing new sources. Examining this subject a little more closely, we learn that the responsible officials, the men who must get out the metals, the managers and the superintendents, are mining engineers, without whose efficient management, with shortage of labor, inefficiency, and high costs continually staring them in the face, supplies would have been woefully short.

Though, naturally, some reluctance was shown in calling upon civilians to take up military work, the War Department, on the whole, has been open-minded in its actions, notably in the calling of Benedict Crowell to become Assistant Secretary of War, practically Director of Munitions. Mr. Crowell was chosen because of his capacity to work and get results. He is a cutter of red tape when possible and the man to whom the War Department is indebted for much of the rapidity with which it has obtained results. The War Department has also had the benefit of the services of the distinguished engineer D. W. Brunton, as the head of its Inventions Board.

That an ample supply of explosives might be furnished to our forces, and that it might avoid entire dependence upon private manufacturers, the Government has built two large smokeless-powder factories, each costing about $50,000,000, and has placed them in charge of two distinguished mining engineers, D. C. Jackling and S. W. Mudd. The Ordnance Department has claimed the services of Prof. Arthur Walker, of the School of Mines, Columbia University.

OTHER WAR ACTIVITIES OF MINING ENGINEERS

Roughing it is a part of the mining engineer's trade, but to him roughing it means living in comfort while the tenderfoot is suffering all kinds of agony. Campaigning in the dead of winter in a desolated country was the rough situation that had to be faced by many of our allies early in the war. It was the cause of death of some, and of great suffering to many, until Peter Nissen, a mining engineer, conceived and constructed by the hundreds a warm, clean, and comfortable hut that could be knocked down, transported anywhere, and put up again in the twinkling of an eye. He saved hundreds of lives, and added materially to the comfort of whole regiments, simply by knowing how to take care of himself.

An interesting instance of the foresight and resourcefulness of mining engineers in this war is that of Lieutenant Stines and F. W. Draper. Stines was engaged in professional work in Russia at the time we entered the war, and, seeing trouble ahead, knowing that the United States would need all of the platinum that it could secure, and observing that much was going from Russia into Germany in spite of their being at war, he undertook to gather together what he could lay his hands on. He succeeded in collecting about 20,000 oz., approximately a quarter of Russia's normal annual production. Just at this time Draper was preparing to leave for home, and equipping himself with all official documents procurable he started East with his ton of baggage. Difficulty after difficulty arose, but Draper and the platinum were inseparable: they clung together until the metal was finally deposited in a bank at Yokohama, whence it proceeded on its journey through the customary channels. This gave rise to the story in the daily press of the mining engineer who smuggled $2,000,000 worth of platinum into the States in his suitcase.

MINING ENGINEERS TAKE PART IN FORMULATING POLICY FOR RUSSIA

It may not be generally known that mining engineers have taken a very prominent part in connection with our Russian policy. The vocation of these engineers has called them to all parts of Russia and Siberia. They have been in intimate contact with the people of all districts, and possess a perspective of the Russian character, political conditions, and geography held by only a few of the official representatives of our Government. It was the American mining engineer who first suggested commercial intervention with a small army to serve only as a police force; and mining engineers have furnished much of the information upon which Washington is now acting, and they are taking an active part in carrying out the Government plans.

As indicating the activity of mining engineers in the war, it may be mentioned that the English society, the Institution of Mining and Metallurgy, has about a third of its members in service, and that a third of these have been officers with the sappers and miners. This society has lost about 10% of those members who entered the service. The American Institute of Mining Engineers has furnished even a larger number of men in the shorter time that we have been in the war, about 800 out of a membership of 7000.

Recognizing the importance of his work behind the lines, at the source of production of raw materials, recognizing his ability as an adviser and his capacity as an administrator, and also recognizing the necessity of his presence as a miner operating from the front line of trenches, the mining engineer has found himself in a difficult situation. Some have gone to the front and some have stayed behind. To both we owe the deepest debt of gratitude for the unselfish part that each has taken in the place where he thought that he could be of greatest service to his country.

Chrome Mining in Canada

Prior to the war, the mining of chrome was a declining industry in Canada, says a consular report from Kingston, Ont., dated Nov. 14. From 1910 to 1914 no chrome whatever was mined and the small amount made came from the stocks on hand. In 1915, 12,341 tons was produced, having a value of $179,543, which is an average price of $14.55 per ton. In 1916 production was doubled, with the quantity being placed at 27,517 tons, but with lower average price—$11.32 a ton.

It was stated in the report of the Department of Mines on mineral production for 1915, with reference to chrome, that: "All available sources are being searched for ore, old dumps resorted, prospects and mines reopened, and every little pocket of ore gophered out and sold." Such conditions have continued, and greater diligence has been displayed in securing this ore in large quantities in the Quebec field. In recent months encouragement has been given to producers by offering higher prices for the ore, in the hope of securing greater tonnage.

Ores of all grades have been mined, containing as low as 10% of chrome, to small quantities of rich ore that run as high as 52 and 54% grade. Concentration of low-grade ores has been practiced in Quebec, and ores ranging from 10.50 to 16.30% grade have been raised by concentration to an average of over 50%. The ruling price for chrome ore of 38 to 50% grade was $26.65 per ton for the 38% ore and an increase of 65c. per unit. A large percentage of the chrome mined in Canada has been exported to the United States. The production of ferrochromium in Ontario has begun, and an output of approximately 75 tons a month is expected.

Magnesite in Greece

Mining has never been of much importance in the Saloniki district of Greece, according to *Commerce Reports*. The increasing demand for magnesite for iron foundries and other industries has led to shipments of this ore during the last two years from the peninsula of Chalcidice. No official information being available showing the quantities shipped to various countries during that period, the following information has been obtained from reliable private sources, and is believed to be accurate.

There are five places where magnesite is obtainable, namely at Yerakino and Cokino Petra, on the peninsula of Chalcidice, quarries northeast and southeast of Vavdos, and at Galatista. The most important of these, the Yerakino mines, have been worked since 1905 and are still far from being fully developed. Before the war, the mine owners calcined practically their total output and then shipped it to Holland, where it was reshipped to different countries. These shipments reached 10,000 metric tons of ore, representing 21,000 tons of the crude ore annually, besides 2000 or 3000 tons of crude ore sent to Italy, France, and Holland. After the outbreak of war, the process of calcination was halted on account of the lack of fuel and the impossibility of obtaining westward-bound freight accommodations.

In 1916, the shipment of the ore to Holland had fallen to 320 tons of crude and 730 tons of calcined magnesite, and 1917 shows no record of sales to that country. Exports to the United States were 12,914 tons of crude ore in 1916, but in 1917 there were none. The British government was the principal purchaser in 1915, 1916, and the first half of 1917, as shipments there reached in that period a total of 40,000 tons, at prices varying from $7.50 to $12.50 per ton f.o.b. Yerakino. Owing to increased cost of labor, machinery and transportation, there has been an increase in price, and on this account since July 1, 1917, practically no new sales in former markets have been made.

Today is an opportune time to send a check for the Comfort Fund of the 27th Engineers.

Impressions of Australia and the Australians

By GEORGE C. STONE

DURING my recent trip to Australia, I spent most of my time with one or both of our Australian members, H. W. Gepp and G. Rigg. Gepp is now general manager of the Electrolytic Zinc Co., of Australasia, and Rigg is technical director of the Broken Hill Associated Smelters, both of which companies are controlled by the same interests, so that their work frequently brings them together.

Gepp has done a really remarkable piece of work since he returned to Australasia, having adapted the electrolytic process to his ore and conditions, planned and built his plant, and got it in commercial operation in less than a year. The plant is at Hobart, Tasmania, and is regularly making 10 gross tons per day of spelter running very uniformly 99.996% zinc (by difference). The plant could make more if sufficient power were available. The present cost is low enough to show a profit, which will be much increased when it is possible to operate at full capacity.

Tasmania Has Ideal Site for Power Supply

The power is obtained from the Tasmanian government, and the natural conditions are almost ideal. The water supply is from the Great Lake, situated in the central plateau, which has an area of about 50 square miles and a catchment basin of several hundred, with an average rainfall of 30 to 40 in. The present dam is at the south end of the lake, on rock, and is only about 200 ft. long, but it raised the level about seven ft. The dam can be raised an additional 10 ft. by increasing its length to about 500 ft., giving a largely increased storage. If this is done, the head waters of the river Ouse could be diverted into the lake by a canal about three miles long.

The Ouse has nearly as large a catchment basin as the lake and a much heavier rainfall, and its addition to the present supply would increase the available power from about 50,000 to 100,000 hp. The outlet of the lake is the river Shannon, the water of which is diverted to a canal about seven miles from the lake. The canal is about three miles long, through nearly level country, to a large but shallow storage pond, from which the water is taken by pipes with a steep drop to the power station at Wadannanna, on the Ouse, giving an effective head of 1100 ft. Though the Ouse rises a little above the lake, it runs over soft rock and has a fall of over 1500 ft. to Wadannanna, whereas the lake and Shannon, flowing over hard dolomite, fall only about 300 ft. in practically the same distance. The power is three-phase, generated at 6600 volts, and stepped up by transformers to 88,000 for transmission to Hobart, about 70 miles to the south.

When the additional water supply from the Ouse is taken, it is planned to run a canal north from the lake for about seven or eight miles to the north edge of the plateau, where an effective head of 1400 ft. can be obtained only 25 miles from Launceston, the second city of Tasmania. The contract with the Electrolytic Zinc Co. provides for power at a rate of £2 per hp. year. During a trip around Tasmania, I visited a number of mines and smelteries. The first was the old Anchor tin mine, near Lottah, northeast Tasmania, which had not been in operation for some time, but was being put in condition for working. The ore is a hard granite containing about 0.4% of tin. It is overlaid by a light cover of soil, which is put through sluices as it is removed. It pays to sluice it, though it would not pay to work it if doing so did not uncover the ore beneath. The project is to crush the ore with breakers and rolls and treat it on jigs and tables.

The Briseis mine, at Derby, about 15 miles west of Lottah, is the oldest and largest alluvial working in Tasmania. At present work is being carried on under the old bed of the river, which has been diverted—and which the operators expect to move again so as to be able to work under the present bed. The ore is washed down by hydraulic nozzle with a head of 200 to 300 ft. and pumped up to the sluice box by centrifugals, and the tailing delivered by gravity to the dumps in the worked-out end of the cut.

The sluice is a box about 16 ft. wide and 3 ft. deep and 150 ft. or more long. It has riffles about 20 ft. apart reaching nearly to the top of the box; the upper 4 in. of each is removable. The ore settles just below the riffles and the sand beyond it. When the first riffle is full, the top bar is taken off, and the sand allowed to flow over into the second until tin shows at the riffle. The top bar is then replaced. It is worked along in this way until all the riffles are full. The flow is then shut off, and the concentrate, which contains about 70% tin, is taken from the top compartment, and from the next also if clean enough, and shipped. The contents of each lower compartment are then shoveled into the one above, and the operation is resumed. It was claimed that material yielding 3 lb. of tin per cu.yd. could be worked at a profit.

The Richest Tin Mine in the World

The most celebrated tin mine in Tasmania is the Mount Bischoff, at Waratah, in northwest Tasmania. It was by far the richest tin mine in the world. the old "Brown Face" running 40%. The early methods of concentrating were very wasteful, and nearly half the tin was lost. Unfortunately, the tailings were run into the White River, which has a very rocky bottom and a fall of over 2000 ft. to the coast, less than 30 miles away, and the numerous floods have washed them all away. The ore is surrounded by a semicircular dike of barren eruptive, and is composed of slates, pyrite, and gossan, which have been mixed up and overturned in a most remarkable way, the pyrite often being above the gossan. The material mined is all soft, and requires no blasting. There are some very rich pockets, but the ore as a whole only runs about 0.3 per cent.

The ore is taken to the mill by gravity on a cableway about three-quarters of a mile long, with a fall of 500 ft. It is crushed by eight batteries of five stamps each. This is admittedly not economical, but the expense of replacing the stamps by better machinery is not justi-

---

*Abstracted from an address delivered to the New York section of the Mining and Metallurgical Society of America and published in Bulletin No. 126, Vol. XI, No. 11, p. 328.

fied by the probable life of the mine. The pulp is divided into three sizes, the two coarser going to two-compartment harz jigs, which recover about 60% of the tin as a rich concentrate. The fines from the stamps are classified and treated on tables which recover about 90% of the tin. The jig tailings are recrushed in a short tube mill, classified and tabled. The total recovery is about 80% in a concentrate containing 70% tin. It rains here about 250 days a year, the average precipitation being about 100 inches.

With tin at £160 per ton, the mine can just pay expenses on ore containing 0.26% tin. J. D. Millen, the manager, has done some remarkable work in studying the deposit structurally, chemically, and microscopically. The proof of the value of his work is that he has been paying dividends regularly from a mine that he was sent to close down eight years ago.

Tasmanian Tin Ore Is Smelted at Launceston

There is a small tin smeltery at St. Helens, on the coast, but it has not been worked for years and probably will not be again. All the Tasmanian tin ore is smelted at the works of the Mount Bischoff Co., at Launceston. The ore is mixed with coal, iron ore, and limestone, and smelted in small reverberatories, giving a fairly pure tin and slags containing 60 to 30% tin. The tin is refined by poling until tests show it is of the proper physical character. The rich slags are resmelted in reverberatories with the addition of scrap iron, limestone, and coke. The resulting slag contains about 2½% tin. The metal is very impure, and is first liquated and then refined, the dross being reworked.

We visited an interesting iron deposit on the Blythe River (N. W. Tasmania). The deposit in places stands above the surface as a high ridge without sides, and test pits have been put in at wide intervals for a mile or more. At all points, the ore is of the same character, a very hard rich blue specular, looking precisely like the ore of Pilot Knob, Missouri.

At Broken Hill, New South Wales, Australia, the mine of the Proprietary is nearly worked out, as this deposit is there only about 400 ft. deep. The whole deposit has proved to be an inverted U, and the largest two deposits are the North and South mines. At the South they are now down 1750 ft., with an unknown depth of ore below them. The lower workings, and drill holes in advance of them, indicate that there is still a large amount of undeveloped ore.

Selective Flotation Used at Broken Hill

All the mills are using differential flotation. Small amounts of acid and oil, or in some cases acid only, are added, and the lead is floated. The lead concentrate contains 58 to 60% lead and 7 to 8.5% zinc, most of the silver going with the lead. In several cases SO_2 is added to prevent the zinc from floating. More acid and oil are added and the zinc is floated. $CuSO_4$ is often added at this stage, 0.20 lb. being said to produce the same effect as 200 lb. of acid. The zinc concentrate contains 47 to 50% zinc, 5 to 7% lead, and 4 to 9% silver.

The recoveries of concentrates vary considerably at the different mines, lead being from 79 to 84%, with an additional 9 to 10% in the zinc concentrate, part of which is recovered. Zinc recoveries of concentrates vary much more, mainly because some do, and others do not, float their slimes. Extractions of zinc are 60 to 83%; 60 to 66% of the silver is in the lead concentrate, and 25 to 30% in the zinc, part of which is recovered.

Several forms of flotation machines are used, most of which are of the well-known types, with mechanical agitation Recently many have adopted the cascade system, with a considerable lowering in cost and without lowering the grade of the product or the extraction. In this the ore pulp is elevated by bucket elevators and flows down through a series of nine boxes, each of which has several nozzles acting as injectors with controlled-air admission. These discharge below the surface of the liquid in the next lower box. The concentrates from the first six are usually shipped and those from the last three are re-treated.

At present no smelting is done at Broken Hill, as all of the mines but the Proprietary, which has its own smeltery, have formed the Broken Hill Associated Smelters, with a plant at Port Pirie. All the lead concentrates produced and part of the zinc concentrates are smelted there.

The Australian Temperament

The labor situation in Australia is very unsatisfactory. Men are scarce, as many new industries have been started, and there is a great shortage of labor due to the large number of the best men who have gone into the army. Nearly 8% of the entire population of Australia has enlisted, and about 10% of the population of New Zealand. The labor unions have control of the government, and all rates and working hours are by government regulations. The Australian is a curious contradiction. He is violently democratic, but wants a very paternal government and not only submits to, but asks for, an amount of government interference in all of his affairs that would be strongly resented here. He is also very loyal to the Empire, but has a very poor opinion of Englishmen and, in many ways, of England.

The Australian workmen, as far as I could judge in the short time I was there, are not a bad lot and have in general a good idea of fair play. Much of the trouble there has undoubtedly been due to misunderstanding on both sides, and is quite as much caused by the employers not knowing how to treat their men as by the men. In many cases, the feeling seems to be that trouble is inevitable and that there is no use in trying to prevent it. At Broken Hill very little has been done toward making working and living conditions either comfortable or even safe, and Broken Hill is a byword in Australia for trouble. The living conditions are very bad, houses poor and very expensive; change houses, in many cases, have only recently been provided. There are many signs of a change, and it is probable that the next year or two will show much improvement.

Progress in Improving Conditions of Employees Noticeable

At Port Pirie, the relations of the company and men are remarkably good, having completely changed since the Broken Hill Associated Smelters took control. There, as everywhere, the men had made many demands for more pay and the last was for "a bob [1 shilling, or 25c.] a day," which they received. Soon after, some of the men came to the management and said, "This extra pay is no use. We got an extra bob a day, and the boarding houses immediately raised their prices three bob a week and all the stores put up their prices; so we are no better off. Help us to live more cheaply." The company at once agreed, and the first thing taken up was firewood, which is both scarce and expensive at Port Pirie. The company bought the wood on a tract of land on the opposite side of Spencer's Gulf, built a landing and put up buildings and water tanks. It then formed a committee, a majority of whom were employees, with a couple of representatives of the company, to arrange for cutting and delivering the wood. This proved of wonderful educational value. Most of such coöperative schemes have failed for one of two reasons: either they were run as a charity by the company, which did not suit the men, or were turned over completely to the men, who did not have the necessary business experience to run them. At Port Pirie they did neither. The representatives of the company were some of its best men, who steered things along rational business lines, letting the men propose arrangements and voting for them if reasonable, and if not starting a debate which lasted until some of the men did make a reasonable proposition. The first trouble at the wood yard was that the men sawing loafed. The committee was shocked and grieved to find that loafing increased the cost, and promptly disciplined the offenders. The next question was delivery. Bids were asked for, and they varied from about 2s 6d to 7s 6d. This was another shock. If they paid more for labor, the wood would cost them more.

The next move was a coöperative shoe store, which has been in operation several months and is saving the average married man about one shilling a day. A small line of clothing has been added, and it is now proposed to build a larger building and increase this department. Any man employed by the company, or a member of his family, and no one else, can buy at this store, but only for cash, and he must take home his own purchases. Arrangements were being made to start a butcher shop, which it was figured would save 2d to 3d per lb. on meat. As the Australians are very large meat-eaters, this will be a considerable item. All of these activities are managed like the wood yard, by joint committees of the company and men. The company advances the necessary capital and receives small interest on it, and everything is sold at cost, plus a small percentage.

The secret of the success is in the character of the men the company has put on the committees. At the Electrolytic Zinc Co., where similar work is under way, the general manager of the company is the chairman of the principal committee and the other representatives of the company are heads of departments.

EMPLOYEES ARE GRANTED VACATIONS ON FULL PAY

I attended one of the meetings, and was much interested in the way it was worked to make the men take the initiative on rational lines. The men have a good idea of what is fair, and will agree to it. At Port Pirie, a vacation camp is being built, to which the men can go with their families. Any man who has not missed more then 12 days for causes other than physical disability is entitled to two weeks in camp with full pay. In counting absence, if a man notifies his foreman he is debited with the time he is absent; if he does not, he is debited with time and a half. The men at once agreed to this, saying "We get time and a half for overtime work; this is the same thing."

When Port Pirie was laid out, a considerable amount of land was reserved for a park, but nothing was ever done with it until last year, when it was proposed at one of the committee meetings that volunteers give a day's work each and that the company furnish the necessary materials to reclaim part of this land. It was done at once, and they now have an attractive park of about 10 acres. The town employs a couple of men to keep it in order, and if any extra work is required it is done by volunteers, of whom there are always plenty. This year it is proposed to build a children's play ground on an additional 10 acres of this land in one day. When I left, over 4000 men and 1000 women had volunteered for this work. The ground was marked out and the apparatus and buildings (in sections) were being prepared for it. As with the park, the company furnishes the material, but the labor is all volunteer.

Largely as a result of such work, Port Pirie was the only large works in Australia that kept in operation during the big strike last year that closed down almost everything in Australia for weeks.

Government Operation—How It Works*

The Department of Justice investigators summarize the Hog Island experiment as an "organized riot," a "tangled mess" and a "state of chaos." They assert that the extravagance and mismanagement have been colossal. It was originally estimated that the plant would cost $21,000,000. It has cost over $61,000,000, and is not complete. Labor and time were squandered as well as money. More men were employed than could be used some of the time. Material was ordered and piled up in a congested mass, clogging the railroads until it could be used. The whole thing was a "riot" of extravagance from the beginning.

But—"no criminal responsibility is fixed." Nobody was really to be blamed. It is too bad, but let's remember it was a Government-controlled job; so what else could you expect? Let us say "Tut, tut" to some one and go on clamoring for more governmental industries.

That is the sort of thing which is pretty sure to happen when the Government tries to invade industry. There was, possibly, some excuse for damning the expense in war time, but it did not make for efficiency. When the full story of Muscle Shoal is told—if ever—it will be a similar chapter, and it has a score or more of littler brothers in Federalized industries to come tagging on behind, in figures under the twenty or sixty million class, but enormous in their total.

We see the same thing in the railroads. Even the hardy McAdoo is staggered by the increased costs. So, too, with the express companies, though they haven't yet had time to run up so large a bill. And it will be so with the telephones and telegraphs. Extravagance, "riot" and "no responsibility." It has always been the story of too much government, everywhere. For instance, even in England, the state management of the wires has caused a loss of over $60,000,000 in operation If we go on, we may even attain the splendid scale of expenses of our own post office!

---

*An editorial from the New York *Sun*.

Must the Prospector Go?*

Must the prospector go? We ask this question with real concern, which will, we believe, be shared by countless readers, lest the picturesque character most affectionately if not first introduced into American fiction by Bret Harte should become a memory only. He is a genuine character, not much flattered or exaggerated as he has been pictured by sympathetic artists through the half century from Harte to London.

If no other sufficient reason has been advanced why the Philistine hand of conservation should be withheld from this kindly, romantic figure, one was given when Senator Pittman, arguing against Government ownership, development, and control of the nation's natural resources, said:

"I believe that you would have a development of the minerals now in sight, and you would never find any more minerals that are lying hidden under the ground. I think you would drive away from the West the prospector, a peculiar individual that circumstances have developed in that country, and without whom no mines would have been found. You will drive him to South America, you will drive him to Siberia, to China, to Africa, to everywhere else on earth where there is a reward for individual suffering and initiative."

It may seem over-inclusive for the Western Senator to say that without the prospector "you will never find any more minerals," and maybe had he spoken with more considered thought he would have restricted his list of minerals to gold and silver, or even to gold alone.

The prospector hunts for gold. In dry gravel, over which rivers ran in the dim past, in the beds of living streams, in ledges of gold-bearing quartz, gold, the visible, palpable yellow metal, is what he seeks. He cares little for gold in combination with other metals: even in quartz he wants gold that can be garnered by simple process—"free" or "native" gold, as he calls it.

Your prospector is a lover of nature, a dreamer, a poet. Harte was writing of the "Luck of Roaring Camp," but he might have written thus of the prospector: "Nature was his nurse and playfellow. For him she would let slip between the leaves golden shafts of sunlight; she would send wandering breezes to visit him with the balm of bay and resinous gum; to him the tall woods nodded familiarly and sleepily, the bumblebees buzzed and the rooks cawed a slumberous accompaniment."

The prospectors who discovered all or nearly all the great mines of the Sierras and the Rockies had no knowledge of geology or of the chemistry of minerals; they cast aside all such as useless mental scrap with the saying, "You can see no further into the rocks than the pick goes." Even in this day of improved tools the prospectors' working outfit consists of little more than a pick, shovel and a pan for washing gravel; little else, for their one little burro has other burdens to carry.

There is no hurry in the prospector's day, no unwaiting trains, no itinerary, no factory whistle's call, no ordered time of labor. In pleasant, watered little valleys to be found even high up on mountain flanks, camp, at agreeable intervals, will be pitched, the burro rested and fattened on plentiful, rich grazing; deer or bear shot, its meat dried in the moistureless mountain air; a thumbed copy of Dickens, or maybe Longfellow, read again by the camp fire.

Yet they find much. The prospector who lazily followed a canyon whose stream grudgingly filled his canvas sack with gold dust, bothered by the black sand so heavy that it reluctantly separated from the heavier gold as his pan was dipped and shaken in the stream, came at last, as he knew he would, to the quartz cropping from which, through the ages, wearing water had dragged particles of free gold. But he profited nothing from the Comstock lode, which gave to the world two hundred millions in gold and silver. Probably he did not much lament his lost wealth. He would have been troubled to have given up his vagrant joys for concern in the monster enginery which, with pneumatic or electric drill, blasts of dynamite, roaring hoist works, thundering stamp mills, whirling grinding steel, loosened, broke down, hoisted, crushed, ground a mountain of ore, concentrating the bothersome black sand from which chemists took gold and silver.

The prospectors who located a cropping of a Rocky Mountain ledge carrying free gold sold it gladly enough for a trifle, and were curious, probably, rather than regretful, when they learned that the ledge turned into one of the greatest copper mines in the world. They remained free from the tangle of high finance, from political turmoil and disappointment, from foiled—or fulfilled—social ambition. Their burro yet carried for them an ample store of bacon, coffee, sugar and corn meal; they tramped as much or as little as they liked; and they had no master. If they located a mine, they would, when it suited their fancy, bond it to an impersonal corporation, whose experts would report on its probable value. If they received one ten-thousandth part of that as their reward, it was enough for them. It gave them a month at some grand hotel in Denver or San Francisco; they saw plays, heard opera, impaired digestion with city food, wilted under city air. Then they gladly answered again the lure of the mountains, the better companionship of truer friends, trees, mighty rocks, wild streams whose falls sing sweetly at night.

We hope the old-fashioned prospector need not go.

Safety Mining Appliances

By A. L. H. Street*

Affirming a judgment in favor of plaintiff for injuries sustained by him through fall of a large and heavily loaded mining bucket in a shaft, due to a defect in the bail, the Springfield, Mo., Court of Appeals lately held in the case of Cole *vs.* D. C. & E. Mining Co., (*204 Southwestern Reporter, 197*), that mine operators are legally bound to cause inspection of all appliances where defects in their condition may imperil mine employees. The court said:

> The general trend of more recent authority is away from the old rule that, the master having purchased a standard appliance from a reputable dealer, he has discharged his duty in the first instance. Undoubtedly regard should always be had for the character of the work and its hazards. No invariable just rule can be conceived. In the purchase of simple tools and appliances to be used in non-hazardous occupations, the master, it seems, has met the requirements when he has supplied the servant with the instruments and appliances of a reputable dealer or manufacturer.

---

*From the New York Sun

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

A Review of the Work of the War Committee Of Technical Societies

THE War Committee of Technical Societies, which has been operating in close coöperation with the Naval Consulting Board and with the General Staff of the Army, has had its work brought to an end by the termination of the war and ceased to exist on Dec. 31. To understand fully the history of this committee it is necessary to go back to the creation of the Engineering Council by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the United Engineering Society, which is described in the bylaws of the United Engineering Society as follows:

> In order to provide for convenient coöperation between the four Founder Societies, for the proper consideration of questions of general interest to engineers and to the public, and to provide the means of united action upon questions of common concern to engineers, the United Engineering Society shall, in addition to its other activities and entirely separate therefrom, establish and maintain a department to be known as the Engineering Council . . . (Par. 116).
>
> The Council may speak authoritatively for all member societies on all public questions of a common interest or concern to engineers, unless objection be made by a majority of the representatives present of one of the Founder Societies or by one-fourth of the representatives present and voting. . .

When war was declared, the engineering and technical men of this country who by reason of age or business restrictions were unable to go to the front began to insist that some means be offered by which they could assist the Government in the study and prosecution of war problems. This feeling, after considerable agitation, resulted in the organization, by the Engineering Council, of the War Committee of Technical Societies at meetings held on June 27 and July 13, 1917. The functions of this committee, as defined by the officers of the Council in their published announcement, are as follows:

> To assist any organization in Washington, such as, for instance, the Council of National Defense, the National Research Council, and the Naval Consulting Board, in any way in which it can bring to the attention of the engineers of the country the necessity for thought and help in the numerous problems that arise in the prosecution of the war.

That the War Committee should cover as broad a field as possible, and afford full facilities to the technical men of this country to utilize their inventive talent for the benefit of the Government, membership in this committee was not restricted to the four great national societies, but other technical organizations were invited to join, with the result that the committee now consists of two members from each of the following societies: The American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Electro-Chemical Society, the Mining and Metallurgical Society of America, the Illuminating Engineering Society, the American Gas Institute, the American Society of Refrigerating Engineers, the American Institute of Chemical Engineers, the Society of Automotive Engineers, and the American Society of Heating and Ventilating Engineers. The American Chemical Society also coöperated, and the officials of the committee were as follows: Chairman, D. W. Brunton; vice-chairman, Edmund B. Kirby; Secretary, Capt. Lloyd N. Scott; Treasurer, Preston S. Millar.

The chairman's report of the activities of the committee states that when the War Committee was first organized, on June 27, 1917, its membership consisted of two delegates from each of the four Founder Societies. Harold W. Buck was chosen as its chairman, and remained in office until pressure of private business compelled him to resign on Sept. 24, 1917. The present chairman was then elected, and as he was anxious to "do his bit," and was too old to go to the front, he has devoted his entire time and attention to the work of the committee since that date.

Finding that the appropriations from the Engineering Council were too small to enable us to work efficiently, continues the chairman, we accepted an offer from the Naval Consulting Board on Oct. 2, 1917, by which we agreed to coöperate with officials of the board, they to provide us with an office, telephone service, and postal privileges. This arrangement has operated most satisfactorily, and under it the two bodies were able to put out a bulletin on "The Enemy Submarine," and later one on "Problems of Aëroplane Improvement." The printing, mailing, and other expenses incidental to the sending out of these bulletins were provided for by the Naval Consulting Board appropriation and approved by the Navy Department.

These bulletins in a measure achieved the desired results, as they placed before the engineers of this country, in concrete form, some of the requirements in both the submarine and aircraft branches of the service and brought to the War Committee and the Naval Consulting Board a much better class of suggestions, ideas, and inventions than they had before been receiving. During the prosecution of the war, new problems of all kinds were constantly coming up in both the Army and Navy, but it was found extremely difficult for us to obtain these at long range.

With the erection and occupancy of the New Navy Building, space was provided for the office of the Naval Consulting Board, consisting of the resident member, who is also chairman of the War Committee, and a staff of examiners, which office was directly connected with the office of the Secretary of the Navy. In this office space was also provided for the work of the War Committee of Technical Societies. This has resulted in the concentration of all work in connection with the Navy Department and has brought the committee in much closer touch with service officials.

The first necessity in successfully maintaining an office at Washington was a capable secretary, but owing to the high cost of living in that city we were unable to find any one with the necessary qualifications for this important office who was willing to volunteer his services. At this juncture the General Staff of the Army offered to aid us by appointing a liaison officer who should be free to devote half his time to War Committee work.

After due consultation with the chairman and the secretary of the Engineering Council, this offer was accepted, and Capt. Lloyd N. Scott, of the inventions section of the General Staff, was appointed liaison officer to the War Committee; and at a meeting of the board held in New York on Sept. 10 he was elected secretary. This arrangement has proved most satisfactory to the Army, the Naval Consulting Board, and the War Committee, as Captain Scott is a staff officer with a wide experience in engineering and business undertakings, which, combined with forcefulness and tact, has made it possible for him to achieve wonderful results under conditions such as now exist in Washington.

The war problems received from the Army and Navy may be grouped into three classes: (a) Those which are suitable for general distribution to our members by means of bulletins and letters; (b) semi-confidential problems which are sent to selected individuals and groups of inventors who are known to be interested in that particular class of work; (c) strictly confidential problems, the solution of which requires the highest order of technical information, and which can be sent only to carefully selected scientists and prominent inventors whose life study has fitted them for the work in hand.

These problems are always mailed in double envelopes, the outer one giving no trace of its contents, and the inner envelope marked "private and confidential." At present the outstanding problems in Class C relate principally to submarine detection devices, aëroplane instruments, especially those required in cloud and night flying, and liaison devices for communication between the advancing front of an army and the artillery protecting them at the rear.

The War Committee, in sending out both bulletins and letters, requested our members to forward all ideas, suggestions and inventions on naval warfare to the Naval Consulting Board, and on land warfare to the inventions section of the General Staff. The material received in response to our bulletins and letters ranged from aëroplane supercharges and fuel for high-altitude flying, down to submarine detectors and depth bombs; from long range guns to trench knives; from observation balloons to tunneling machines; and from caterpillar tanks to radium sights.

Up to date, more than 110,000 ideas, suggestions, and inventions have been received and passed upon by the Navy Department and the Naval Consulting Board, either separately or conjointly; and the inventions section of the General Staff, which is a much younger organization, has already handled over 25,000. The crest of the inventions wave for the Navy Department and the Naval Consulting Board was reached in the early months of the war, when the receipts amounted to as high as 600 per day, and that of the inventions section of the Army in July last, when they received 124 per day. All the material received by both organizations is subjected to careful study and consideration by specialists, and those inventions deemed to have merit are immediately sent to the department of the Army or Navy where they can be most readily utilized.

Inventions as received by the Naval Consulting Board and inventions section of the Army may be roughly divided into four classes: (1) Those which have no intrinsic or suggestive value; (2) those which, though having no real value in themselves, suggest new lines of thought and investigation; (3) inventions which have considerable promise, but are not yet developed to a point where it is possible to pass judgment on them; (4) inventions which are sufficiently perfected so that they can be investigated and tested.

Ample facilities for testing inventions of the fourth class are now provided by the Bureau of Standards and Bureau of Mines in Washington. The ideas, suggestions and inventions belonging to classes 2 and 3 are, of course, much more numerous than those of Class 4, and the necessity of providing some means of solving problems and developing inventions has long been apparent. In many instances the inventors have neither the funds, scientific knowledge, nor mechanical skill to perfect their own inventions; hence aid in each of these directions is necessary, that the country may reap the full benefit of the originality of its citizens.

In its financial relations the committee has been singularly fortunate, as, owing to the generous support given by the Navy Department, the Naval Consulting Board, and the inventions section of the General Staff, it has expended only $1843.01 of the $4700 appropriated by the Engineering Council; and all of the funds contributed by organizations not included in the four Founder Societies are still intact in the hands of the treasurer.

The Great War, which has just been brought to such a glorious conclusion, has given us all a realization of the dangers of inadequate preparation for national defense. In no department has this been felt so severely as in the scarcity of engineering officers and the ignorance of military affairs on the part of those that were obtainable. To benefit by past experience we must insist that in every engineering school the students are given a thorough military training. The last war and the wars in future will be engineers' wars, and it is to the engineers that the country must look for officers to supplement the efficient, highly trained but numerically inadequate supply graduated from West Point and Annapolis.

Now that the war is over, the Government can scarcely expect continuous volunteer service from our members, and after consultation with all of the parties at interest it has been decided that though the engineers of this country still maintain their readiness to assist the Government in every possible way, it will be more economical and convenient for the Army and Navy to function with the members of the societies which united to form the War Committee of Technical Societies through the secretaries of these organizations. For this reason the Engineering Council asked that the committee be dissolved on Dec. 31, at which time our appropriations will cease.

Lists of the officials and membership of the societies included in the War Committee have been filed with the War and Navy departments, and their officials have been requested to continue the work which has heretofore been carried on by the War Committee of Technical Societies, through the secretaries of these different organizations, an arrangement which I have no doubt will prove extremely satisfactory to all concerned.

Monazite-Sand Situation in Brazil

Brazilian monazite sand, which is largely mined in the State of Espirito Santo, is usually sold in either the Rio de Janeiro or the Victoria market, says *Commerce Reports*, although in certain cases sales have been effected at the mines and payment made for delivery at the mines, the sellers quoting the price, for convenience, as of Victoria, bags, bagging, transportation, and export duty included.

Before the war the German trust (Welsbach A. G., Hamburg and Berlin) was the only purchaser of monazite sand and virtually ruled the market. All transactions relative to shipments were conducted through firms in Rio de Janeiro, which had contracts with the trust. At present the only firms engaged in the business and operating their own mines are P. S. Nicholson & Co., Rua Visconde de Inhaúma 8, Rio de Janeiro; H. M. Sloat, Avenida Rio Branco 109, Rio de Janeiro; and the Société Minié, Rio de Janeiro.

The cost of bagging this sand, after it has been mined and stored at the plants, usually averages $4.25, American currency, per ton. However, if the cost of mining, transporting, and concentrating the sand at the plant were to be included with the cost of bagging, it would average between $17 and $23.

During the period when the German trust had a monopoly of the sale of Brazilian monazite sand, the price at Victoria (capital of the State of Epirito Santo) ranged between $21 and $25 per ton. The sand was transported from several beds 60 to 120 kilometers (37 to 75 miles) from Victoria. At present (Sept. 26, 1918) the cost of transportation from the Benevente district to the port of Victoria is $7.50 per ton; from the Guarapary district, $6; and from the Carapebus mines, $5. The only mines now being worked are in the Carapebus district, but work will soon be resumed in the Guarapary district. However, the uniform price for this product, delivered at Victoria, has for some time approximated $25 per unit of thorium, and as sales are all based on the thorium value of the sand, the distance from the mine to the port of shipment does not enter into the calculation of the price.

Stocks of monazite sand at Victoria or Rio de Janeiro are kept at minimum quantities, owing to the fact that storage must be paid, and as a rule the exporters never have on hand at either port more than enough to fill one or two medium orders.

There are no facilities for satisfactorily determining the thorium content of monazite sand in Brazil, and the preliminary estimates of 5% are usually modified up to as high as 6%, or down to as low as 4½%, according to the beds from which the sand is taken.

Peace Effects on Australian Mines

SYDNEY CORRESPONDENCE

The factors governing future conditions are so many and so uncertain that it is not possible to forecast the effects of peace during the next few years. It is, however, possible to review some of the chief factors that will influence the effects. These are metal prices, labor, materials, transport, and ore grades. The last four named will be the largest factors in deciding the critical metal prices at which it will no longer pay to produce. Although the metal prices will naturally fix themselves at a profit margin above production cost for the rest of the world, such prices may yet be too low to enable Australian mines to be worked profitably. It is recognized that the interim between demobilization and the full resumption of industries may last 12 months or more. A decrease in metal prices during this period has already been anticipated by a general fall in share values of base-metal mines, although not to the level obtaining immediately after the breaking out of the war. Labor will be increasingly plentiful as troops return, and, it is optimistically expected, will become more efficient with the return of the best of the workers, who went to the front.

Wages, however, are unlikely to fall for many years. Materials will become cheaper, as Australian manufactures have increased since the war began. With more ships, imports, so long restricted, will expand. Australia waits for all kinds of American mining machinery and electrical appliances, both for renewals and extensions. Within six months, therefore, it is confidently expected that materials will begin to fall in price. One cause of this will be the increase in numbers of ships and a decrease in ocean transportation cost. The immediate result will be a reduction in the large accumulations of concentrates and metals, enabling past contracts to be fulfilled and new ones to be made.

The last item, ore grade, will remain about the same for producing lead-silver-zinc mines, but will probably diminish for producers of copper, tin, gold and rare metals. On the other hand, the extension of flotation and leaching methods will improve recoveries on existing ores and make lower-grade ores workable.

The harder times to be expected during the next few years will force economy and stimulate production. This means that the larger, lower-grade districts of Australia will have to be exploited on "wholesale" American lines. There is also the natural stimulation to prospecting with the demand for gold and tin. It has been the experience that "new fields" mean rich ones, whether alluvial or lode. When West Australia reckoned returns by the ounce, instead of the pennyweight, there was no complaint of high costs, although, in the early days, they were certainly as high as today; and similarly for tin.

Natural economic laws will convince Australia that her immediate future lies in the production of raw materials, rather than of manufactured goods, except as required for local consumption

Bamboo Roads in Burma

BY HARLEY E. HOOPER

It often falls to the lot of the mining engineer to build a road cheaply and quickly, and the following description of road construction in Burma may be applicable for use in other tropical localities: In the Tavoy district, Lower Burma, the rainfall during the monsoon season is exceptionally heavy. In the middle of this season, it was necessary to haul wolfram ore over 10 miles of jungle road which the bull-cart traffic had reduced to a series of morasses or bogs. The road was first corduroyed with 3-in. and 4-in. saplings and these were covered with a few inches of laterite.

---

*Tavoy, Lower Burma.

In carting the laterite, the few good portions of the road were badly cut up and the job was costing about 80 rupees[1] per 100 feet.

Bamboos of 2-in. diameter were split into four and laid longitudinally, at 1-ft. centers, along the road. Similar quarter sticks were closely woven, in sets of two, across the longitudinal strips, two over and two under. The alternate longitudinals were held up while the cross pairs were put in and then tapped back into position. The contract for the road, including the rough leveling, was let at 16 rupees per 100 ft., and 100 coolies could cut and lay 1000 ft. per day. The hard, external part of the bamboo was always laid upward.

To split the bamboo, a rough cross is erected, about three feet above the ground and against a firm wooden frame. The end of the bamboo is slightly split twice with a dah, and the four pieces are thrust through the angles of the cross with a good push.

An elephant hitched to an improvised cart, made from the steel wheels of a portable engine, formed part of the transport kit, and he negotiated the bamboo matting repeatedly, leaving no visible impression. Owing to the naturally uneven length of the longitudinals, the joints are staggered, thus making a continuous semi-elastic mat hundreds of feet long. It is an improvement to pin down the sides, but not an absolute necessity. The sharp curves in the road are covered without any noticeable irregularity in the matting. The mud works up slightly in the softest parts, but the heavy rains wash it down again, and the mat usually presents a clean and orderly appearance. Such a track will last from four to five months, sufficient to see one well through the monsoon period and give a chance for road repairs to be made during the dry season.

Cost of Explosives

Under the above title there appeared in the *Journal* of Dec. 14 a complaint from a "Gold Miner" regarding the rising cost of explosives during the last three or four years, in the face of a reputed fall in the price of powder for military purposes. Several communications from the explosives manufacturing companies have been received which give reasons for the advance in the cost of mine explosives. These are of sufficient interest to warrant publication, and some of the important paragraphs are quoted below:

From E. I. du Pont de Nemours & Company:

As you know, prior to the war, the high-explosives industry was developed to a high degree, as a result of our activities in the business since the year 1802. On the other hand, the manufacture of military smokeless had been conducted on a limited scale, affording no opportunity for the invention of cost-saving machinery or in process of manufacture.

With the tremendous volume of military business coming to us after the beginning of the European War, we were afforded an opportunity to work out economies previously unthought of. This resulted in a reduction in cost that more than overcame the increasing costs of raw materials, labor, etc.

I believe this explains why there is no connection between the two considerations, but it may be well to state that industrial explosives and military explosives are two separate and distinct manufacturing undertakings. Industrial explosives cannot be manufactured in military explosives plants, nor can military explosives be manufactured in industrial explosives plants.

From the Atlas Powder Company:

It is quite true that as compared with prices existing before the beginning of the European war, prices for dynamite have practically doubled, and the greater part of the advance has been in the last two years. The advances in prices for such explosives were compelled by advances in their manufacturing costs, the increased cost being due to increased price we have had to pay for the material entering into their manufacture, the increased labor costs, increased freight rates on both raw materials and finished products, and numerous other items that have affected the great bulk of commodities produced in this country. We think that reference to prices for such materials as enter into the manufacture of explosives, which have been published in the *Journal* from time to time, will show that practically every one of these materials has increased in price from 150 to 300%, and in some cases even more. You are, of course, familiar with the increase in wages of labor, which has applied to our industry the same as it has to all other industries. To our minds the increase in the price of blasting explosives of about 100%, in the face of increase in the costs of the materials from which such explosives are made, which is from 150 to 300%, indicates that the explosive manufacturers have in no way taken advantage of conditions which have existed, but, on the contrary, have kept down the prices of blasting explosives to the lowest possible figures. This has certainly been our policy, and we will welcome return in prices of these explosives to levels more nearly in line with those existing before the war, as the relatively high prices that have existed recently tend to discourage the consumption of explosives.

From the Ensign-Bickford Company:

We are not in a position to make any comments except as regards our own products: namely, safety fuse and cordeau-Bickford. We are glad to give the following, which we believe will clearly substantiate the absolute necessity for increased prices in the case of safety fuse. On the other hand, it will point out that in the case of cordeau-Bickford, there has been but one raise since the beginning of the European war. This was made Sept. 15, 1915, and is a relatively slight one.

The cost of materials alone for the manufacture of safety fuse has advanced, roughly speaking, in the following proportions: Fuse powder, double; jute yarns, 50%; cotton yarns, four times; cloth, three times; water-proofing materials, double. In addition, the labor cost has advanced at least double, if not more, and the overhead charges have increased correspondingly. On the other hand, taking ordinary double-tape fuse for comparison, on Sept. 1, 1914, the price of double-tape fuse was $5.10 per 1000 ft. list; and it is now $10 per 1000 ft. list. The price of plain cordeau was $42.50 per 1000 ft. list; and it is now $57.50 per 1000 ft. list.

[We are glad to present the replies of several powder manufacturing companies to the question raised by our correspondent. These replies bring forth two important things. The first is that the manufacture of military and mining explosives is conducted along very different lines, and that prices are therefore not comparable. The second is that the increased cost of mining explosives has been brought about by the increased cost of materials, labor, and freight. The last has a familiar sound; we have heard it before. There is no doubt about the cost increases, and, in spite of the rise in the cost of mining explosives, we are inclined to disagree with our correspondent, in the absence of specific proof to the contrary, that the mines have been singled out as legitimate game by the powder manufacturing companies.—EDITOR.]

Sulphur Committee's Work Completed

Under the general plan of dissolution of the various sections of the War Industries Board, the work of the sulphur and pyrites section of the board has been practically concluded. W. G. Woolfolk is chief of the section. In consequence, the Chemical Alliance's committee on production, distribution, and control of sulphur-bearing materials has ceased to function with that section of the board. This became effective Dec. 11.

An Emergency Placing of Pumping Equipment, aggregating a total capacity of 20,000,000 gal., was completed in 24 hr. at the Old Dominion mine, in Arizona, according to its report for 1917, with the exception that the transfer of a cable from one shaft to another was not finished.

---

[1] The present value of the rupee is 1s 6¼d., or about 36 cents.

Consolidating the American Engineering Professions

By A. D. Flinn*

THE organization of engineers in America is chaotic, complex, and illogical. As consequences there are confusion, waste, inefficiency, and dissatisfaction, which, however, are exaggerated in some minds. If no associations existed, it would be relatively easy to plan and create a system of organization that would satisfy demands much more effectively than does the present multiplicity of unrelated societies. But there have grown with the years traditions, and loyalties, and prejudices, clustering about the societies that now are. An answer to the problem thus created is not easy. To me the solution is not obvious, but some progress in the process is now appearing. There must be extensive consolidations, more federation, and much simplification, each of which demands elimination. Steps are being taken, or preparations made for them, in various ways and places, and by a number of agencies. They will be accelerated as their benefits gain appreciation; but education, time, and patience are needed for attaining the goal.

The Problems Confronting a Consolidation Scheme

What are the present desirable limits to consolidation and federation? To what goal should they tend? By what methods and means can they best be brought about? These and similar questions are not being answered conclusively, because the necessary facts are not in hand. We have been muddling along in an unengineering fashion, attempting to plan and design and specify without a survey. On Sept. 12, Engineering Foundation by formal vote proposed to make the much-needed survey and preliminary studies, the four Founder Societies concurring. Of the necessity for this survey I have been more deeply convinced with the passing weeks, as I have listened to ineffective arguments and to misstatements based on ignorance which can be corrected only by the results of the proposed survey of engineering organizations.

Without the enlightenment of such a survey it now seems that the following elements of organization are desirable for the engineering profession in America: Excepting possibly three or four cities having large numbers of engineers, there should be in each community, having a sufficient group of technical men to be organized, one organization that embraces them all. Reasons for this are obvious. This organization may be an association of local societies and sections of national societies, or it may be a society admitting to its membership men of all branches of the profession. Examples of both forms of organization exist in a number of places. Local organizations should have large measures of autonomy, but should conform to approved types and standards.

Logically, the next step in organizing would be the combining of these local organizations into one or a few national societies, so that the loyalty, interest, comradeship, and activities naturally developed by the local organizations would flow to the national societies. But at this step the difficulties increase. Many engineers cannot become active members of local organizations, because of distances from headquarters; others do not desire local membership. If there were only one national society, many of the difficulties of scheming a system of organization would disappear; but there are, and probably for some years will be, several national societies of importance, and in each local organization there will be members of two or more national societies. A number of plans have been submitted to me for overcoming these difficulties. None is wholly acceptable. These problems lie at the bottom of the tasks of the committee on development, of the American Society of Civil Engineers, and of the committee on aims and organization, of the American Society of Mechanical Engineers, and similar committees which may be appointed by other societies. Many engineers are giving them earnest thought.

There are said to be approximately 400 organizations of engineers in America, of various kinds. Of these, about one-quarter are the leading national societies and their local sections. In general, the remaining societies have no official relationship, excepting the associations of local societies and sections in a few communities. Consequently the engineering profession, before the public and Government, has no one organization which represents it as a whole, as have the medical profession, the lawyers, the chemists, the architects, the Chamber of Commerce and even labor. In the memberships of the Founder Societies, aggregating 35,000 engineers, there have been variously estimated to be only one-third to one-sixth of the total number of engineers in the country. The engineering profession lacks solidarity.

Engineers Have Exceptional Facilities

Not a little of the dissatisfaction voiced in various quarters as to the shortcomings of the national societies grows out of ignorance or lack of apprehension of benefits actually received. In no small measure the complainants are at fault in not making better use of the facilities provided and the means of information put within their reach. Furthermore, some important benefits of membership in large technical societies are intangible and not capable of definition; not a few persons overlook these. Nevertheless, there are causes for reasonable dissatisfaction. The societies are endeavoring to remove these as they are recognized and remedies can be found. Humanity and its institutions will never be wholly rid of dissatisfaction, and to this truism engineers are no exception.

In this connection, a quotation from the presidential address of Charles T. Main to the American Society of Mechanical Engineers, December, 1918, is interesting reading:

In the *Monthly Bulletin* of the American Institute of Mining Engineers, March, 1918, there appeared the following:

"The vision dwells in the minds of many that ultimately these four great societies, lightening the emphasis they place upon their differences, may see the time when, for the solidarity of the

---

*Secretary, Engineering Council.

> profession, for their best interests, as well as for the increase of their influence on the country at large, they may become one great national association of engineers. With the gain in power and prestige inevitably following such an aggregation, freedom for individual development may be achieved through divisions along the lines of technical interests, which might either follow the present four grand divisions or be more minutely subdivided.
>
> "An organization of this sort could and probably would be more strictly professional than any of the four have been heretofore, and through the prestige and power of its numbers could establish standards of ethical conduct for its members, violation of which would bring grave consequence."
>
> This great vision is worthy of the most careful consideration and might be carried with safety to a point where the national societies would be gathered in under one executive head, without any one losing any vital portion of its individuality.
>
> This would be a great step in advance and perhaps as far as we should go for some time to come.

Whatever scheme of organization be ultimately selected, it must be flexible, so as to meet successfully constantly changing conditions, and it must provide for both technical and social requirements of the membership, while maintaining high standards. "Social requirements" is here used to mean, in addition to social intercourse among members, services of the organizations to Government and to the public, and services to engineers individually, such as assistance in securing engagements and better standing in corporate and governmental employment. Technical and social functions probably will be best kept distinct. Some engineers even suggest separate organizations; but at present prefer separate departments of one organization or of a federated group of organizations.

THE UNITED ENGINEERING SOCIETY

So far as known, none of the leading organizations has stated a definite policy on these questions. Opinions herein expressed are only personal. The statements in this paper are merely a contribution to the general discussion of this subject by one who for several months has had especial opportunities for learning the opinions of others and gathering a little information.

As regards the joint activities of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, the present organization seems involved; and even some members of the governing bodies of these societies have difficulty in keeping relationships straight. It is, however, not so complex as some persons assume. It may be simply stated as follows: The four Founder Societies named have joined in creating the *United Engineering Society* to hold and administer property and to perform other broad functions for them. At their request the United Engineering Society has established three departments, the Library Board, the Engineering Foundation, and Engineering Council.

The Engineering Societies Library has possibilities for active usefulness to the engineering profession and to the industries of this country. Its present passive services are good and of great value, but the library can do much more. Funds are needed at once for complete re-cataloguing of the books, for strengthening the collection of books, and for instituting new lines of service. The books of the societies have been brought together, but they have not yet been assembled as one library. Never, except during the war, has it been so important that all useful recorded technical information should be fully and quickly accessible to engineers —not only to those in the New York district, but also to those scattered throughout the whole land.

The Engineering Foundation now has an endowment of $300.000, yielding an annual income of $15,000. It rendered vital financial assistance to the National Research Council at the latter's inception in 1916, and for the year terminating in September, 1917. That council performed services of great importance to the Government during the war. For the future it already has in hand many projects. One of the most important of these is the promotion of industrial research, in which the Engineering Foundation is coöperating. The Engineering Foundation investigated a scheme for spray camouflage of ships; is conducting long-time tests on the wear of gears, and is making a research on the selective control of wireless communication. It has offered to undertake a "survey of existing engineering organizations, and from information thus developed to formulate a series of constructive recommendations which may be serviceable in guiding the further development of local and national engineering organizations, in their relations to the profession of engineers, to the public, and to one another." Other projects are being studied, but cannot yet be announced. Engineering Foundation's policy is to devote its energies and resources to undertakings of broad application, such as bringing about and stimulating coöperation among existing agencies engaged in research and outlining programs and organizations for research in specific fields.

The Engineering Council, since its organization meeting on June 27, 1917, has made progress in exploring its proper field of activity and fixing some of its boundaries. It has accomplished much useful but negative work. In other words, its rejections have been important and have consumed much time. But there are noteworthy constructive achievements, also, on the credit side of its records. During hostilities the Council rendered no small aid to the Government through the American Engineering Service, which procured thousands of engineers for the War, Navy, and other departments, and through the War Committee of Technical Societies, which assisted the Naval Consulting Board and the Army General Staff in examining scores of thousands of suggestions for naval and military devices. Through efforts of its public affairs committee, the Council aided in having the military draft adjusted to permit the continuance of training in the engineering schools of the vitally necessary technical men. Through the industrial affairs committee vigorous opposition was offered to "anti-efficiency legislation" in Congress. Ten days after the signing of the armistice, the Engineering Societies Employment Bureau, with the four Founder secretaries as its board of directors, was substituted for the war-time American Engineering Service. The fuel conservation committee acted in a consulting capacity to the Fuel Administration and the Bureau of Mines in securing war economies, and is continuing its much-needed services into the era of peace. The water-conservation committee is prepared to promote right, and to oppose wrong, national or state governmental actions relating to water-power or other utilization of water, by supplying statements of facts rather than joining in controversial support or opposition of any particular measure. The license committee, with members judiciously distributed throughout the country, is collecting information on the licensing of engineers by the various states, and is preparing to render proper assistance in these matters whenever needed. The patents committee, coöperating with other similar bodies, is preparing important action for the improvement of the patent law and practice. During the spring and summer, the secretary visited groups of engineers representing the local societies and sections of national societies in 20 different cities from the Atlantic seaboard to the Pacific Coast. In 30 or more communities local correspondents have been selected for direct communication between Engineering Council and engineers at distances from headquarters. Furthermore, important projects of interest to all engineers are in preparation and may soon be announced. One of these is the formation of a national service committee, which is to have an office in Washington, as the representative of American engineers at the national capital.

All aims and endeavors of engineers through their national and local societies and their joint instrumentalities must be pervaded by a sincere spirit of service, not alone of one to another, but by all to the community, the state, and the nation. Such public service by engineers, architects, chemists, scientists, doctors, lawyers, and clergymen is our professional obligation, the *noblesse oblige* of a free and democratic people. Each profession has its distinct service to perform. In each profession there are big men and small men; each must contribute according to that which he has. Service is the only true stepping-stone to that eminence which alone is worth attaining. Greater opportunities have never opened to American engineers than those which confront them in these rapidly passing years of war and "reconstruction."

Santa Gertrudis Co., Ltd.

The annual report of the Santa Gertrudis Co., Ltd., for the year ended June 30, 1918, shows that a profit of £112,544 5s 1d was made during the period. Dividends absorbed £131,350, and directors' remuneration, £1125 8s 10d. The company's holdings in the Cia. de Santa Gertrudis and the Cia. Beneficiadora de Pachuca remain unaltered.

At the property of the Cia. de Santa Gertrudis, 324,652 tons of ore was sold, containing 24,251 oz. gold and 4,316,901 oz. silver. Ore disclosures during the year were of little importance and have not added materially to last year's estimates of reserves. Operating costs increased slightly, but this was more than offset by the higher price of silver.

Milling operations at the plant of the Cia. Beneficiadora de Pachuca averaged 80.7% full capacity. The reduction was due to a shortage of cyanide, and, later, to difficulties in the operation of the settling and filtering plant. Additional equipment is now being considered. During the year 324,762 tons of ore was treated, from which a recovery of 21,856 oz. gold and 3,775,745 oz. silver was obtained. The recovery is given as 87.95%, but as this is based on the combined value of the product, as compared with the combined value of the metals in the ore, and will vary according to the fluctuations in the price of silver, the information is of economic interest only.

Flotation experiments were concluded, with results which showed that the process, in its present stage of development, cannot compete commercially with cyanidation for the treatment of the company's ore. Aluminum is now being used in place of zinc dust for precipitation purposes. A considerable saving is already assured, which will be increased as operations are extended.

Method of Securing Anchor Bolts

Neat cement poured around anchor bolts and allowed to set for three weeks develops such a tenacity that the bolts will break under tension before they loosen. Where a machine must be "anchored" to its foundation bed and ready to operate within a few hours, the use of molten lead to hold the anchor bolts securely is unquestionably the better method, as its full strength is developed as soon as it has cooled. In setting up horizontal air compressors and similar machines which develop a constant vibration when in operation, and as a consequence produce strain on the anchor bolts, the lead shows a tendency to become compressed in the direction of the movement. Thus in time a slight movement of the machine upon its foundation when running will be noticeable. Cement, on the contrary, has the property of becoming harder the longer it sets, and so "improves with age."

To demonstrate this, a series of tests was recently made by A. L. Sweetser. Holes were drilled to a depth of three feet in hard limestone rock, and half of the bolts were set in lead and the remaining half in portland cement. The anchor bolts were ¾ in. in diameter. At the end of three weeks a 20-ton hydraulic jack was used in an attempt to "pull the bolts." Those imbedded in lead started to loosen under a load of 12 tons, whereas the bolts in the cement did not loosen at 17 tons and in fact broke before the load reached 20 tons. The experiment proved that for reliability, strength, and simplicity in use cement is unquestionably preferable to lead.

Butte & Superior Mining Co.

The report of the Butte & Superior Mining Co., for the third quarter of 1918 shows that 108,182 tons was milled, as compared with 114,716 tons for the previous three months—a decrease due to shortage of labor and the inexperience of green miners. The percentage extractions and the grade of concentrate produced were both slightly higher; and metallurgical results during the latter part of the period of review were such as to justify the prediction that future extractions would be materially improved. The increased extraction of zinc, in concentrate form, from 90.925 to 91.133%, is of especial interest because the improvement has been made despite the fact that the zinc content in the heads has decreased from 16.242 to 15.647 per cent.

A further increase in mining and milling costs is noticeable, and is largely attributable to the fact that an advance of 50c per day in the wage scale was made at the beginning of the quarter.

Graphite Exports From Ceylon to the United States, as given in *Commerce Reports*, amounted to 801 tons in the second quarter of 1918, compared with 4862 tons in the corresponding quarter last year. The decrease is due obviously to the restrictions of the War Trade Board.

The Fluid Ton

By A. W. ALLEN

The need of a definite term to designate a mass fluid unit, in connection with the assaying of cyanide solution containing gold and the rapid calculation of dilution ratios, resulted in the formulation, by Rand metallurgists, of a new unit of measurement. Ten years or so ago the fluid ton, then used for the first time in conjunction with the short ton of 2000 lb., was defined as the amount of solution or water occupying 32 cu.ft. The idea was favorably received, and the new unit has been adopted, in connection with certain industries, in all English-speaking countries.

THE accompanying tables are presented in order to familiarize engineers with the characteristics of a comparatively new unit, and to serve as a means for the ready conversion of gallons and cubic feet into fluid tons, and *vice versa*. There has been an urgent need for a convenient unit to represent large amounts of water or solution in many phases of engineering. The value of the fluid ton in this connection has been recognized in wet-metallurgical operations, and its use might well be extended.

An ore is generally reduced by crushing and grinding operations in a water or solution medium, and, almost invariably, its weight is recorded and it is assayed or analyzed for metal content on the basis of

TABLE I CUBIC FEET AND APPROXIMATE FLUID TONS

Cu Ft.	0	1	2	3	4	5	6	7	8	9
0	...	0.03	0.06	0.09	0.12	0.16	0.19	0.22	0.25	0.28
10	0.31	0.34	0.37	0.41	0.44	0.47	0.50	0.53	0.56	0.59
20	0.62	0.66	0.69	0.72	0.75	0.78	0.81	0.84	0.87	0.91
30	0.94	0.97	1.00	1.03	1.06	1.09	1.12	1.16	1.19	1.22
40	1.25	1.28	1.31	1.34	1.37	1.41	1.44	1.47	1.50	1.53
50	1.56	1.59	1.62	1.65	1.69	1.72	1.75	1.78	1.81	1.84
60	1.87	1.90	1.94	1.97	2.00	2.03	2.06	2.09	2.12	2.16
70	2.19	2.22	2.25	2.28	2.31	2.34	2.37	2.41	2.44	2.47
80	2.50	2.53	2.56	2.59	2.62	2.65	2.69	2.72	2.75	2.78
90	2.81	2.84	2.87	2.90	2.94	2.97	3.00	3.03	3.06	3.09

Cu.Ft.	000	100	200	300	400	500	600	700	800	900
0	....	3.12	6.25	9.37	12.50	15.62	18.75	21.87	25.00	28.12
1,000	31.25	34.37	37.50	40.62	43.75	46.87	50.00	53.12	56.25	59.37
2,000	62.50	65.62	68.75	71.87	75.00	78.12	81.25	84.37	87.50	90.62
3,000	93.75	96.87	100.00	103.12	106.25	109.37	112.50	115.62	118.75	121.87
4,000	125.00	128.12	131.25	134.37	137.50	140.62	143.75	146.87	150.00	153.12
5,000	156.25	159.37	162.50	165.62	168.75	171.87	175.00	178.12	181.25	184.37
6,000	187.50	190.62	193.75	196.87	200.00	203.12	206.25	209.37	212.50	215.62
7,000	218.75	221.87	225.00	228.12	231.25	234.37	237.50	240.62	243.75	246.87
8,000	250.00	253.12	256.25	259.37	262.50	265.62	268.75	271.87	275.00	278.12
9,000	281.25	284.37	287.50	290.62	293.75	296.87	300.00	303.12	306.25	309.37

TABLE II. FLUID TONS AND CUBIC FEET

Fluid Tons	0	1	2	3	4	5	6	7	8	9
0		32	64	96	128	160	192	224	256	288
10	320	352	384	416	448	480	512	544	576	608
20	640	672	704	736	768	800	832	864	896	928
30	960	992	1,024	1,056	1,088	1,120	1,152	1,184	1,216	1,248
40	1,280	1,312	1,344	1,376	1,408	1,440	1,472	1,504	1,536	1,568
50	1,600	1,632	1,664	1,696	1,728	1,760	1,792	1,824	1,856	1,888
60	1,920	1,952	1,984	2,016	2,048	2,080	2,112	2,144	2,176	2,208
70	2,240	2,272	2,304	2,336	2,368	2,400	2,432	2,464	2,496	2,528
80	2,560	2,592	2,624	2,656	2,688	2,720	2,752	2,784	2,816	2,848
90	2,880	2,912	2,994	2,976	3,008	3,040	3,072	3,104	3,136	3,168

TABLE III U. S. GALLONS AND APPROXIMATE FLUID TONS

U. S. Gallons	0	100	200	300	400	500	600	700	800	900
0		0.418	0.835	1.253	1.671	2.089	2.506	2.924	3.342	3.760
1,000	4.177	4.595	5.013	5.431	5.848	6.266	6.684	7.102	7.520	7.937
2,000	8.355	8.773	9.191	9.608	10.026	10.444	10.862	11.279	11.697	12.115
3,000	12.533	12.951	13.368	13.786	14.204	14.622	15.039	15.457	15.875	16.293
4,000	16.710	17.128	17.546	17.964	18.381	18.799	19.217	19.635	20.052	20.470
5,000	20.888	21.306	21.724	22.141	22.559	22.977	23.395	23.812	24.230	24.648
6,000	25.066	25.483	25.901	26.319	26.737	27.154	27.572	27.990	28.407	28.825
7,000	29.243	29.661	30.079	30.496	30.914	31.332	31.750	32.168	32.585	33.003
8,000	33.421	33.839	34.256	34.674	35.092	35.510	35.927	36.345	36.763	37.181
9,000	37.598	38.016	38.434	38.852	39.270	39.687	40.105	40.523	40.941	41.358

TABLE IV. FLUID TONS AND APPROXIMATE U. S. GALLONS

Tons	0	1	2	3	4	5	6	7	8	9
0		239	479	718	957	1,197	1,436	1,673	1,915	2,154
10	2,394	2,633	2,872	3,112	3,351	3,590	3,830	4,069	4,309	4,548
20	4,787	5,027	5,266	5,505	5,745	5,984	6,224	6,463	7,602	6,942
30	7,181	7,420	7,660	7,899	8,139	8,378	8,617	8,857	9,096	9,335
40	9,575	9,814	10,053	10,293	10,532	10,772	11,011	11,230	11,490	11,729
50	11,968	12,208	12,447	12,687	12,926	13,165	13,405	13,644	13,883	14,123
60	14,362	14,602	14,841	15,080	15,320	15,559	15,798	16,038	16,277	16,516
70	16,756	16,995	17,235	17,474	17,713	17,953	18,192	18,431	18,671	18,910
80	19,150	19,389	19,628	19,868	20,107	20,346	20,586	20,825	21,064	21,304
90	21,543	21,783	22,022	22,261	22,501	22,740	22,979	23,219	23,458	23,698

TABLE V CUBIC FEET PER MINUTE AND FLUID TONS PER 24 HOURS

Cu Ft per Min	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.0	4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	40.5
1	45.0	49.5	54.0	58.5	63.0	67.5	72.0	76.5	81.0	85.5
2	90.0	94.5	99.0	103.5	108.0	112.5	117.0	121.5	126.0	130.5
3	135.0	139.5	144.0	148.5	153.0	157.5	162.0	166.5	171.0	175.5
4	180.0	184.5	189.0	193.5	198.0	202.5	207.0	211.5	216.0	220.5
5	225.0	229.5	234.0	238.5	243.0	247.5	252.0	256.5	261.0	265.5
6	270.0	274.5	279.0	283.5	288.0	292.5	297.0	301.5	306.0	310.5
7	315.0	319.5	324.0	328.5	333.0	337.5	342.0	346.5	351.0	355.5
8	360.0	364.5	369.0	373.5	378.0	382.5	387.0	391.5	396.0	400.5
9	405.0	409.5	414.0	418.5	423.0	427.5	432.0	436.5	441.0	445.5

the short ton of 2000 lb. Under such conditions, the estimation of ore by weight and water or solvent by volume leads to confusion, and makes calculation unavoidable before a statement of ratio of dilution or metal content per ton is available.

The weights and volumes as applied to water in the metric system are practically interchangeable, and 1 gm. of pure water occupies 1 c.c. at a temperature of 4° C., at a pressure of 760 mm. of mercury. No such convenient relation exists in the other standard systems. The imperial gallon of water weighs 10 lb. avoirdupois, at a temperature of 62° F. and a pressure of 30 in. of mercury, and occupies a space of 277.41 cu.in. This is found a convenient unit for recording either volume or weight. The U. S. gallon occupies a space of 231 cu.in., and so the weight of a number of them cannot be estimated without calculation.

The final abolition of the gallon as a unit of measurement in hydraulics as well as metallurgy is to be desired. It is an absurdly small unit anyway, and its use often leads to confusion between the U. S. gallon and the imperial gallon. There can be little question as to its inadequacy in many phases of industry. Engineers on both sides of the international boundary are agreed as to the suitability of the fluid ton as a unit in connection with the measurement of water and solution in wet chemico-metallurgical operations. Let them also agree as to the advisability of abolishing the gallon as a recognized unit in other phases of engineering effort.

DEFINITION OF A FLUID TON

The fluid ton is neither a unit of weight nor a unit of volume. Both factors must be taken into consideration. A uniform weight for the water or solution—62.5 lb. per cu.ft.—is assumed; and, on this basis, the fluid ton is calculated according to volume measurement. A definition in substantial agreement with that given by W. J. Sharwood[1] would be:

> *Fluid ton:* Thirty-two cubic feet. A unit to correspond with the short ton of 2000 lb., and of sufficient accuracy for many hydrometallurgical, hydraulic and other industrial purposes, according to which it is assumed that the water or other liquid under consideration weighs 62.5 lb. per cubic foot.

With regard to the strict record of actual weight, the fluid ton, as defined, will coincide with the short ton of 2000 lb. only at a fixed temperature and pressure. One cubic foot of water at 4° C. and atmosphere pressure weighs 62.428 lb., so that there would always be a slight error on this account. This, however, is insufficient to detract, to appreciable extent, from the value of the new unit, which is meant to be used only where extreme accuracy would be meticulous and unnecessary, and where large volumes of liquid are under consideration.

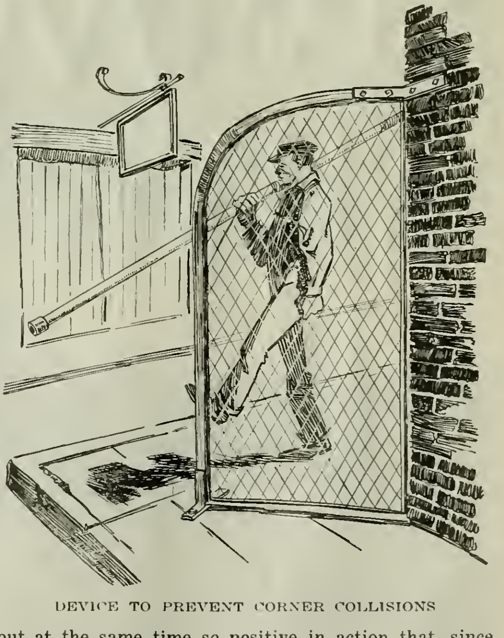
USE OF THE FLUID TON IN MILL PLANNING

Engineers engaged in design work on hydrometallurgical plants usually make the preliminary estimates for storage capacity and conveyance needs on the basis of dilution and general requirements. That is to say, if a 100-ton plant is under consideration, and a 6 to 1 milling dilution is anticipated, this would mean a delivery of 600 tons of water or solution per day at crushing or grinding machine. Pumping and storage capacity is therefore calculated on this basis; and it would certainly be convenient if the fluid ton were more widely used as an alternative capacity unit by manufacturers. Circular-tank capacities are sometimes tabulated in technical books on the fluid-ton basis, but practically all pumping and conveying equipment is standardized according to its capacity in gallons, or cubic feet per hour or minute. The number of gallons that a certain pump can handle every minute is information that has no significance to many engineers. Performances of such machines are usually measured on the 24-hour basis, and the most convenient unit to use for this purpose is the fluid ton.

Safety Corner Guard

By L. V. LAUTHER*

In almost every plant is a corner where accidents frequently occur, regardless of safety signs, mirrors, or lookout windows. Such accidents are usually caused by one man coming into unexpected contact with something being carried by another man who is walking in the opposite direction. An ingenious method of obviating such troubles which is absolutely fool proof, but at the same time so positive in action that, since its adoption, no more so-called corner accidents have happened, is shown in the accompanying cut.



DEVICE TO PREVENT CORNER COLLISIONS

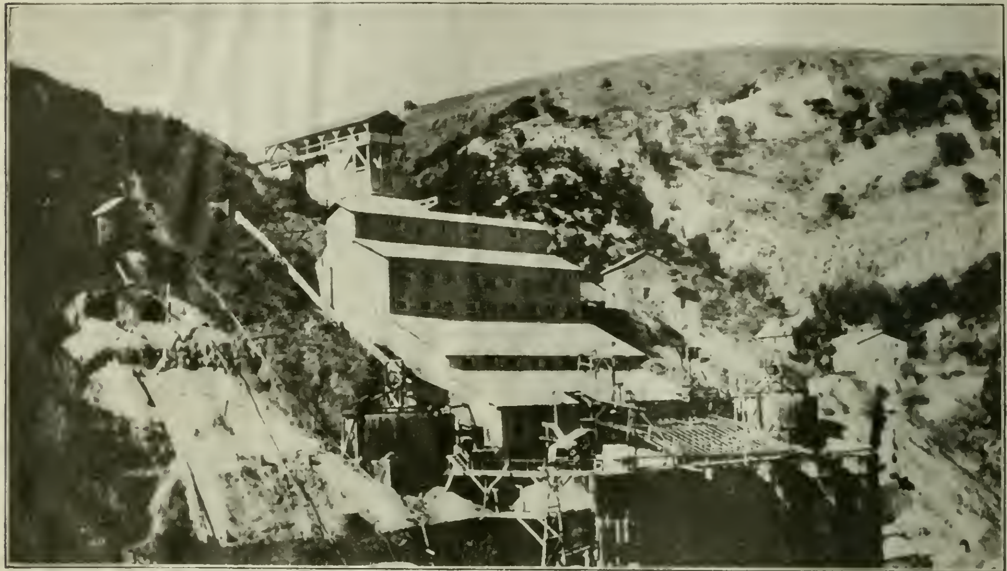
A piece of pipe is bent to the required shape, and the lower end buried or concreted into the ground. The space between this and the corner is covered with coarse wire netting. The device makes it necessary for pedestrians to walk around the projection, and in doing so they are able to see who and what is coming in the opposite direction and take precautions.

---

[1] *Min. Mag.*, Nov., 1918.

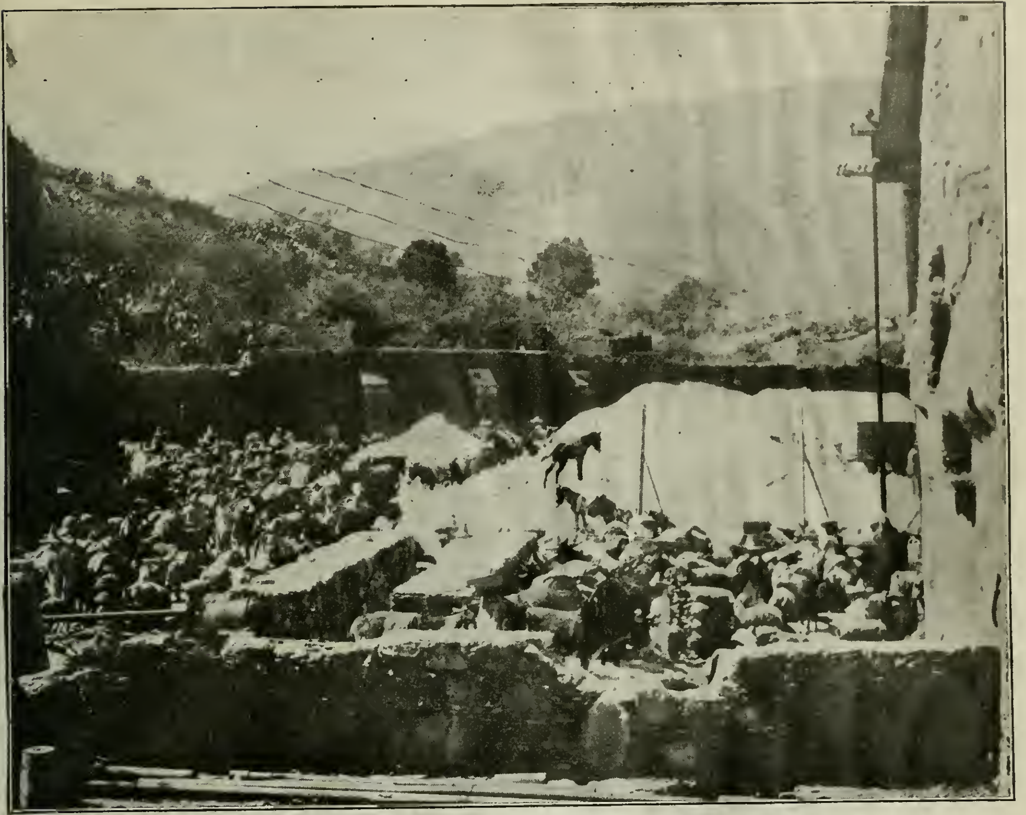
*Manhatten Rubber Manufacturing Co., Passaic, New Jersey.

Scenes From a Mexican Mining Camp



MILL OF THE PROVIDENCIA MINING AND MILLING CO., AT GUANAJUATO, MEXICO

SORTING SILVER ORE AT GUANAJUATO, MEXICO



SHIPPING HIGH-GRADE SILVER ORE, CUBO MINING AND MILLING COMPANY

SORTING, SCREENING, AND TRAMMING SILVER ORE AT GUANAJUATO, MEXICO

A Tribute to James Douglas

BY JAMES COLQUHOUN

IT WAS as "the professor" that I first knew him, and it is as "the professor" that I, like other old timers, prefer to remember him. He went to Arizona in 1882, I a year later; and there we worked side by side for more than 20 years. I cannot recall the day when first I saw him, but we soon became friends, and we maintained an unbroken friendship to the end.

He was older than I was, and more experienced, yet he never presumed on that account. His views were presented with a modesty which never deserted him, and a moderation which was at once a lesson and an example.

His early training and the personal influence of his noble and self-sacrificing father had left a note of seriousness in his character, but he could unbend on occasion, and could give and take when wit and humor held the field. He never failed, if within reach, to attend my annual dinners, always as the most honored guest. His speeches, reminiscent of old times and old timers, were always instructive and enjoyable; and he was just as eager to listen and as ready to enjoy the flow of humor which is characteristic of the West and of Western men.

His outlook was as wide and as far-reaching as his knowledge, and his knowledge was profound. He spoke well on any subject, and he never failed to command the interest and sympathy of his audience. He had none of the finish and style of the trained orator. In speech he was plain, direct, and unaffected. His strength lay in his good heart, in his sincerity, and in his desire to spread the light of knowledge. Always he pleaded with us for the exchange of experience between the various mines and metallurgical plants. Like the father of us all, as he was in a sense, he passed from one camp to another, a carrier of good will and an example of bright and generous thinking. It was to me he first came with the proposal that our companies should agree to the "side-line boundary." That the agreement was consummated with such happy results to both parties was due as much to the influence of his lofty character as to the soundness of his arguments.

Dr. Douglas was always my guest when he found his way to Clifton, and no guest was more gladly welcomed. In his own inimitable way he made himself one of the family. He loved children, and so young was he in spirit that he would join with them in their games. Once I found him in a deadly football contest with my two little boys. The boys had challenged him, and he had promptly accepted the gage. They selected the parlor for the field of battle, and there, to my dismay, I found them hotly engaged, quite regardless of the consequences to the furniture, windows, and bric-à-brac. I stopped the game on the plea of "rough play," and the professor appeared to be even more disgusted with the decision than were his opponents.

When the Morenci Southern was building, the engineer acting for the company let a contract to the Mormons for the removal of alluvial soil. When the Mormons entered upon the contract, however, they found that for more than a mile this alluvial soil had been cemented into a hard conglomerate, which could not be moved with anything short of giant powder. There was consternation in the Mormon camp, and my friend, President Kimball, their worthy head, came to me and requested that I use my influence to right the wrong. I advised him to go to the professor, but, like others before him, he did not care to "beard the Douglas in his den." I finally consented to write to the professor, and the matter was promptly arranged in the right spirit, much to the relief of the Mormons, the professor remarking, in his dry way, that geology sometimes overshot the mark.

Shortly before the war I met the professor in London. I had not seen him for years, and our meeting was to me a very great pleasure. He was not a day older in spirit. We drove through Walbrook, a narrow lane, and found the way blocked by a beer wagon, anchored to which were two powerful horses. In a moment, and before I could interfere, the professor had the horses by their heads and had led them to a wider space, leaving room for our taxi to pass. The driver came out, wiping the froth from his mouth, and getting ready to swear, but a look at the professor's triumphant and smiling face was enough. No one could swear at the professor.

We agreed to revisit the old scenes in Arizona at some early date in the future, but alas! that pleasure was not to be.

Some one described the professor as the John Bryce of Arizona. I do not agree, although I admit a resemblance. Man of letters the professor undoubtedly was, but he will be remembered not as the historian but as the great captain who more than any other man helped to make Arizona what it is. He had the gift of attracting and holding brainy men, who served him with that splendid loyalty which only the true chieftain can command.

It was an essential part of his policy that the happiest relations should be maintained between the employees and the company. He was one of the first to recognize that the interests of the employee and the interests of the employer are identical, and not in conflict, and through foul and fair weather he adhered to that principle.

He loved the West and he loved the ways of the West. In the depths of the mine, watching the development of new orebodies, or at the metallurgical plant contemplating and discussing the most recent improvements, he was in his element and at his best.

As I recall him now, with all his endearing traits of character, I feel that without him the West will never be quite the same to me. But his spirit—his broad, tolerant, and kindly spirit—will go marching on from generation to generation, making for progress and prosperity; preaching "charity to all and malice to none."

The professor has "gone West"; he has crossed the great divide, and there, let us hope that by God's kindness he found awaiting him some of the boys who had gone before—some of the boys who, true to his teaching, had given proof on the battlefield that there "are some things in this world more precious than life itself."

Protection Against Reversed Phases

If a three-phase motor is disconnected from a circuit and the phases are reversed, it will, when reconnected, run backward. Such reversal, in general routine operation, aside from the inconvenience it causes, may not be a serious matter, and the error can be corrected at the motor terminals. In other instances, however, serious consequences may result. The reversal of a hoist motor, for instance, might wreck the machinery and cause loss of life.

To protect motors against phase reversal where such protection is necessary, the Westinghouse Electric and Manufacturing Co. has developed a reverse-phase relay with positive and dependable operating characteristics. If a phase is reversed, if a phase fails, or if the voltage drops below 75% of normal, the relay contacts close and trip the circuit breaker, either through a shunt-trip coil or by short-circuiting an under-voltage trip coil having a series reverse resistor.

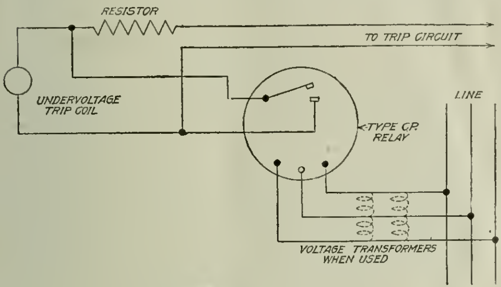


DIAGRAM OF CONNECTIONS

The relay operates on the induction principle. When properly connected, the torque holds the contacts open against the restraint of a spiral spring. On low voltage the torque diminishes and the spring closes the contacts. On reversal of the phase connections, the reversed torque assists the spring in closing the contacts.

Recognition of Technical Engineers

The following letter was recently received by the Engineering Council:

Mr. Alfred D. Flinn, Secretary, December 4, 1918.
Engineering Council,
29 West 39th St.,
New York City.

DEAR SIR:

Referring to your letter of Nov. 20th to the Director General of Railroads calling attention to wages and working conditions of civil, mechanical and electrical engineers of various ranks and their technical assistants:

This matter was taken up with the Director General, and this board has been advised that where such positions as engineers, assistant engineers, draftsmen, and other men of technical training or experience employed on the staff of the chief engineer of the valuation department or the general staff of the mechanical department are not reached by the operation of Supplements Nos. 7 and 8 to General Order No. 27, their cases should receive special treatment at the hands of the Federal managers.

If any of the employees in the service of railroads under Federal control in whom you may be interested feel that the provisions of wage orders affecting their positions are not being properly applied, it is suggested that they take their cases up with the division of labor, in accordance with the provisions of Circular No. 3, copy of which is attached for your information and guidance.

Very truly yours,
(Signed) G. H. SINES,
Chairman.

The Industrial Situation at Essen

The Essen correspondent of the Dutch journal *Yzeren Staal Kroniek* gives an interesting description of the industrial situation in his district on Nov. 17, when the armistice had been signed, which was summarized in the *Ironmonger*. Observant persons, he says, knew that the war industries could not go on much longer, but the people almost to a man were living under a spell, which was suddenly broken when the source of wealth dried up. Then came the cruel disillusion, and it needed a good many days to bring the popular mind back to an understanding of the realities. Three-quarters of our raw material came from Lorraine, which is lost, and we are dependent upon imports to a far greater extent than we were before. On the whole, the revolution took its course quietly, and very little blood was shed. The censorship has to a large extent been abolished, but it is still maintained to prevent evasions of taxes and the transfer by the rich of their capital to foreign countries. Demobilization is proceeding quietly, but in the factories the workmen are demanding and obtaining concessions such as were formerly unheard of. For instance, when a workman has an accusation to bring against a foreman the latter is called upon to justify himself in the presence of the aggrieved man, and if he cannot do so he is reprimanded or dismissed. Many of the foremen have thoroughly deserved this, for during the war workmen were not allowed to leave their places, and there have been many instances of oppression on the part of employers and foremen. The employers in the Ruhr district have now conceded a universal eight-hour day, which has already been put into practice for pitmen, furnace men, and engineers, and will be enforced all round from Dec. 1. On Saturdays the working day ends at 2 p.m. Sunday work, night work, and overtime are to be paid at extra rates.

The sale of iron and steel products for the home market has been freed from control, but all export trade remains state controlled. An extensive program of nationalization is being introduced, under which all wholesale export business, shipping communication with foreign countries, mining, and the iron industry, all factories such as locomotive-building works, which produce mainly for public purposes, and banking are to be taken over by the state. The state will also regulate shipbuilding, divide raw materials among the industries, and introduce a number of new monopolies.

Alaska Gold Mines Co.

The quarterly report of the Alaska Gold Mines Co., covering the months of July, August, and September, 1918, shows that the mine produced about 2400 tons per working day. The amount of ore milled was 218,930 tons, a decrease of 1018 tons, and caused by shortage of labor. Mill heads showed an average gold value of $1.323, an increase of $0.159 over the previous quarter. The extraction was raised from 81.96% to 82.39%. The net income from yield amounted to $1.09328 per ton, as compared with operating expenses, less miscellaneous income, $1.14802, showing a loss per ton of $0.05474, as compared with $0.04607 during the previous three months.

The mill was operated during the period on an eight-hour basis, and, together with the power equipment, was maintained in good condition despite the labor shortage. Every possible economy is being practiced, but the company is unable to operate profitably, and there seems to be no prospect of satisfactory financial results so long as present conditions continue.

Milling in Cyanide Solution*

The outstanding features of milling in cyanide may be summarized as follows:

ADVANTAGES

1. The milling and regrinding plant offers exceptional advantages for the solution of gold and silver by reason of the intimate contact betwen the metal and the solvent.

2. A saving in water consumption may be effected by milling in cyanide when the settlement of the ore is difficult; when the dewatering units are ineffective, or when the residue is being discharged at under 20% moisture.

3. A simplification of plant arrangement is possible and separate return-pumping and storage systems for solution and water are unnecessary.

DISADVANTAGES

1. Decrease in amalgamation efficiency when this recovery method is practiced; corrosion of plates, and increased consumption of mercury.

2. Higher cyanide consumption and longer time that is required to effect a lower extraction of the metal in the ore.

3. Increase in the amount of metal-bearing solution in circuit, with greater liability for mechanical loss, and proportionately higher precipitation costs per ton milled.

4. Liability of neglect in milling and grinding plant operation on account of the poisonous nature of the diluent.

APPLICABILITY

1. When no advantage, either economical, metallurgical, or chemical, arises from the use of a preliminary alkaline treatment of the ore or the water used for milling purposes.

2. When amalgamation, if adopted, would result in an inappreciable saving.

3. When it is not necessary to fine-grind or slime the ore preparatory to cyanidation, thus obtaining a product which, in residue form, usually contains more moisture than if coarser crushing, followed by leaching, had been adopted.

4. When dewatering prior to cyaniding, to within a few percentages of the amount of moisture to be discharged in the residue, is impracticable.

Probably no other chemico-metallurgical process is being operated under so many different conditions as the one dealt with in the article from which this summary has been taken; and for this reason an effort has been made to avoid dogmatic decisions. The conclusions are based on many data and observation of practical operation under a great variety of conditions, with an extensive amount of experimental research, coupled with the available information on the subject.

The necessity for the marshaling of facts and the classification of ideas on this important development is obvious. The subject of milling in cyanide is barely mentioned even in recent textbooks; and the method has often been adopted as a necessary concomitant in the utilization of a specialized process of solution recovery, and sometimes without an apparent realization of the advantages in favor of the alternative method of milling and thickening in alkaline water as a preliminary to cyanide treatment.

---

*Abstracted from an article by A. W. Allen in *Chem. & Met. Eng.*, May 15, 1918.

French Buying and Distributing Associations

The *Journal Officiel* of the French Republic has published a list of the organizations that have been formed for the purchase and distribution in France of raw materials for industrial use. All these organizations, known as groups, committees, offices (comptoirs) and associations (consortiums), are in the form of limited companies with a nominal capital, and are under government control. The following are identified with the mining and metallurgical industries:

Comité des Forges de France, Comptoir de Longwy (Ironmasters' Association).

Comptoir français de ferro-silicium (ferro-silicon).

Comptoir français de ferro-tungstène (ferro-tungsten).

Cie. des forges et aciéries électriques (electric steel makers).

Comptoir d'exportation des products métallurgiques (metallurgical products).

Consortium des marchands de fer (iron merchants).

Société minerais et métaux (ores and metals).

Société aluminium français.

Société le nickel.

Groupement des consommateurs de mineral de manganése.

Comptoir d'achat des tréfileurs de France (wire makers).

Comptoir d'achat des étireurs de France (wire drawers).

Comptoir de répartition des tubes (tubes).

Groupement des étireurs de tubes d'acier (steel tubes).

Comptoir des tubes pour airons (aircraft tubes).

Groupement des importateurs d'amiante (asbestos).

The German Potash Industry

The manager of the German potash syndicate recently reported that the deliveries in the first eight months of 1918 amounted to 810,000 tons of pure potash, of the value of £10,550,000. It was impossible to give a forecast as to the total turnover for the year, as the deliveries depend upon the condition of the railway transport services, which was excellent to the middle of August. The demand for potash salts by agriculturists continued to be exceptionally large, and, despite all difficulties, producers were able to supply considerably more than the requirements in peace times.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Revenue Bill Amended

In the opinion of the majority of the members of the Finance Committee, the Senate has amended the Revenue Bill so as to remove injustices exemplified by the effect the bill, as passed by the House, would have had on such an operation as that of the New Cornelia Copper Co. Gordon R. Campbell, secretary of the Calumet & Arizona Mining Co., sets forth the New Cornelia case in a letter to the Finance Committee, which reads as follows:

On examination of House Bill 12,863, Report No. 617 of the Committee on Finance, being "An act to provide revenue, and for other purposes," I call your attention to Section 311, covering the war-profits credit.

Section (a) gives to old corporations a credit equal to the average net income of the corporation for the pre-war period. But if the corporation had no income for the pre-war period, this credit is limited by section (b) to 10%, and if it is a new corporation not in existence during the pre-war period it is placed upon the same basis as corporations having pre-war income and is allowed a credit of the same percentage as corporations having pre-war income.

There are many mining companies that were organized long before the pre-war period which had no earnings whatever during the pre-war period, but were prospecting and developing their properties and preparing for the time when there might be some income. Such corporations are placed at an undue disadvantage over old corporations and are not allowed a credit which other corporations in like business are allowed before assessing a war tax.

For a concrete example use our New Cornelia Copper Co., which was organized in 1909 as a successor to several corporations which had been developing a copper property in Arizona prior to that time. The new corporation continued to develop the property from its organization, but had no income during the pre-war period and was not a producer of copper during that period. Later developments both on the property, orebodies, and in the method of treatment of ores since that time have developed a very valuable mine. As a matter of fact, it is the only new producer of copper in the years 1917 and 1918, or during the period since the United States entered the war, to add a considerable tonnage to the supply of copper. It began production on a considerable scale in June, 1917, and since that time has produced about 70,000,000 lb. of copper.

Under Section 311 other copper-producing companies will be allowed from 50 to 200% credit before the war tax can attach; in other words, they will pay an excess-profits tax but no war tax. These companies also had the benefit of the high prices of copper prior to the entrance of the United States into the war and prior to the time when the price of copper was fixed at 23½c. a pound.

This new company has sold all the copper which it produced at the price fixed by the Government, and has no war profits; yet on account of the wording of the act it would seem that it would be compelled to pay a war-profits tax of 80%, and if forced to pay such a tax at the present time, it would be practically thrown into bankruptcy, as its income of the past year has been barely sufficient to pay the debts incurred to enable it to become a producer.

Is there any reason why corporations having no pre-war earnings should not be placed in the same class as corporations not in existence for at least a whole year during the pre-war period?

I suggest the elimination of paragraph (b) of Section 311 and the amendment of paragraph (c) to read substantially as follows:

"If the corporation had no net income for the pre-war period, then the war-profits credit shall be the sum of one and two."

This would place old corporations having no pre-war earnings and new corporations, which, of course, could have no pre-war earnings, in the same class, and place them on an equality with old corporations having pre-war earnings.

I believe that you will see the justice of this and sincerely hope that you will use your best efforts to secure the amendment of the bill accordingly.

I also desire to register a protest against those provisions of the act which extend these taxes through years subsequent to 1918.

It is believed that the New Cornelia example is typical of many mining operations. As amended by the Senate, Sections 327 and 328 read as follows:

Sec. 327. That in the following cases the tax shall be determined as provided in Section 328:

(a) Where the commissioner is unable satisfactorily to determine the invested capital as provided in Section 326;

(b) In the case of a foreign corporation;

(c) Where a mixed aggregate of tangible property and intangible property has been paid in for stock or for stock and bonds and the commissioner is unable satisfactorily to determine the respective values of the several classes of property at the time of payment, or to distinguish the classes of property paid in for stocks and for bonds, respectively;

(d) Where, as compared with representative corporations, engaged in a like or similar trade or business, the taxpayer would (under Section 326) be placed in a position of substantial inequality, because of the time or manner of organization, or because the actual value of the assets on Mar. 1, 1913, was substantially in excess of the amount at which such assets would be valued for the purpose of computing invested capital under the provisions of Section 326;

(e) Where the invested capital is materially disproportionate to the net income as compared with representative corporations engaged in a like or similar trade or business because:

1. The capital employed, although a material income-producing factor, is very small or is in large part borrowed;

2. There are excluded from the invested capital as computed under the provisions of Section 326, intangible assets of recognized and substantial value built up or developed by the taxpayer;

3. The net income for the taxable year is abnormally high due to the realization in one year of (a) gains, profits, or income earned or accrued during a period of years or (b) extraordinary gains or profit derived from the sale of property the principal value of which has been demonstrated by prospecting or exploration and discovery work done by the taxpayer. When the tax is determined under this paragraph proper allowance shall be made for the taxes which would have been payable in prior years if the gains, profits, or income earned or accrued in such years had been taxed at the rates then applicable;

4. Proper recognition or allowance can not be made for amortization, obsolescence, or exceptional depletion due to the present war, or to the necessity in connection with the present war of providing plant which will not be wanted for the purpose of the trade or business after the termination of the war.

Sec. 328. (a) In the cases specified in Section 327 the tax shall be the amount which bears the same ratio to the net income of the taxpayer (in excess of the specific exemption of $3000) for the taxable year, as the average tax of representative corporations engaged in a like or similar trade or business, bears to their average net income (in excess of the specific exemption of $3000) for such year. In such cases the commissioner shall compare the taxpayer only with representative corporations whose invested capital can be satisfactorily determined under Section 326 and which are, as nearly as may be, similarly circumstanced with respect to gross income, net income, profits per unit of business transacted and capital employed, the amount and rate of war profits or excess profits, and all other relevant facts and circumstances.

(b) For the purposes of subdivision (a) the ratios between the average tax and the average net income of representative corporations shall be determined by the commissioner in accordance with regulations prescribed by him with the approval of the Secretary.

(c) The commissioner shall keep a record of all cases in which the tax is determined in the manner prescribed in subdivision (a), containing the name and address of each taxpayer, the business in which engaged, the amount of invested capital and net income shown by the return, and the amount of invested capital as determined under such section. The commissioner shall furnish a copy of such record and other detailed information with respect to such cases when required by resolution of either House of Congress, without regard to the restrictions contained in Section 257.

Repeal of the arsenic rules and regulations has been announced by the division of collateral commodities of the U. S. Food Administration.

Tin Export Restrictions Removed

The War Trade Board announced on Dec. 23 that restrictions on the exportation of tin and tin plate had been removed, as the necessity for strict conservation of tin and its products no longer existed. Applicants were told that if they would refile applications for which licenses had been refused, these would be given immediate consideration.

Industrial Situation in Belgium

H. C. Hoover has just completed a survey of the entire Belgian situation as disclosed by the evacuation, and has made the following report:

> Prior to the armistice the German army had completely destroyed a zone of railroads and canals some 20 miles wide, extending across Belgium. After the armistice there was comparatively little destruction of transportation to the rear of this zone, and with the rapid rehabilitation of transportation facilities across this zone of destruction the problem of distribution of food and of reconstruction can be undertaken with much less difficulty than at present.
>
> The Germans in their final retreat removed but little of the relief supplies. Their action toward the native harvests and cattle in their withdrawal differs widely in different areas. They started to take all remaining hogs from the western part of Belgium, except those hidden by the peasants in underground caves. After the armistice, however, and with the demoralization of the German army in its final retreat, many of these beasts were abandoned or sold by soldiers to the peasants further back, and in practical results there appears to have been no widespread cattle stealing in the retreat, although during the four years of occupation there has been a great diminution—probably more than one-half—in the total number of cattle and hogs. It can be said almost literally that horses have disappeared out of Belgium, there probably not being 15% of the original animals left.
>
> Investigation proves that industrial and residential destruction in Belgium varies greatly in different localities, and with different industries. For instance, out of the steel furnaces in Belgium 35 or 10 have been deliberately destroyed by the Germans in their determination to end the Belgian steel industry. Many of the textile mills have been put out of commission, either through deliberate destruction and removal of machinery, or by removal of the copper and brass parts and electric motors. Some of the textile mills of the more antiquated type of equipment apparently did not appeal to the Germans, and they can be gotten into action at an early date. The Germans seem to have focused themselves on the modern equipments.
>
> The glass industry has been but little interfered with, and the stern promise of retribution by President Wilson seems to have saved the coal industry except for very few mines, although actual explosives and wires were laid in place for the destruction of a large number of mines. The President's warning seems to have created a sudden change of heart.

New Research Bill Drafted

WASHINGTON CORRESPONDENCE

A substitute for the Smith-Howard Bill has been prepared by the National Research Council. The intent of the substitute bill is the same as that of the Smith-Howard measure, namely, "To establish engineering experiment stations in the states, territories, and the District of Columbia in connection with state-supported universities or engineering schools for the promotion of engineering and industrial research as a measure of industrial, military, and naval preparedness in times of peace or war."

From such discussion as has been had, it is apparent that a bill giving the central powers to the National Research Council would receive the support of most of those interested. The National Research Council's substitute recognizes Federal aid as desirable to scientific and industrial research. It provides for state scientific commissions appointed by the respective governors. The commission is to be composed of at least five eminent scientific men. They are to serve without salary. They shall designate the institutions which are to participate in the fund. These commissions each year are to pass on the applications for aid and are to prepare a budget covering the cost of approved research.

In Washington most interested persons believe that Government bureau initiation and control of research is not desirable. The author of the Smith-Howard Bill is Phineas V. Stephens, of New York. K. G. Matheson, president of the Georgia School of Technology, is understood to have coöperated closely in the matter.

Explosives Handled Carelessly

WASHINGTON CORRESPONDENCE

Supervision of the handling, care, and storage of explosives during the war has revealed that there is widespread disregard for safety in handling of these materials. As a result, the U. S. Bureau of Mines, in withdrawing its estimate for explosives work, which was made before the armistice, has let it be known that another estimate will be substituted, so as to permit of a Federal inspection service, to be conducted in coöperation with the state services.

Experiments are already in progress at the Bureau's laboratories in an attempt to evolve the best methods for converting military explosives into explosives which can be used in works of peace. Means already have been devised whereby T.N.T. can be used in making the flameless explosive adapted to use in coal mines.

The cessation of munitions shipments found 55,000,000 lb. of T.N.T. in the Government's hands. It is believed that this material will stand storage for 15 years. Permanent storage is available, however, for only 38,000,000 lb. It is believed that the remainder can be converted into forms which will permit its prompt use in public works and other Government activities.

Permission has been granted by the Interstate Commerce Commission to the Long Island R.R. to establish rates dependent upon the value of the following commodities, refined in transit at Laurel Hill, N. Y.: Copper anodes, bars, bullion, cakes, cathodes, ingots, matte, ore, slabs, and lead bullion.

Denain & Anzin Steel Works, France—The *Ironmonger* gives some details of the destruction of the steelworks of the Denain & Anzin company, at Denain, by the Germans, which shows how they did their dirty work. It appears that the plant was closed for want of material and labor on Sept. 15, 1914, soon after the Germans entered the place. The manager was repeatedly requested to reopen it for the manufacture of German war material, but he refused, and toward the end of the year the Germans sent down Captain Bocking, a prominent German ironmaster, to take possession. After making an inventory, Bocking called in German workmen, assisted by 3000 Russian prisoners, and proceeded to strip the place, all the plant being sent to German competitors of the company, whose addresses are known. After this another German called Dreyer, who before the war had been employed by the French Homécourt steel works, was sent to pull down the principal buildings, the remainder being blown up, with the exception of a few sheds which were used as warehouses by the Germans until they were ejected from Denain, when they set them on fire.

Braden Men Aid Comfort Fund

Again it is possible to announce the receipt of a generous contribution to the 27th Engineers' Comfort Fund from South America. The staff at El Teniente mine of the Braden Copper Co. had the mining regiment on its Christmas list, and, just before the holiday, wired the fund the sum of $450 with the best Christmas wishes of the donors. The latter were: James Chambers, E. J. Craig, R. E. Douglass, Alma Ek, Horace R. Graham, L. E. Grant, H. W. Jones, A. J. Noerager, J. F. Pearce and W. W. Stevens. Men at the company's plant contributed $21 more. Thus the Comfort Fund is carried well along toward its goal of $20,000.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$18,492.77
C. M. Eye	10.00
C. A. Burdick	5.00
Mining and Metals Section, National Safety Council	125.00
John Herman	10.00
Lane Pearl	5.00
W. L. Gibson	5.00
C. M. Fenton	10.00
Charles Le Vasseur (monthly)	5.00
B. N. Jackson	10.00
H. A. Johann	10.00
Mrs. A. B. Emery, Messina, Transvaal	10.50
A. C. Stoddard	5.00
Robert E. Tally	25.00
Nelson P. Hulst	20.00
Lawrence Addicks	20.00
B. R. Boyd	25.00
E. R. Varela	5.00
W. J. Olcott	25.00
J. E. Clennell	10.00
C. M. Eye (monthly)	10.00
A. H. Hoffman	10.00
Francis Drake	25.00
Employees of Sociedad Minera Backus y Johnston del Peru	176.29
Charles Le Vasseur (monthly)	5.00
E. Wartenweiler	10.00
Walter Douglas	100.00
Robert E. Dye	10.00
R. T. Hancock	2.00
El Teniente Staff, Braden Copper Co.	450.00
Employees, Braden Copper Co.'s plant	21.00
Total	$19,653.56

Friends are urged to help the Comfort Fund make a strong finish. All checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Priority List of Engineer Units

The War Department has announced that the following engineer units have been placed on the priority list for orders to return to this country:

The 40th Engineers, placed on priority Dec. 4. 33 officers, 623 men; 109th Engineers, sappers, placed on priority Nov. 26; 311th Engineers and engineer train, placed on priority Nov. 29, 57 officers, 1685 men; 312th Engineers, placed on priority Nov. 26; Headquarters, 24 officers and 29 men; Headquarters Co., 2 officers and 156 men; Co. A, 3 officers and 224 men; Co. B, 5 officers and 221 men; Co. C, 5 officers and 217 men; Headquarters detachment, 1 officer and 3 men; Co. 1. 4 officers and 245 men; Co. E, 6 officers and 237 men; Co. F, 5 officers and 241 men; 312th Engineers, 2 officers and 74 men; 319th Engineers and train, placed on priority Dec. 4. 4 officers and 217 men; Co. E, 4 officers and 222 men; Engineer casual Co. No. 1, placed on priority Dec. 4, 2 officers and 223 men; 2nd Engineers, placed on priority Dec. 6, Co.'s F, I, K, and medical detachment, 7 officers and 760 men; Co.'s D, E, G, and H, 35 officers and 1000 men; 26th Engineers, placed on priority Dec. 17; Co. A, 8 officers and 253 men; Co. B, 2 officers and 231 men; 27th Engineers, placed on priority Dec. 16, 46 officers and 1400 men; 29th Engineers, placed on priority Dec. 12; Headquarters and detachment, 2 officers and 8 men; Co. B, 14 officers and 238 men; Co. C, 11 officers and 185 men; Co. B, 8 officers and 83 men; Co. E, 14 officers and 119 men; Attached, 3 officers and 18 men; Co. F and detachment, 24 officers and 408 men; Engineer casual Co No. 1, placed on priority Dec. 4, 2 officers and 223 men; 317th Engineers, placed on priority Dec. 4, cancelled Dec. 16.

It was stated that the units generally arrive in this country from four to six weeks after being placed on priority list.

December Mining Dividends

December dividends by 39 United States mining and metallurgical companies totalled 20,709,125, as compared with disbursements of $29,004,548 by 43 companies in December, 1917. The Yukon Alaska Trust made its usual quarterly payment of $203,433. Canadian and South American companies paid $2,144,040 in 1918 and $1,530,734 in December, 1917.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$2 00	400,000
Allouez, c	Mich.	1 50	150,000
Am. Sm. and Ref., com	U. S.-Mex.	1 50	914,970
Am. Sm. and Ref., pfd	U. S.-Mex.	1 75	875,000
Argonaut, g	Calif.	.05	10,000
Atolia, tung	Calif.	.50	50,000
Bingham Mines, c	Utah	.50	(a) 75,000
Caledonia, l.s	Ida.	.03	78,150
Calumet & Ariz., c	Ariz.	2 00	1,284,960
Calumet & Hecla, c	Mich.	15.00	1,500,000
Centennial, c	Mich.	1 00	90,000
Chino, c	N. M.	1.00	869,980
Columbus-Rexall	Utah	.02½	14,659
Cresson Cons., g	Colo.	10	122,000
Cons. Ariz. Sm., c	Ariz.	.05	83,150
Copper Range, c	Mich.	1.50	594,598
Davis Daly, c	Mont.	.25	150,000
East Butte, c	Mont.	1.50	631,097
Federal Min & Sm., pfd	U. S.	1.75	209,757
Golden Cycle, g	Colo.	.03	45,000
Grand Central	Utah	.03	18,000
Hecla, l.s.	Ida.	15	150,000
Homestake, g	S. D.	50	125,580
Horn Silver, s.l.z.c.	Utah	.05	20,000
Internat. Nickel	U. S.-Can.	1.00	1,673,384
Iron Cap, c	Ariz.	.25	36,225
Isle Royale, c	Mich.	.50	75,000
Kennecott, c		1.00	2,786,953
Nevada Con., c	Nev.	.75	1,499,593
Old Dominion, c	Ariz.	1 00	297,071
Osceola, c	Mich.	2.00	192,300
Quincy, c	Mich.	2.00	220,000
Ray Con., c	Ariz.	75	1,182,384
St. Joseph Lead	Mo.	.50	704,733
Tom Reed, g	Ariz.	.02	18,191
United Eastern, g	Ariz.	.07	95,410
Utah Con., c	Utah	.25	75,000
Utah Copper	Utah	2.00	3,248,980
Western Dev., l.s	Colo.	.50	25,000
Yellow Pine, l.s.z	Nev.	.12	120,000

(a) Payable in 4¼% Liberty Bonds.

Canadian, South American Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	$1.25	1,122,780
Hedley, g	B. C.	15	18,000
Hollinger, g	Ont.	.10	492,000
Kerr Lake, s	Ont.	25	150,000
Lake Shore Mines, s.g.	Ont.	02½	50,000
Min. Corpn. of Can., s	Ont.	18¾	311,260

The total paid by United States mining and metallurgical companies in 1918 was $165,134,997; by Canadian, Mexican, Central and South American mines, $23,548,294; and by holding companies, $2,101,871.

A full review of the year's dividends will appear later. As this will be made up from revised returns, there will be some changes in the totals as here given.

Germany's Industrial Future

Dr. Walter Rathenau, head of the German General Electric Co., one of the largest employers of labor in Germany, recently said:

"Germany is ruined for generations to come. It is the greatest calamity that has happened in any country for 2000 years. We are ruined politically, industrially, and economically.

"All our people here do not yet know the truth. I told the German people that they would lose the war, but everybody scoffed at me.

"We have a population of nearly 70,000,000. Half of them can live on what grows on our soil or is found below it. The other half live on the industries for which all materials have to be bought and paid for by what they sell.

"Now our colonies are going; and Alsace-Lorraine,

DINNER OF THE ROCKY MOUNTAIN CLUB TO SOLDIERS AND SAILORS AT THE HOTEL ASTOR, CHRISTMAS, 1918 too, with all the ores and the greater part of the potash production. There is danger of losing other parts of our country, the Danish and so-called Polish districts, which in reality are German.

"Then comes the question of indemnities. If the indemnities are high, the interest and repayments will take our savings, and we shall have nothing with which to expand our industries. Black ruin will face us, and there will be a great tide of emigration, probably to South America and the Far East and certainly to Russia. It will be most dreadful, and the result will be the Balkanization of Europe.

"The disappearance of Germany from a position of importance will be the most dangerous fact in history. Sooner or later the Eastern powers will press on the Western civilization.

"Germany has been hungry for three years, but it is not yet starving. Everybody who sees Germany will say that she is not starving now, and that is perfectly true. But if you talk of provisions to be found in Germany, you must say truthfully that they will be exhausted in two months; and if you wait until then to send food, it will be too late, because 70,000,000 people cannot be fed as easily as, say, 7,000,000 Belgians. Ships are the greatest factor in feeding Germany."

Dr. Rathenau said that he had seen the damage done in Belgium and Northern France, and his estimate of the indemnity payable for this was £1,000,000,000. That sum would, if anything, be excessive.

The Rocky Mountain Club's Dinner*

Two hundred convalescent wounded soldiers will start back into the West today, whence they came something like a year or more ago to demonstrate in France what an easy job it would be for a Pacific Coast or Rocky Mountain type of scrapper to finish off the world war and get the boys out of the trenches for Christmas. Up to yesterday each of the men with a wound stripe thought the war and his experience quite the dominant thing, and there was many a thrilling story all ready to take the lead in the first conversation back home.

The war won't figure so prominently now, for the wounded 200—and several hundreds of other soldiers and sailors—dropped in at the Astor Hotel yesterday and met the members of the Rocky Mountain Club, men who all have a reputation for having done big things out in that part of the country from which the Sunset Division came.

FED 800 SOLDIERS LAST YEAR

So when the division came East on its way to France last year, the Rocky Mountain Club members took them in hand on Christmas Day and filled them up with turkey and the kind of real Christmas cheer they would have had back home. The Rocky Mountaineers called it the Partition of Turkey at Yuletide, and the 800 of the Sunset Division men and the club members present promised there would be a Christmas feast for Western men in olive drab every Christmas while the war was on.

Yesterday's dinner was larger in attendance by a thumping half. The club had announced that a thousand would be there. The *Sun* man carefully estimated between 1200 and 1300, and you would have needed a shoehorn to admit another man. Five hundred in khaki had been invited through Secretary Baker. Three hundred and fifty gobs had received their bids by way of Secretary Daniels. British Consul-General Bayley, who sat at the table of honor and made a speech, had collected, by request, about 150 Canadians and Australians around town. From the "Marseillaise" lying in the harbor came two tables of French bluejackets.

"This isn't enough," thundered John C. Montgomery, master of ceremonies, to his aids. "Go on out and round up some more." So they went out and they rounded up more, and if anybody rounded up made a fight to stay away, nobody heard about it.

They had oysters and turkey and all that, as much of it as they could eat. They were entertained with a cabaret procured from two or three theatres. The cabaret held forth from the dais at the end of the grand ballroom, but now and then trickled down among the tables.

The toasts were in bottled sweet cider, with a wicked hint on the souvenir menu that the club was doing its best for good cheer, but the boys probably would have to wait till they got home to some dry state in the West, like Montana. The club president, John Hays Hammond, had sent an appropriate greeting to the guests. It was printed in the menu leaflet, along with this poem from Mountaineer Senator Bert M. Fernald, of Maine. He wrote it, too:

Soldiers all, a royal welcome
  To the land you love so well;
You have captured Bill the Kaiser,
  You have licked his Huns like Hell!
We're indebted for your valor,
  For the bravery you have shown,
You have fought a hero's battle,
  You shall wear a hero's crown.
Saddened memories will linger
  Of those fallen in the fray,
Happy, cordial, Christmas Greetings
  To you from old U. S. A.

Hail, O hail, ye valiant Sailors!
  Following Uncle Sam's advice
You have whipped the German Army,
  Put old Kaiser Bill on ice.
All the nation joins in welcome,
  All the people now are glad,
We'll remember in the future
  Every husky Sailor lad.

Secretary Baker had delegated his task of providing some guests to General Somebody, who has passed it along to Colonel Somebody Else, and so on till they put it up to Capt. R. A. Flood, at Camp Merritt, and he brought in 200 convalescent wounded from overseas, on condition that he could have 'em back to entrain for the camp at 8:30 and for their homes in the West tomorrow morning. So, after dinner the U. S. S. "Columbia's" jazz band officiated, and the cabaret furnished dancing partners to while away the afternoon.

The gobs and their officers present were from the transport and cruiser service, from the destroyers, and from the "George Washington" and the "Manchuria" in particular.

The Governors of all the Rocky Mountain states are men of might in the club. They all sent messages, and most of them added contributions, just to be sure the turkey went around.

---

*From the New York Sun, Dec. 26, 1918.

Editorials

Differences in Economic Opinion

STUDENTS of economics and finance cannot fail to have noticed the fundamental differences in opinions that are expressed by the two great financial organizations of New York—the National City Bank and the Guaranty Trust Co. The former has steadily, during the period of the war, warned against the danger of inflation and has consistently advised measures to avert it. The Guaranty Trust Co., on the other hand, has denied that there has been any inflation and has rather implied that it would not have been a bad thing if there had been a little.

These different views revert to a fundamental difference in economic doctrines respecting money. Mr. Vanderlip holds firmly to the quantitative theory of money. Owing to what follows from that theory and what he considers to be the recent, and still existing, state of inflation, he is of the opinion that readjustment in prices will be delayed and that a high range of prices is to be expected for a long time to come. Indeed, in a recent address he expressed himself very optimistically in this respect.

Mr. Sabin, on the other hand, views "the critical transition period now upon us" with grave concern, and considers that "we face the problem of adjusting a tremendously stimulated production to a decreasing market, and must not forget that if we are to compete successfully with the rest of the world we cannot load our production with excessive costs."

Both of these great financial organizations issue periodical publications to which their officers, economists and statisticians contribute. The difference in the thought that has been running through the respective publications for a long time has been both interesting and stimulating. Even so abstruse a subject as the quantitative theory of money has its practical bearings. In fact, the practical bearings are manifold and of fundamental importance in determining the financial policies and the welfare of nations.

La Ingenieria Internacional

REALIZING the value of the international exchange of ideas on things engineering, the McGraw-Hill Co. on Mar. 1 will begin publication of a magazine dedicated to that purpose. While eventually it is expected to appear in editions in several languages, the original issue will be in Spanish, under the name *La Ingenieria Internacional*, and to serve Latin-America and Spain.

The purpose of the new magazine, which has been under consideration for some years, is to afford a medium for the presentation of those developments in American engineering which may be of value to engineers, contractors, and manufacturers in other lands. At the same time, following the practice of the present McGraw-Hill publications, a far-flung editorial organization will be developed, so that there will be drawn into the paper the best of engineering practice in Latin-America, Spain, and other Spanish-speaking countries. Aside from this function, the new magazine will be an important developer of international good will, and at the same time a medium by which American manufacturers engaging in export trade can carry their message to prospective buyers in foreign lands.

It may be a cause of surprise that the McGraw-Hill Co., whose specialized papers circulate so widely overseas, should establish a magazine to serve the foreign field. The reason, however, is not hard to find. The present highly specialized papers appeal only to those who are situated where engineering enterprise has made such progress that there is room for the specialist and need for the best refinement in equipment and design. But everywhere the world over are territories newly developing, where the engineer, the contractor, and the manufacturer must turn his hand to many lines. It is to serve the general practitioner so situated that the new magazine, and its later companions in other languages, will be started. The specialized papers in English will still hold their place as the recorders of the best in the advanced practice of American engineering.

Work of the Bureau of Mines

A SUMMARY of the work of the Bureau of Mines was given in the *Journal* of Dec. 21, as taken from the director's report for the year ended June 30, 1918. This report, although quite voluminous, is quite disappointing, in that it does not tell what was really accomplished during the year. As explained by the director, by far the larger fraction of the Bureau's work was done for or in connection with various departments, war boards, and war activities, and at the time of editing it was naturally inexpedient to state publicly its accomplishments in detail.

Perhaps the most useful work accomplished was that of assisting the Army in equipping itself with means to withstand gas attacks and in the development of means for offensive gas and fume attacks, all of which the Bureau was in a position to do because of the large staff of employees who had been studying ways and means of preserving life in the presence of toxic gases. If the Bureau had had no other accomplishments to its credit during the year, this alone would have been ample reason for its existence.

The various publications of the year covered a wide range of usefulness, and much was accomplished that it would be impossible or impracticable for private industry to have attempted. The work planned and started, though yet unfinished, covers even a wider field, and it is questionable if the Bureau is not beginning to do or trying to do some of these things that had better be left to private endeavor. We refer particularly to milling and metallurgical problems respecting the common or much-used metals. So much of this work has been undertaken, and so few results have been published, that it may not yet be time to criticise this work either favorably or unfavorably, and yet we cannot help but feel that special problems which have already been attacked by private individuals or companies should not in general be taken up by the Bureau. When the Bureau can only follow, summarizing or confirming the work of others in the development of purely commercial processes, we believe that it goes outside of the useful field. Where it can lead the way, by investigating or developing methods that are beyond the means of private capital, or methods that have no immediate commercial value but may be of value in years to come, these certainly constitute a proper field for its activities.

Concentration and the metallurgy of the common metals are subjects that should be left largely to the private practitioner. The recovery and use of the rare or uncommon metals, as, for example, radium, might well be taken up by the Bureau. In this we do not mean to criticise the Bureau for what it has done, but rather to criticise the judgment of those who authorized and instructed the Bureau to conduct specific experiments that should have been left to the laboratories of private engineers and should have been paid for by those who were to benefit, and not by the Government. It is quite proper for the State of Minnesota to establish an experimental station for the study of iron ores. That state is the owner of large tracts of uncommercial iron ore and is financially and directly interested in converting those ores into a commercial product. It does not follow, however, that our Government should spend the public moneys in developing the private resources of the State of Minnesota or those lands held privately. There may be need of a public testing plant in Minnesota, but for the present private endeavor is quite capable of placing on the market a very large amount of ore at reasonable figures, and the public is not suffering from a lack of iron ore that any effort of the Government can relieve.

We are only too happy to credit the Bureau of Mines with all of the splendid work that it has done, but in giving that praise we do not wish the Bureau to think that we have no real criticism to offer of what it has not accomplished.

We cannot help but feel that a part of the present unfortunate manganese - chromium - sulphur situation should have been foreseen and to a certain extent forestalled by the Bureau. In his report the director states specifically that the sources for the production of these substances had been most thoroughly examined before June 30, 1918, by which time the war demands were also fully known. If the Bureau had all of this information, some one is certainly to blame for not having made it public, for not having taken precautions against overproduction of an unmarketable material—for not having prepared to handle the situation on the suspension of hostilities.

We hope that the Bureau did pass its information on to less capable but more authoritative powers. It and the Survey are nevertheless receiving a great portion of the blame from those who have stocks of unsalable ore on hand, from men who were urged by "Government representatives" to get out every pound of ore that they could. In the days not far ahead, when appropriations are being asked for, some miners are going to remember that they were "stung" through the representatives of the Interior Department, whether that memory is deserved or not.

We trust that in the near future the Bureau may find it opportune to publish what it really did do in the great war work—what information it gathered and distributed. It may be late for general public utility, but we believe it will appear greatly to the credit of the Bureau.

No Work, No Food and No Fuel

IT WAS a foreign diplomat who aptly characterized the Bolshevik principles as "high wages for no work. the taking of others' property without punishment, and no taxation."

But the above principles, simple as they appear, have not been found to work satisfactorily in practice. The Russian workmen, who have tried them, complain that although everything now belongs to them, they are unable to get a living.

They have robbed the thrifty and well-to-do and have turned them out of their dwellings. But the workmen—or should we say the ex-workmen—do not find it so satisfactory to occupy a palace while starving and freezing as they did when they lived in huts and tenements and had enough to eat and keep reasonably warm.

Standardized Methods

THE *Journal* has been particularly fortunate in securing the series of articles, "Standardization of Mining Methods," by Charles A. Mitke, of the Phelps Dodge Corporation. Though this title may be somewhat formal, suggesting that the papers are written for the eyes of managers and efficiency engineers, our readers will soon find that Mr. Mitke has merely stated the proper way of doing things around a mine, in language that may be understood by every one on the property, from mucker to manager, and, if there is a proper way, it may be appropriately called the standard method for that mine.

The aim of the technical press is, naturally, the dissemination of technical information, which includes details concerning the right way of doing things, both great and small, and the larger the number of readers that may be reached, the more useful the publication. Bearing this in mind, it has been the hope of the *Journal* that it might reach not only the manager and superintendent, but that it might be as useful to the foreman, the shift boss, and the laborer.

In the present day of high costs, it is the duty of every man on the job to do his utmost to keep those costs from mounting ever higher; it is his duty to absorb all the information available bearing on his particular field; to educate himself and to become efficient. The engineer must follow closely all established rules and examine every new suggestion, that he may use his energy and knowledge to the best advantage; the foreman that he may use his tools and men in the most efficient manner; the miner and the prospector that they may accomplish the greatest amount of work with the least expenditure of energy; and all of them that they may do their work in the most sane, safe, and healthful manner.

Some wise heads may say that there is little which is absolutely new in these papers. Perhaps so; but neither is there anything new in the dictionary, and that is a very useful publication, though unfortunately it does not possess the merit of being readable.

The articles which Mr. Mitke has contributed cover completely the fields of which they treat, and in a manner that makes them good reading for all classes of workers. We know this because of the numerous letters of appreciation that have reached our desk. The requests for extra copies of the *Journal* containing these articles have been so numerous that it has been decided to publish them in pamphlet form.

We wish to hear from mining companies who need men, both mining engineers and miners, and would like to have the names and addresses of those who are retiring from service in the Army and Navy. We are keeping files of concerns that want men and men that want places, and shall do our best to match the two wants in the interest of both parties. We urge mining companies especially to communicate with us if they need either miners or engineers.

The Rocky Mountain Club naturally would not say anything about this itself, but we think that it has great reason to be proud of itself for the good work that it does in giving a Christmas dinner to the soldiers and sailors and the fine way in which it does it. The Christmas dinner for 1200 soldiers and sailors in the Hotel Astor last week, to which were invited men from all branches of the services, besides the British, Canadian, Australian, French, and whatever other Allies happened to be in New York, was a very excellent dinner. Everything about it was lavish. This refers not only to the food, but also to the entertainment. When the Rocky Mountain Club does anything of this sort, it makes a thoroughly good job of it.

BY THE WAY

Every member of the 11th Regiment, Engineers, recruited chiefly in New York, has been cited for gallantry while brigaded with British troops in the fighting at Cambrai, according to a letter received at the headquarters of the Association of the 11th Engineers from Col. William Barclay Parsons, the regimental commander, now in France. The 11th Engineers, which is a railway regiment, was one of the first to go over to France, it having embarked before the middle of 1917. It was in this that Irving was a captain.

One winter night in 1874, runs Dan De Quille's "Big Bonanza," some of the residents of Virginia City were startled by seeing what seemed a column of flame 50 or 60 ft. high shooting up from the mouth of an old shaft near the old upper works of the Ophir company. On reaching the spot, they found that there was no smell of smoke and that the supposed fire was a weirdly white light in which the faces of all were of a corpse-like pallor. The light resembled one of the shooting spires of the aurora borealis, with some of the same waving and inconstant motion. On gazing down the shaft the interior was seen to glow like a furnace at white heat. The timbers were particularly brilliant. Each splinter or bit of fungus seemed darting dazzling rays that streamed steadily in all directions. The phenomenon lasted over half an hour, and was undoubtedly caused by the belching forth of a highly phosphorated gas from the abandoned works.

Travelers and refugees just out of Russia tell weird tales of the business methods of the Bolsheviki, says the *Evening Post*. A man who knows the big Russian banks intimately says that the bank clerks were regarded with suspicion, as possibly members of the bourgeoise class; hence their wages were cut to the level of the street cleaners, honest men who pushed a broom instead of a pen. Thereupon they quit. So barbers, porters, and other miscellaneous folk were introduced, whose main principle seemed to be the elimination of the ancient axiom that account books should "balance." The bank ledgers, said this observer, will never balance again.

The medical correspondent of the London *Times* says that it seems reasonable to believe that throughout the world about 6,000,000 persons perished from influenza and pneumonia during the last three months. It has been estimated that the war caused the death of 20,000,000 persons in four and a half years. Thus, the correspondent points out, influenza has proved itself five times deadlier than war, because in the same period, at its epidemic rate, influenza would have killed 100,000,000. Never since the Black Death has such a plague swept over the world, he says, adding that the need of a new survey of public health measures has never been more forcibly illustrated.

In the days of Porfirio Diaz, many Americans heeded the invitation extended still earlier by Benito Juarez and others to "come and help Mexico develop her resources," or words to that effect. The chances of fair treatment seeming good, one A. R. Shepherd (often known as "Boss Shepherd") took up a little concession of about 61 square miles in the Batopilas mining district, in the State of Chihuahua. The boss stuck rather close to the job, while his first mine was in the making, and, like many a good handler of labor, acquired something of a reputation for proficiency in monologue of the kind that tends to spur industrial effort, but is a little out of place in refined circles. However, it is said that in his home life Shepherd was religious to the point of punctiliousness in such matters as the observance of grace at meals. One Sunday, after a strenuous week in getting the little mill running smoothly, he sat down for a quiet home dinner. With bowed head he asked that the food be duly blessed, getting along nicely in the humble prayer, and with every prospect of success in said concession, when suddenly he detected some interruption of the rhythmic dropping of the stamps. After a brief listening pause, during which machinery matters seemed to be going from bad to worse, he suddenly ejaculated "Now, what in hell is the matter with that —— —— —— of a mill?" During the awkward silence which ensued, the foreman must have detected the trouble, for the battery resumed its former tune, as Shepherd continued, "and for thy blessed grace and loving-kindness we humbly thank Thee, O Lord, Amen."

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons ar furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittance are made in even dollars, we will return the excess over an order in coupons if so requested.

COPPER

10235—ALLOYS—Pure Carbon-Free Manganese and Manganese Copper. Arthur F. Braid. (Bull. 143, A. I. M. E., Nov., 1918; 2 pp.) 40c.

10236—ANALYSIS—The Spectroscopic Determination of Lead in Copper. C. W. Hill and G. P. Luckey. (Bull. 142, A. I. M. E., Oct., 1918; 11 pp., illus.) 40c.

10237—FLOTATION—Mill Practice at Flotation Plant of Utah Leasing Co. H. H. Adams. (Salt Lake Min. Rev., Nov. 15, 1918; 4¾ pp., illus.) 20c.

10238—MECHANICAL PROPERTIES—The Action of Reducing Gases on Hot Solid Copper. Norman B. Pilling. (Bull. 142, A. I. M. E., Oct., 1918; 14 pp., illus.) 40c.

10239—MEXICO—Copper Distribution in Mexico. (Min. and Sci. Press, Nov. 16, 1918; 1 p., illus. by map.) 20c.

10240—PRICE-FIXING of Copper. Lewis Kennedy Morse. (Reprinted from Quart. Journ. of Economics, Nov., 1918; 35 pp.)

10241—QUEENSLAND—Recent Developments at Mount Cannindah. Lionel C. Ball. (Queensland Govt. Min. Journ., Sept. 16, 1918; 5 pp., illus.) 60c.

10242—SOUTHWEST—Notes on Certain Ore Deposits of the Southwest. W. Trovote. (Bull. 142, A. I. M. E., Oct., 1918; 13½ pp.) 40c.

10243—UTAH COPPER CO.—The Utah Copper Enterprise—III and IV, The Mine. T. A. Rickard. (Min. and Sci. Press, Oct. 19 and 26, 1918; 15 pp., illus.)

10244—UTAH COPPER ENTERPRISE—V, Mining Methods. T. A. Rickard. (Min. and Sci. Press, Nov. 2, 1918; 3½ pp., illus.) 20c.

GOLD AND SILVER—GENERAL

10245—AIR BLASTS in the Kolar Gold Field, India. (Bull. 142, A. I. M. E., Oct., 1918; 10½ pp.) Discussion of paper by E. S. Moore, previously indexed. 40c.

10246—AMALGAMATION. The Berdan Pan for Amalgamation. A. W. Allen. (Eng. and Min. Journ., Dec. 21, 1918; 1 p., illus.) 20c.

10247—GOLD QUESTION—Review of the Gold Problem. H. N. Lawrie. (Min. and Sci. Press, Oct. 26, 1918; 6 pp., illus.) 20c.

10248—PRODUCTION—International Gold Conference at Spokane. Courtenay De Kalb. (Min. and Sci. Press, Sept. 14, 1918; 2 pp.) 20c.

10249—VENEZUELA—The Gold District of Venezuela. H. Huntington Miller. (Min. and Sci. Press, Nov. 16, 1918; 3 pp., illus.) 20c.

10250—WESTERN AUSTRALIA—Gold Mining in Western Australia—V. Thomas Butement. (Chem. Eng., Oct. 5, 1918; 4¾ pp., illus.)

IRON AND STEEL—METALLURGY

10251—ELECTRIC FURNACES for the Production of Steel and Ferro-alloys. J. A. Seede. (Gen. Elec. Rev., Nov., 1918; 14 pp., illus.) 20c.

10252—ELECTRIC FURNACE in the Steel Foundry. W. E. Moore. (Iron Age, Nov. 14, 1918; 1½ pp.) 20c.

10253—LABORATORY—Speeding Up the Steel Works Laboratory. H. C. Kimber. (Chem. and Met. Eng., Sept. 28, 1918; 2¾ pp., illus.)

10254—OIL FUEL—Burning Oil in Cupolas. John Howe Hall. (Iron Age, Nov. 7, 1918; 1 p.) 20c.

10255—OXYGEN IN STEEL—Determination of Oxygen in Steel. (Iron Age, Dec. 26, 1918; 1 p., illus.)

10256—RAILS—A Metallographic Investigation of Transverse-Fissure Rails with Special Reference to High-Phosphorus Streaks. G. F. Comstock. (Bull. 143, A. I. M. E., Nov., 1918; 16 pp., illus.)

10257—STELLITE AND HIGH SPEED STEEL Compared. (Iron Age, Dec. 26, 1918; 1¼ pp., illus.)

10258—WELDING of Iron and Steel. W. H. Cathcart. (Iron Age, Dec. 26, 1918; 5¾ pp., illus.)

LEAD AND ZINC

10259—ALLOY—Ulco Hard Metal. Francis C. Frary and Sterling N. Temple. (Chem. and Met. Eng., Sept. 28, 1918; 1¾ pp., illus.)

10260—ELECTROLYTIC ZINC. (Bull. 142, A. I. M. E., Oct., 1918; 4¾ pp.) Discussion of paper by C. A. Hansen, previously indexed.

10261—FLOTATION—Differential Flotation of Lead and Zinc Sulphides. Algernon Del Mar. (Min. and Sci. Press, Nov. 23, 1918; 2¼ pp., illus.) 20c.

10262—FLOTATION—Feeding Flotation Oil in the Cœur d'Alene. C. T. Rice. (Eng. and Min. Journ., Dec. 14, 1918; 2 pp., illus.) 20c.

OTHER METALS

10263—ALUMINUM and Its Light Alloys. VI, Bibliography. Paul D. Merica. (Chem. and Met. Eng., Nov. 15, 1918; 4 pp.)

10264—ALUMINUM—Solders for Aluminum; a Report of a Discussion on Aluminum Solders Carried on by the Bureau of Standards with the View of Discovering the Best. Paul D. Merica and Louis J. Gurevich. (Metal Ind., Nov., 1918; 4 pp., illus.) 20c.

10265—ALUMINUM SHEETS—The Testing of Aluminum Sheets. Robert J. Anderson. (Iron Age, July 18, 1918; 2 pp., illus.) 20c.

10266—ANTIMONY—Electrolytic Refining of Antimony. Y. C. Wong. (Chem. and Met. Eng., Sept. 28, 1918; ¾ p.)

10267—ARSENIC and Its Occurrence in South Queensland. H. I. Jensen. (Queensland Govt. Min. Journ., Oct. 15 and Nov. 15, 1918; 9 pp., illus.)

10268—CHROMITE—Sampling and Analysis of Chromite. Abbot A. Hanks. (Min. and Sci. Press, Nov. 16, 1918; 1¼ pp.) 20c.

10269—MAGNESIUM; Some of Its Present Commercial Applications. (Chem. and Met. Eng., Sept. 28, 1918; 1 p.)

10270—MOLYBDENUM—Recent Developments in Molybdenum. L. F. S Holland. (Min. and Sci. Press, Oct. 19, 1918; 2¾ pp., illus.) 20c.

10271—PLATINUM—Russia's Production of Platinum. Albert R. Merz. (Journ. Ind. and Eng. Chem., Nov., 1918; 5 pp., illus.) 60c.

10272—QUICKSILVER—Metallurgical Practice on Cinnabar at Idria, Austria. Rolland Sterner-Rainer. (Chem. and Met. Eng., Nov. 15, 1918; 6½ pp., illus.)

10273—RADIOACTIVE LUMINOUS MATERIALS. Wallace Savage. (Chem. and Met. Eng., Sept. 28, 1918; 2½ pp., illus.)

10274—TIN—The Conservation of Tin. (Metal Ind., Oct., 1918; 5¾ pp., illus.) A symposium held at the convention of the Institute of Metals Division of the American Institute of Mining Engineers at Milwaukee, Wis., Oct. 9-10, 1918. 20c.

10275—TIN—A Statistical Summary of Tin; a Review of the Development of the Economic Use of Tin—History of Its Commerce—Production, Consumption and Average Prices—Measures Taken to Reduce Consumption. Edith M. Miller. (Chem. and Met. Eng., Sept. 28, 1918; 7 pp., illus.)

10276—TITANIUM AND CHROMIUM—A Rapid Method for Determining Titanium and Chromium in Beach-Sand. E. P. Barrett. (Min. and Sci. Press, Nov. 30, 1918; 1¼ pp.) 20c.

10277—TUNGSTEN—The Determination of Tin in High-Grade Wolfram Ores and the Use of Lead as a Reducing Agent in Pearce's Assay. A. R. Powell. (Journ. Soc. Chem. Ind., Sept. 30, 1918; 3½ pp.)

10278—TUNGSTEN—The Metallurgy of Tungsten. (Bull. 142, A. I. M. E., Oct., 1918; 1½ pp.) Discussion of paper of Zay Jeffries previously indexed.

10279—TUNGSTEN—Pine Creek Tungsten Mine. (Min. and Oil Bull., Nov., 1918; 2¾ pp., illus.)

10280—TUNGSTEN AND MOLBDENITE—Some Wolfram and Molybdenite Occurrences. H. I. Jensen. (Queensland Govt. Min. Journ., Oct. 15, 1918; 3¼ pp., illus.)

10281—TUNGSTEN ORES—The Genesis of Tungsten Ores. R. H. Rastall. (Min. Journ., Sept. 28, 1918; 1¾ pp.; to be continued.) 40c.

10282—WAR MINERALS. J. E. Spurr. (Econ. Geol., Nov., 1918; 12 pp.) 60c.

NONMETALLIC MINERALS

10283—ASBESTOS: British Empire's Resources. (So. Afr. Min. Journ., Oct. 12, 1918; 1¼ pp.) 40c.

10284—CERAMIC MATERIALS in Queensland; Shale, Clay and Pearl White. Lionel C. Ball. (Queensland Govt. Min. Journ., Sept., 1918; 1¾ pp.) 60c.

10285—FLUORSPAR—The Fluorspar Market and the Local Supply. A. L. Sweetser. (Eng. and Min. Journ., Dec. 14, 1918; 1¼ pp.) 20c.

10286—NITRATE INDUSTRY in Chile. (Statist, Nov. 9, 1918; 1 p.) 40c.

10287—POTASH—The Alsace Potash Deposits and Their Economic Significance in Relation to Terms of Peace. Paul Kestner. (Journ. Soc. Chem. Ind., Nov. 15, 1918; 9 pp., illus.)

10288—POTASH—The Alsatian Potash Mines and Works. (Chem. Tr. Journ., Dec. 7, 1918; 1¼ pp.)

10289—POTASH in Nebraska. J. M. Lliteras. (Chem. and Met. Eng., Oct 15, 1918; 1¾ pp., illus.)

10290—POTASH—Our Natural Resources of Potash. Frederick W. Brown. (Min. and Sci. Press, Dec. 7, 1918; 3½ pp.) 20c.

10291—QUEENSLAND—Ceramic Materials in Queensland; Shale, Clay and Paris White. Lionel C. Ball. (Queensland Govt. Min. Journ., Sept. 16, 1918; 1¾ pp.)

10292—REFRACTORY MATERIALS—Notes on the Refractory Materials of South Wales. J. Allen Howe. (Iron and Coal Tr. Rev., Nov. 1, 1918; 1¼ pp.) 40c.

10293—SALT—Origin of the Texas Domes. (Bull. 142, A. I. M. E., Oct., 1918; 7½ pp.) Discussion of paper by E. L. DeGolyer, previously indexed.

10294—SULPHUR—Per la Nostra Industria Solfifera. (L'Ind., Chimica, Min. e Met., Sept. 25, 1918; 1¾ pp.)

10295—SULPHUR—The Rustler Springs Sulphur Deposits. E. L. Porch, Jr. (Bull. No. 1722, Univ. of Tex., Apr. 15, 1917; 71 pp., illus.)

10296—SULPHUR DEPOSITS of the Trans-Pecos Region, in Texas. Kirby Thomas. (Eng. and Min. Journ., Dec. 7, 1918; 2½ pp., illus.) 20c.

10297—WAR MINERALS. J. E. Spurr. (Econ. Geol., Nov., 1918; 12 pp.)

PETROLEUM AND NATURAL GAS

10298—ENGLAND AND WALES—Oil Deposits in England and Wales. (Iron and Coal Tr. Rev., Dec. 6, 1918; 1 p.; to be continued.) 40c.

10299—GULF COAST—Possible Existence of Deep-Seated Oil Deposits on the Gulf Coast. (Bull. 142, A. I. M. E., Oct., 1918; 2½ pp.) Discussion of paper by A. F. Lucas, previously indexed. 40c.

10300—JAPAN—Petroleum in Japan. J. Morgan Clements. (Econ. Geol., Nov., 1918; 13½ pp., illus.) 60c.

10301—MEXICAN OIL SITUATION, The. (Min. and Oil Bull., Nov., 1918; 2 pp., illus.) 20c.

10302—MEXICO—Oil in Southern Tamaulipas, Mexico. (Bull. 142, A. I. M. E., Oct., 1918; 4 pp., illus.) Discussion of paper by Ezequiel Ordoñez, previously indexed. 40c.

10303—TEXAS—The Oil Fields of Northeastern Texas. W. L. Watts. (Min. and Oil. Bull., Nov., 1918; 5½ pp., illus.) 20c.

10304—WATER—Cement Plugging for Exclusion of Bottom Water in the Augusta Field, Kansas. H. R. Shidel. (Bull. 142, A. I. M. E., Oct., 1918; 7½ pp., illus.) 40c

10305—WATER TROUBLES in the Mid-Continent Oil Fields and Their Remedies. Dorsey Hager and G. W. McPherson. (Bull 142, A. I. M. E., Oct., 1918; 7 pp., illus.) 40c.

MINING—GENERAL

10306—ALABAMA—The Mineral Resources of Alabama. Eugene A. Smith. (Am. Electrochem. Soc., May, 1918; 5 pp.)

10307—CHUTES—Driving and Timbering Transfer Chutes at Hecla Mine. C. T. Rice. (Eng. and Min. Journ., Dec. 7, 1918; 2½ pp., illus.) 20c.

10308—DRILLING—Diamond Drilling in Cornwall. J. A. MacVicar. (Min. Mag., Oct., 1918; 4 pp.) 40c.

10309—EXPLOSIVES—Standardization of Mining Methods—IV. Charles A. Mitke. (Eng. and Min. Journ., Dec. 7, 1918; 5½ pp., illus.) 20c.

10310—FIRE PROTECTION—Standardization of Mining Methods—V. Fire Protection for Metal Mines. Charles A. Mitke. (Eng. and Min. Journ., Dec. 14, 1918; 5½ pp., illus.) 20c.

10311—LEACHING—Free Acid Determination in Presence of Metallic Salts. Louis F. Clark. (Eng. and Min. Journ., Dec. 21, 1918; 2½ pp.) 20c.

10312—MEXICO—La Mineria en el Estado de Sonora; Informe del Gobierno del Estado. (Bol. Minero, July and Aug., 1918; 8 pp.)

10313—QUARRY SAFETY RULES. (Industrial Accident Commission of Calif., Jan. 1, 1918; 57 pp.)

10314—QUARRYING—Labor Saving in Limestone Quarrying. Oliver Bowles. (No. 1, War Minerals Investigations Series, U. S. Bureau of Mines, Sept., 1918; 15 pp.)

10315—RUSSIA—Mining in Russia. Herbert C. Woolmer. (Min. and Sci. Press, Nov. 2, 1918; 2 pp., illus.) 20c.

10316—SAFEGUARDING the Mine Shaft. D. E. Charlton. (Eng. and Min. Journ., Dec. 21, 1918; 2¼ pp., illus.) 20c.

10317—SHAFTS—The Caisson Method for Foundations and Mine Shafts. George R. Johnson. (Proc. Engrs. Soc. of W. Penn., Oct., 1918; 30 pp., illus.)

10318—SOUTH AFRICA—Possibilities of Base Metal Production of South Africa. G. H. Stanley. (So. Afr. Min. Journ., Aug 24, 1918; 2 pp.)

10319—SOUTH AFRICA—The Exploitation of Our Mineral Resources; Review of the Opportunities Created by the War. T. G Trevor (So. Afr Min. Journ, Nov. 2, 1918; 1½ pp.)

10320—SPAIN—Estadistica Minera de España año 1917. (Revista Minera, Sept. 24, 1918; 1 p.) 40c.

10321—STANDARD EQUIPMENT—Standardization of Mining Methods, VI—Standard Equipment. Charles A. Mitke. (Eng and Min. Journ, Dec. 21, 1918; 3½ pp., illus.) 20c.

10322—SURVEYING—The Magnetic Needle in Mine-Surveying. L. H Cooke (Min. Mag., Sept, 1918; 5 pp.) 40c.

10323—WELL-DRILL BLASTING J C Costello. (Min. and Sci Press, Nov 23, 1918; 3¾ pp., illus) 20c.

METALLURGY—GENERAL

10324—CHATTANOOGA DISTRICT The Chemical, Electrochemical and Metallurgical Resources of the Chattanooga District T P Maynard. (Am. Electrochem Soc, May, 1918; 5 pp)

10325—CHLORINE—Commercial Uses of Chlorine. V. R. Kokatnur (Chem and Met Eng, Nov 1, 1918, 5 pp.) Review of direct and indirect applications of chlorine in independent uses, metallurgy poisonous gases, inorganic salts and organic solvents, pharmaceuticals and intermediates, read before the American Electrochemical Society Oct 1 1918

10326—HYDROMETALLURGY—Calculation of Extraction in Continuous Agitation Andrew Ham and Harrison Streeter Coe (Chem and Met Eng, Nov 1, 1918; 1 pp)

10327—HYDROMETALLURGY—Leaching and Filtration Nomenclature A. W Allen (Eng and Min. Journ., Dec. 7, 1918; 1 p) 20c

10328—METALLOGRAPHY and the War. Zay Jeffries. (Chem. and Met Eng, Sept 28, 1918, 2 pp)

10329—PYROPHORIC-ALLOY INDUSTRY—The American Pyrophoric-Alloy Industry Alcan Hirsch. (Chem. and Met. Eng Sept 28, 1918, 2¼ pp)

10330—REFRACTORIES—Carborundum Refractories. S C Lanbarger (Chem and Met Eng Sept 27 1918, 3 pp, illus.) Comparative account of silicon carbide refractories, with those in general use; great improvement made in therminal conductivity efficiency and strength

10331—REFRACTORIES—Study of Silica Products. A Bigot. (Iron and Coal Tr Rev Nov 8 1918; 1½ pp)

10332—REFRACTORIES—The Corrosive Action of Flue Dust on Firebricks. J. W. Mellor and W. Emery. (Iron and Coal Tr. Rev., Oct. 25, 1918; 1 p.)

10333—REFRACTORY—Seasoned Silica Brick from Roof of a Basic Open-Hearth Furnace after 135 Charges. C. S. Graham. (Iron and Coal Tr. Rev., Dec. 6, 1918; 1¼ pp., illus.)

10334—SAFETY—Injuries from Molten Lead. Chesla A. Sherlock. (Iron Age, Nov. 21, 1918; 2 pp.)

10335—SMELTER FUME—Electrostatic Precipitation. (Bull. 142, A. I. M. E., Oct., 1918; 3¾ pp.) Discussion of paper by I. H. Eschholz, previously indexed.

10336—SMELTER FUME—The Cottrell Electrostatic Recovery Process of Flue Dust and Fumes. H. J. Bush. (Journ. Soc. Chem. Ind., Oct. 31, 1918; 2½ pp., illus.)

SAMPLING AND ASSAYING

10337—LABORATORY—Speeding Up the Steel Works Laboratory. H. C. Kimber. (Chem. and Met. Eng., Sept. 28, 1918; 2¼ pp., illus.)

10338—METALLURGICAL ANALYSIS—Speeding Up Metallurgical Analysis. Harold C. Parish. (Chem. and Met. Eng., Sept. 28, 1918; 3½ pp.)

FUELS

10339—COAL—The Economical Use of Coal. T J Nelson. (Iron and Coal Tr. Rev., Dec. 6, 1918; 3½ pp., illus.)

10340—CARBOCOAL. (Bull. 142, A. I. M. E., Oct., 1918; 9½ pp.) Discussion of paper by C. T. Malcolmson, previously indexed.

MINING AND METALLURGICAL MACHINERY

10341—CONVEYORS Robert S. Lewis. (Min. and Sci. Press, Sept. 14, 1918; 7 pp., illus.) 20c,

10342—ELECTRIC-FURNACE PROBLEMS, Notes on. J. L. McK. Yardley. (Bull. 142, Oct., 1918; 5½ pp., illus.)

MINING AND METALLURGICAL MACHINERY

10343—AIR COMPRESSORS—Lubrication of Air Compressors. W. H. Callan. (Eng. and Min. Journ., Dec. 14, 1918; ½ p.) 20c

10344—PUMP—Rejuvenating a Worn-Out Pump. H. H. Hunner. (Eng. and Min. Journ, Dec. 21, 1918; ½ p.) 20c.

10345—WELDING—Metallic-Electrode Arc Welding. O. S. Escholz. (Eng. and Min. Journ., Dec. 21, 1918; 2 pp, illus.) 20c.

INDUSTRIAL CHEMISTRY

10346—CHEMICAL GLASSWARE. E. C. Sullivan. (Chem. and Met. Eng., Sept. 27, 1918; 1 p.)

10347—CHEMICAL IRON WARE; a Description of the Silicon Irons—Acid Resisting, a Relative Term—Comparative Action of Corrosives—Acid Resisting Castings. (Chem. and Met. Eng., Sept. 28, 1918; 3¼ pp., illus.)

10348—CHEMICAL PORCELAIN—Recent Developments in the Manufacture of Chemical Porcelain. J. C. Bailar. (Chem. and Met. Eng., Sept. 27, 1918; 1 p.)

10349—CHEMICAL STONEWARE: Preparation and Selection of Materials, Acid-Resisting Tests and Annealing Ware. A Malinovszky. (Chem. and Met. Eng., Sept. 27, 1918; 2¼ pp) Paper read before Am. Inst of Chem. Engrs., June, 1918.

10350—CHEMICAL WORKS—Portland Cement Construction for Chemical Works. Maxmilian Toch. (Chem. and Met Eng., Sept. 27, 1918; ½ p.)

10351—NITRIC ACID—Development in Nitric Acid Manufacture in the United States Since 1914 E. J Pranke. (Chem. and Met. Eng., Sept. 25, 1918; 2 pp; also Gen. Elec. Rev, Nov, 1918) Paper before Fourth Nat. Exposition of Chem. Industries, Sept 24, 1918.

10352—NITROGEN FIXATION—Direct and Indirect Methods of Nitrogen Fixation E. Kilburn Scott (Chem and Met. Eng, Sept. 25, 1918; 3¾ pp, illus) Abstract of paper before convention of A. I E. E., June 27, 1918.

10353—NITROGEN FIXATION FURNACES E. Kilburn Scott (Gen. Elec. Rev., Nov., 1918; 11 pp., illus) Paper before Am. Electrochem. Soc., Sept. 30, 1918. 40c.

10354—POTASH—A Wet Process for Extracting Potash from Cement Dust. J. G. Dean. (Chem. and Met. Eng., Sept. 26, 1918; 8½ pp., illus.)

10355—POTASH—The Kelp-Potash Plant of the Lorned Manufacturing Company An interview with L. H. Thompson, Vice-President (Chem and Met. Eng, Sept. 26, 1918; 3 pp, illus.)

10356—SULPHURIC ACID—Large Scale Sulphuric Acid Manufacture Andrew M. Fairlie (Chem and Met Eng, Sept 25 1918; 4½ pp, illus) Description of Tennessee Copper Co. plant

10357—WATER SOFTENERS—Chemical Control of Water Softeners Louis F. Clark (Chem. and Met. Eng., Nov. 1, 1918; 4 pp.)

MISCELLANEOUS

10358—HEALTH—Mosquito Elimination and Malaria Prevention. C N Harrub. (Eng. and Min. Journ., Dec 21, 1918; 1¾ pp.) 20c.

10359—LABOR—Important Phases of the Labor Problem: Recruiting of Men, Low Labor Waste, High Productivity and the Promotion of Contentment-Collective Bargaining Discussed Magnus W Alexander (Iron Age, Nov 21 1918; 4 pp) An address delivered to the annual convention of the National Founders' Association, New York, Nov 14.

10360—LABOR—Reciprocity on the Part of Labor Needed to Solve Industrial Problem J Parke Channing (Eng and Min. Journ., Dec. 14, 1918; 1¼ pp.) 20c.

10361—LABOR—Welfare Work in the Mining Industry H Lipson Hancock. (Chem Eng, Oct 5, 1918; 7½ pp., illus)

10362—MANAGEMENT—The Personal Element in Management (A. M Heckman (Min. and Sci Press, Oct. 19, 1918 1½ pp)

10363—POWER—Its Significance and Needs Chester G. Gilbert and Joseph E. Pogue (Bull. 102, Part 5 U S. National Museum, 1918; 63 pp illus)

10364—REINFORCED CONCRETE vs Salt Brine and Sea Water. Henry J. M. Creighton. (Chem and Met. Eng, Oct 15, 1918; 5¼ pp, illus) Paper before Faraday Socy, July 1918 Cites many examples of failure in reinforced concrete showing the cause to be due to electrolytic corrosion of reinforcements.

Personals

Have You Contributed to the Association of the 27th Engineers?

Harry J. Wolf examined mining property in Clear Creek County, Colo., during the early part of December.

George Crerar recently spent a short time in Salt Lake City, Utah, on his way to San Luis Potosi, Mexico.

Maxwell W. Atwater, mining engineer, has been appointed manager of the Davis-Daly Copper Co., of Butte, Montana.

C. H. McCullough, Jr., vice-president of the Lackawanna Steel Co., has been elected president of the company, to succeed **E. A. S. Clarke.**

Bulkeley Wells, who was recently elected president of the American Mining Congress, to succeed **Walter Douglas**, has returned to Denver.

Herbert G. Officer has resigned his commission in the Air Service and is now with the Andes Copper Mining Co., 42 Broadway, New York.

Morris P. Kirk, mining engineer, of Salt Lake City, Utah, has been appointed general manager of the Yellow Pine Mining Co., Goodsprings, Nevada.

G. M. Colvocoresses, mining engineer, recently went to Lark, Utah, to inspect the mine and mill of the Ohio Copper Mining Co., of Utah, with which he is connected.

M. S. MacCarthy and **J. M. McClave** examined properties at Jamestown, Boulder County, Colo., last week, on which discoveries of uranium and radium were reported.

G. H. Clevenger has completed research work at Colorado Springs for the U. S. Bureau of Mines, and after Jan. 1 will be with the National Research Council, Washington, D. C.

L. R. Robbins, mining engineer and geologist for the Tonopah Belmont Development Co., of Tonopah, Nev., has been appointed general superintendent of mining for the company's Tonopah property.

Oba Wiser, metallurgical engineer, has resigned as assistant mill superintendent of the Chino Copper Co., of Hurley, N. M., to accept the management of the Republic Mining and Milling Co., Hanover, New Mexico.

Lieut. Roy B. Earling has been discharged from the National Army, in which he has been serving as an artillery instructor, and has returned to Metcalf, Ariz., where he will continue in charge of the Arizona Copper Co.'s mines.

M. L. O'Neale has resigned as superintendent of the Connellsville Basin Coke Co., near Morgantown, W. Va., to accept the position of mine and mill superintendent of the New York Pyrites Co., of Gouverneur, New York.

W. D. B. Motter, Jr., mining engineer, has resigned as manager of the Benson Mines Co., Benson Mines, N. Y., to join the staff of the Guggenheim Brothers as assistant consulting mining engineer, with headquarters at 120 Broadway, New York.

C. E. Wheelock, of Mogollon, N. M., recently registered at the office of the American Institute of Mining Engineers, New York. Others who registered there during the week were James T. Nixon, London, England; Lieut. H. G. Mathews, Los Angeles, Calif.; H. M. La Follette, La Follette, Tenn.; C. F. Moore, Boston, Mass.; L. G. Weeks, Bisbee, Ariz.; R. B. Eldredge, Colorado Springs, Colo.; and P. J. Bandy, Mexico City, Mexico.

Obituary

L. S. Woodbury, president of the Great Falls Iron Works, Great Falls, Mont., died Nov. 22.

Sherman Henry Boright, manager of the Lonely Reef mine, Rhodesia, died of pneumonia Nov. 2. He was a charter member of the Canadian Mining Institute.

Gideon J. Giroux died at Nogales, Ariz., of heart failure, aged 70 years. For many years he was superintendent of the Sultana mine, near Carbo, Sonora, Mex., and had a share in that property at the time of its purchase by the Cole-Ryan interests.

Keith C. Fraser, assistant superintendent of the Bartlesville Zinc Co., died of pneumonia, following influenza, on Dec. 12. He was a graduate of the School of Mines, Rolla, Mo., and had been connected with the Bartlesville Zinc Co. for several years.

Harold E. Martin, district engineer of the Oliver Iron Mining Co., with headquarters at Eveleth, Minn., died of pneumonia following an attack of influenza on Dec. 16, aged 36 years. He entered the service of the Oliver Iron Mining Co. in the operating department at Hibbing, Minn., January, 1906, and in September, 1913, was transferred to the engineering department. He was later made chief engineer of the Hibbing and Chisholm districts, which position he held until January, 1917, when he was made chief engineer of the Virginia district.

Societies

The Mining Convention which was to have been held in Vancouver, B. C., under the auspices of the Vancouver Chamber of Mines during the first week in January, 1919, has been postponed indefinitely.

American Mining Congress, California committee, has called a convention of all mineral and oil producers for Jan. 15 and 16, 1919, at the Palace Hotel, San Francisco. A state chapter is to be organized. This convention had been postponed on account of the epidemic. The annual meeting of the Colorado Chapter was held in Denver on Jan. 2-4.

A New Metallurgical Society, exclusively confined to the branches dealing with steel, iron, and their alloys, was decided upon recently at a meeting of a number of prominent metallurgists at Pittsburgh. The aim of the society will be the promotion of the arts and sciences connected with the metallurgy of iron, steel, and their alloys. A committee to complete the plans formed at this meeting was appointed, and D. L. Mathias, of Mackintosh, Hemphill & Co., Pittsburgh, was selected as chairman. The necessary data and steps to materialize the society are now being prepared by this committee.

Technical Schools

University of Idaho, at Moscow, Idaho, will establish a vocational school for miners at Wallace, Idaho. An eight-weeks' term will be held, at which will be given practical instruction in rock breaking, use of powder, timbering, pumping, and other underground work. Most of the time will be spent in one of the large mines. Frank H. Skeels, mining engineer, will be in charge. The course is established under the recent Smith-Hughes Act, under which the Federal Government pays half the cost and the state, the other half.

Harvard School of Engineering has been reörganized, and its courses will be open to students on Jan. 1, continuing during the summer to enable the entrants to complete a full year's work by the opening of the next academic year in September. Some time ago Harvard University and the Massachusetts Institute of Technology agreed to combine effort in engineering instruction, making use of funds provided under the will of the late Gordon McKay. The agreement was objected to, and the Massachusetts Supreme Court held that the arrangement was not in accord with the provisions of the will. The new arrangement has been approved both by the trustees of the McKay estate and by the governing boards of the university. The instruction will be carried on entirely by a Harvard faculty, appointed by the university governing boards, and students who satisfactorily complete four years of study will receive the degree of bachelor of science. Higher degrees will be granted after additional study. Instruction will be offered in the following subjects; mechanical engineering, civil engineering, sanitary engineering, electrical engineering, mining and metallurgy, and industrial chemistry. The faculty includes the following: Henry Lloyd Smith, professor of mining and metallurgy; George Sharp Raymer, assistant professor of mining; Albert Sauver, professor of metallurgy and metallography; and Louis Caryl Graton, professor of economic geology.

Industrial News

Goodyear Tire and Rubber Co., Akron, Ohio, completely reorganized its plant from a war to a peace basis within a few days after the armistice was signed. Seventy two hundred and fifty employes were engaged, in whole or part, on Government work, and less than 12% of them lost as much as one day from work.

Wellman-Seaver-Morgan Co., Cleveland, Ohio, has opened a San Francisco office at 415-417 Rialto Bldg., in charge of Norman S. Ross. Business originating from California, Nevada west of the 115th meridan, Lower California, and Josephine, Jackson and Klamath counties in Oregon will receive the attention of Mr. Ross. Horace N. Trumbull, recently discharged from the Engineer Officers' Training School at Camp Humphreys, Va., and formerly advertising manager of the SKF Ball Bearing Co., of Hartford, Conn., has been appointed advertising manager of the W-S-M Co. at Cleveland.

Trade Catalogs

Gasoline Locomotives. J. D. Fate Co., Plymouth, Ohio. Catalog No. 4, Bull. A. 8½ x 11; pp. 21; illustrated. Specifications and descriptions of three-ton and six-ton sizes of Plymouth gasoline locomotives.

Jeffrey Bucket Elevators. The Jeffrey Manufacturing Co., Columbus, Ohio. Catalog No. 244; 8½ x 11; pp. 71; illustrated. Gives details of elevators selected from numerous styles used in handling materials in many industries of the country. Now ready for distribution.

Rails. Walter A. Zelnicker Supply Co., 325 Locust St., St. Louis, Mo. Bull. 250; 3½ x 8½; pp. 84; illustrated. Descriptive of rails, locomotives, cars, cranes, shovels, pipe, machinery, tanks, steel piling, power plant equipment, machine tools, wire rope, hoists, and contractors' equipment. Copy free on request.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Filtration—Process of Extracting Solids. Ellis Edgar Howson, Salt Lake City, Utah. (U. S. No. 1,284,346-7; Nov. 12, 1918.)

Furnaces, Lining for. Walter C. Ely, Terre Haute, Ind. (U. S. No. 1,284,880, Nov. 12, 1918.)

Furnace, Metallurgical. John Kralund, Brooklyn, N. Y., assignor to Doehler Die Casting Co. (U. S. No. 1,284,711; Nov. 12, 1918.)

Kilns—Apparatus for Utilizing Waste Heat and Increasing Circulation of Air During Drying and Burning Processes. Thomas B. Sullivan, Kansas City, Mo. (U. S. No. 1,284,943; Nov. 12, 1918.)

Leaching—Process for Recovering Metals from Ores. Clarence L. Larson, Kellogg, Idaho, assignor to Bunker Hill & Sullivan Mining and Concentrating Co., San Francisco, Cal. (U. S. No. 1,284,910; Nov. 12, 1918.)

Magnetic Separator for Sorting Heterogeneous Material. Daniel R. Bryan, Chatham, N. J. (U. S. No. 1,284,872, Nov. 12, 1918.)

Retort, Continuous Rotary. Paul S. Shoaff, Long Beach, Calif. (U. S. No. 1,284,479; Nov. 12, 1918.)

Steel—Manufacture of Steel Direct From Iron Ores. Luis Tejero Grouselle, Grenoble, France. (U. S. No. 1,284,094; Nov. 5, 1918.)

Sulphuric Acid, Process and Apparatus for Producing. Harry V. Welch, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. Nos. 1,284,166-7; Nov. 5, 1918.)

Sulphuric-Acid Manufacture. Linn Bradley, East Orange, N. J., assignor to Research Corporation, New York, N. Y. (U. S. No. 1,284,175; Nov. 5, 1918.)

Tunneling Machine. Edward S. McKinlay, Oak Creek, Colo. (U. S. No. 1,284,398, Nov. 12, 1918.)

Editorial Correspondence

WALLACE, IDAHO—Dec. 26

Suspension of the Law Requiring Annual Assessment Work on mining claims for the year 1919 is being discussed, and sentiment in the Cœur d'Alene district appears to favor it. Owing to unsettled industrial conditions that will probably prevail throughout 1919, there is a strong feeling that claim owners should be relieved of performing the annual labor. Labor and prices of mining supplies will no doubt remain at a high level during the year, though possibly lower than they are now, so that little would be accomplished for the expenditure, which, even in normal times, is little more than an evidence of good faith exacted from the claimant, and is of little value so far as developing a mine is concerned. However, there is no sentiment in favor of suspending the law beyond 1919.

Property Rights of the Caledonia Mining Co., Kellogg, Idaho, whether received by grant from Bunker Hill & Sullivan Mining and Concentrating Co. or otherwise, are held in perpetuity without restrictions or reservations by the company, Stanley A. Easton, president, has recently notified stockholders of the Caledonia company. Mr. Easton terms the following a misstatement, it having just come to his attention: "As a result of apex litigation in 1911, when the Bunker Hill & Sullivan Mining Co. obtained control of Caledonia by receiving 1,305,000 shares of new stock, making the issued stock 2,605,000 shares, par $1, a stipulation was made, in conformity to Cœur d' Alene practice, under which the Caledonia property would go to the B. H. & S. Co. in event that Caledonia should exhaust its ores or failed to operate at a profit. For the protection of the minority stockholders a further stipulation forbade the use of Caledonia's funds for the purchase of outside properties. This means that in the event of the happenings of the first stipulation Caledonia will lose title to its holdings and cease to exist."

DENVER, COLO.—Dec. 26

Importation of Mexican Labor into Colorado to supply the urgent demands of the mining industry is a possibility in the near future. The matter has received the consideration of the U. S. Immigration Service, in coöperation with the U. S. Employment Service, and the proposed importations will be permitted under such restrictions as may be made by the director-general of the latter organization.

HOUGHTON, MICH.—Dec. 29

The Operation of the Flotation Process in the Michigan district may be looked upon as the most important development made in copper extraction in the district during 1918. The most conspicuous success of flotation has been achieved by the White Pine company, a Calumet & Hecla subsidiary. The output of copper now runs close to half a million pounds a month, practically double the output secured before the use of flotation. This doubling in production has been accomplished without any increase in rock tonnage and with very little betterment in quality of rock mined. Two shafts are furnishing the rock. A third shaft is sinking, exploring and opening the lode, which continues erratic as ever. However, openings are now far enough in advance to assure continuance of operations at present rate of production for five years, regardless of further openings with depth. The third shaft is opening good looking rock.

The Seneca Shaft is now 60°, around the curve. It has attained a depth of 1612 ft. The Kearsarge lode proper ought to be struck at 1625 ft. Sinking had been interrupted for a week owing to the fact that a station had to be built at 1600 ft, a fork cut to take care of the water coming into the shaft, and plans completed for an underground hoist at this point, as the bucket cannot make the curved shaft satisfactorily. Seneca has broken the world's record for shaft sinking in copper mining work. The first drilling was done Feb. 13, 1918, and the speed attained in putting this shaft down has been remarkable. The men employed were experts, in direct charge of one of the best shaft men in northern Michigan. In addition to the highest wage scale ever paid for similar work, a straight bonus went to all of the men. Despite published statements, no arrangements have been made for stamp milling the Seneca output, when it comes from the lode. It will probably be six months before enough rock will be ready to need a stamp mill. After the shaft cuts the lode it will go through it, down through the footwall trap. Then the first crosscut will be run and drifting started. Even then, the sources of rock supply will be limited to two places in the lode. The construction of the headframe in the shafthouse has been completed. The crusher and motor have been ordered and ought to be delivered within two weeks.

BOSTON, MASS.—Dec. 21

The Alaska-Juneau Gold Mining Co. has called a special meeting of stockholders for Jan. 10 to vote on the issue of $3,500,000 first mortgage 10-year 7% gold bonds, of which $1,500,000 or so much as may be necessary will be exchanged at par for outstanding obligations and floating debt; $500,000 will be sold at not less than par to stockholders. The proposed issue is to provide funds for retiring floating debt and to pay for alterations and improvements to the milling plant, estimated to cost $500,000. The present mill, as originally designed and erected, contained many experimental features that have turned out to be unsuitable for the ore. With no funds and shortage of labor, working out a remedial operation has been slow and costly. Under the proposed plan of improvement and alteration, the company estimates that within two years its milling capacity will be brought up to 8000 tons a day by an expenditure not to exceed $500,000. According to President Bradley, these milling improvements will permit the property to earn an operating profit in normal times of $1,400,000 per year. In January of this year Alaska-Juneau crushed 118,809 tons of rock, of an average assay value of 69½c per ton, losing 17.40c. in tailings, at a milling cost of 43c. per ton. In September the company treated 21,015 tons of ore, of an assay value of $1.32 per ton, and lost 19.50c. per ton in tailings. Milling costs this month have jumped to $1.17 per ton. In short, its cost of milling this ore, exclusive of general and administrative expenses, was but a few cents less than the total gold value of the ore itself. The average for the 10 months to Nov. 1, with October officially estimated, gives 498,861 tons treated, of an average assay value of 86.50c. per ton, of which 17¾c per ton was lost in tailings. Total mill extraction was 79½%, and average cost 63c. per ton. Thus the company recovered from 498,861 tons of ore a net value of $376,707 for which it had to pay in operating expenses 63c. per ton, or $311,282, and this does not include administration and general expenses.

VICTORIA, B. C.—Dec. 28

An Embargo on Lead Ore and Concentrate Shipments to the Trail smeltery is the substance of a report now in circulation. The explanation given is that there must be a hiatus until settled peace conditions are established. It is suggested that such embargo will be likely to remain in effect all winter.

The Vancouver Assay Office stopped its purchases of platinum on Dec. 31. This institution was opened during the latter part of the war to encourage platinum production in Western Canada. In this connection, the placers of the Tulameen River were prospected by representatives of the Imperial Munitions Board in Canada. Indications were that, if work development were continued as energetically as it started, a considerable quantity of platinum would be recovered. With the war over and the demand much lighter, operations by the government on the Tulameen River have ceased. The Vancouver assay office was established to receive this platinum, as well as that recovered by companies or individual prospectors and operators throughout the province, and also that of private individuals. Payment was made at $105 an oz. It is believed that the Canadian government will not do away with the assay office, but will maintain it for the benefit of prospectors and miners.

A Petition to Establish an Ore-Testing Plant in British Columbia and to continue drilling placer ground on the Tulameen River will be presented to the dominion government by the mining bureau of the Vancouver Board of Trade. The same organization proposes asking the provincial government for an explanation of its failure to diamond-drill iron properties of the province to estimate the available tonnage of magnetite and hematite ores. With respect to the ore-testing plant, it is asserted that British Columbia operators are handicapped because they have to send sample shipments to Ottawa for treatment. The type of plant required would cost about $75,000, it is stated, and such an expenditure would be amply repaid in benefit to the mining men and the industry. As to Tulameen platinum operations, it will be pointed out that during the last three months 14 holes have been drilled and that the showings obtained fully warrant further prospecting. To discontinue the work now, it is argued, would be wasteful and unjustified. It has been demonstrated that this valuable mineral exists in the placer ground, and the commercial possibilities of the resource should be determined before the work is abandoned.

A Bounty of Fifty Cents a Ton on Iron mined and smelted in Canada, to be paid by the dominion government, and the establishment, with the support of the federal administration, of a blast furnace and steel plant at or near the city of Port Arthur, Lake Superior, are asked for in petitions to be laid before Premier Borden at an early date by the people of the district of Port Arthur. Arguments for the bounty are as follows: That during the last decade over 90% of the product of Canadian furnaces was from imported ore; that the proportion of domestic iron ore smelted in Canada has gradually declined until, in 1917, it was only 4.23%; that a large tonnage of Canadian iron ores could be made available for use by some preliminary treatment, if the cost of such treatment were compensated for by a bounty, the ores of the Atikokam Range requiring roasting, Loon Lake ores hand sorting, Magpie siderite ores calcining, and Moose Mountain and Bathurst ores concentrating; that extensive areas of promising iron formations exist in Canada, and it is reasonable to expect that merchantable ore will be found in these ranges when systematically exploited. It is also held that such a bounty would stimulate prospecting and would indirectly increase the customs receipts of the dominion. In support of the petition for a dominion furnace and steel plant it is stated: That practically all the steel plants in the dominion are in eastern Canada and have received $16,000,000 in bounties; that between 1905 and 1915 Canada imported iron and steel products to the value of about $632,000,000; that the population of western Canada is now over 2,000,000 and in 10 years has increased 171%, whereas that of eastern Canada has increased only 17%; that there are about 19,000 miles of railway in western Canada radiating westward from the city of Port Arthur, and manufacturing plants representing over $308,000,000; and that the United States Steel Corporation some years ago erected a large steel plant at Duluth at a cost of over $25,000,000 to supply the requirements of the Western states and is about to proceed with the erection of additional mills at a cost of approximately $15,000,000. The policy recommended to the dominion government in the launching of the proposed industry is that the cost be placed at about $15,000,000 and that the interest for 30 years on 80% of the actual capital invested be guaranteed, or that the same guarantees be allowed as have been given to Canadian drydocks and shipbuilding plants, to the extent of about $13,000,000.

The Mining News

ALASKA

NOVEMBER SHIPMENTS of domestic copper ore, matte, etc., from Alaska to United States were 11,574 gross tons. The copper contents was 6,607,216 lb., valued at $1,704,925.

ALASKA GASTINEAU (Thane)—Second shift put on at Thane mill. Will soon add third shift. Labor supply better. Practical miners scarce.

ARIZONA

Cochise County

HILLTOP (Paradise)—Struck orebody 1900 ft. from portal of lower tunnel. Ore of same grade as in upper tunnel.

Greenlee County

SHANNON (Clifton)—Manager J. W. Bennie denies company is to close down, as reported from Boston.

Pima County

STUMP (Silverhell)—Sold by George H. Daily to Charles H. Behr, of New York, who will sink present 75-ft. shaft to 400 ft. and install surface equipment. Ore carries copper, lead and silver.

Pinal County

MAGMA COPPER (Superior)—November copper production was 992,271 pounds.

Santa Cruz County

HOSEY (Patagonia) — Installed compressor plant and breaking ore with machine drills.

THREE R (Patagonia)—Purchased by Gunn-Thompson interests, through Magma Copper Co., of Superior. Property under examination for several months. Well-developed and has been shipping good-grade copper ore. Reserves of low-grade sulphides believed to warrant erection of large concentrator.

Yavapai County

DUNDEE-ARIZONA (Jerome)—Starting extension of tunnel workings past shaft at 120 level, to cut sheared zone, expecting to develop body of carbonates and oxides. Planning for treatment plant, if ore found warrants expense.

GRAND ISLAND (Jerome)—Shaft down about 450 ft. and sinking rapidly.

JEROME-PORTLAND (Jerome)—R. B. Westervelt, attorney of Prescott, appointed receiver, succeeding Frank H. Dyer.

JEROME VERDE (Jerome)—Shipping 600 tons a month of 8% copper ore.

UNITED VERDE EXTENSION (Jerome)—New 60-room employee's hotel opened Jan. 1.

VERDE COMBINATION (Jerome) — President John L. Dyer denies consolidation is considered between company and Green Monster and Grand Island companies. During last year Combination has done about 5500 ft. of work.

ARKANSAS

Marion County

EDITH (Rush)—Taken over by John De Costa and associates, of Kansas City, Mo., who will start operations immediately. Ore zinc carbonate. Plant includes modern mill. Formerly heavy producer. Capt. Charles Le Vasseur in charge.

MONTE CHRISTO (Rush)—Producing free hand-cobbed carbonate with small force.

SURE POP NO. 2 (Rush)—Two good runs of ore recently disclosed in straightening some drifts.

CALIFORNIA

Calaveras County

ESPERANZA (Mokelumne Hill)—Mine abandoned and machinery sold. Idle for 20 years. Once worked on large scale, employing 100 men. Recent high costs of mining prevented expected reopening.

Colusa County

PLATINUM DEPOSIT near Fouts to be developed by John M. Connolly, of Willows, during winter. Opened by tunnel. Ore carries gold and traces of platinum.

Eldorado County

STEEL CHROME (Placerville) — Attached for lumber account of $5500. Plant and mine, 12 miles from Folsom, idle; 80 tons of ore and concentrates ready for shipment, but no market. Case typical of other chrome mines.

Kern County

SILVER STAMPEDE reported from Randsburg district by Wade Hampton Williams and John W. Kelly, of Amalie and Bakersfield. High-grade silver ore, 16 miles west of Randsburg.

Modoc County

HESS (Alturas)—Produced $20,000 last season under lease to Peter Keegle. Ore reserve sufficient for two years' run of mill.

Nevada County

IDAHO MARYLAND (Grass Valley)—Property of Maryland Gold Quartz Mining Co. sold by S. P. Dorsey Estate, owners, to Eastern capitalists, represented by Rufus Thayer, attorney, and Bulkeley Wells. Mines closed since 1894 New officers elected were Roy H. Elliott, San Francisco, president, and Rufus Thayer, secretary. A new board was elected, but names were withheld.

EMPIRE-PENNSYLVANIA (Grass Valley)—Usual tonnage being crushed in Empire 60-stamp mill. Quicker delivery soon of Pennsylvania ores due to completion of new electric ore car line.

GOLDEN CENTER (Grass Valley)—Unwatering completed to 1800 level, permitting development at that depth for first time in years.

NORTH STAR (Grass Valley)—Underground crew increased in Champion. Development resumed on extensive lines followed before war. Labor supply better and some supply costs lower. No indication of wage reduction.

Plumas County

DROEGE (Greenville)—Development disclosed good ore near main workings. Additional equipment planned.

Riverside County

PALISADE (Blythe)—To ship ore to El Paso smeltery. New motor-truck road under construction. Four carloads bismuth lead-silver ore of good grade on dump.

Shasta County

CRYSTAL (Igo)—Reopened by A. N. Kingsbury, lessee, after 30 years' idleness; only silver mine in Shasta County. Ore carries high-grade silver and some gold. Mine relocated as White Star. Owned by J. P. Kingsbury, W. D Bull and W. H. Hubbard, all of Igo.

AFTERTHOUGHT (Ingot) — Flotation plant started Dec. 18. Plant and improvements said to have cost $750,000. Capacity, 300 tons in 24 hours. Saves both zinc and copper. Especially adapted to Afterthought ores, of different character from others in Shasta copper region. Mine and mill employ 100 men.

MAMMOTH (Kennett) — Arrangements being made for handling ore from Spearhead mine in Nevada.

Sierra County

MARIPOSA (Alleghany)—Ore from new ground supplying mill steadily.

SLATE CREEK HYDRAULIC (Port Wine)—Large concrete dam completed. Will start piping when water is available.

Trinity County

ESTABROOK GOLD (Trinity Center)—New dredge launched. Designed by Union Construction Co. of San Francisco.

Tuolumne County

DUTCH-APP-SWEENEY (Jamestown)—Mill construction progressing. Large reserves in lower levels.

BELMONT-SHAWMUT (Shawmut) — Sixty-stamp mill and flotation plant in full operation. New work on lower levels adds to reserves. Large crew retained, despite labor shortage.

FORTUNA (Sonora)—New mill treating ore from recent development. Eaton and Hamilton, owners.

DEAD HORSE (Sonora)—Mine and others in group to be reopened. Developed by 1800-ft. tunnel, to be used as working-level and equipped with electric hoist. Rebuilding New Albany flume. Surface buildings to be removed to better sites. Otto Fleiser, superintendent.

Yuba County

SMITHURST (Browns Valley)—Optioned to Samuel Bowden. To be unwatered. Adjoins Rattlesnake mine, formerly high-grade producer.

COLORADO

Clear Creek County

GAUNTLET GOLD (Idaho Springs)—Organized to take over and develop old Mammoth mine. Will operate through Argo tunnel. A. D. Hobson, superintendent.

San Juan County

CALEDONIAN M. & M. (Silverton)—Mill recently overhauled. Satisfactory test run made on ore developed during last few months. G. Gustafson, mill superintendent.

San Miguel County

NOVEMBER SHIPMENTS of concentrates from Telluride district were 55 cars from Smuggler-Union and Black Bear; for same period last year, 132 cars.

BELMONT-WAGNER (Telluride)—Mine and mill down owing to labor shortage and influenza.

COLORADO VANADIUM (Telluride)—Opening new vanadium mine above Fall Creek station, on San Miguel River. Boiler plant, compressor, and 2300-ft. aërial tramway will be installed at once. Company will also develop its ground on Bear Creek side of San Miguel River. Ore to be treated at plant of Primos Chemical Co., Vanadium, Colorado.

Summit County

BLUE FLAG (Breckenridge)—Will develop Illinois Gulch property during winter. Owned by Blue Flag Mining Co., of Cripple Creek. Property equipped with mill. B. F. Hall, superintendent.

FARNCOMBE HILL GOLD DREDGING (Breckenridge)—Worked under lease by Tonopah Placer Co., with No. 2 dredge.

LIBERTY LEASING (Breckenridge)—Operating old Monte Cristo mine in upper Blue River section of district. Has remodeled and electrified milling plant. Frank Peabody, superintendent.

SILVER KING (Breckenridge)—Being developed under lease and bond by State Senator Siewers Fincher. Crosscutting from shaft to No. 3 vein.

Teller County

REVA GOLD (Cripple Creek)—Developing properties of Rose Nicol Gold Mining Co. under bond and lease. Sinking main shaft. Will sink 150 ft. more and cut ninth level station.

VICTOR (Victor)—Komat Leasing Co. developing. Will make trial shipment soon.

IDAHO

Shoshone County

RICHMOND (Adair)—Sinking winze from main tunnel 1000 ft. from portal.

NABOB (Beeler)—Inspected by J. F. Harrington, of New York, president. Will increase mine force and build 150-ton mill by spring.

IDAHO-CARBONATE HILL (Mullan)—Work stopped until spring owing to labor conditions and influenza. Shaft down 440 ft. Preparing to crosscut vein.

ST. JAMES (Wallace)—Installing compressor. Will continue crosscut to vein, identical with Sunset, on west.

SUCCESS (Wallace)—On 1600, lowest level, ore shoot 3 to 7 ft. wide proved for over 100 ft. Marked increased in lead as compared with zinc. Good orebodies, mostly zinc, on 1500, 1400 and 700 levels.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Copper production in November was 10,499,711 lb. Producers were: Ahmeek, 1,773,127 lb.; Allouez, 451,518; C. & H., 5,036,575; Centennial, 196,274; Isle Royale.

1,318,059, La Salle, 131,033; Osceola, 1,150,640; Superior, 96,000; and White Pine, 346,485 pounds.

ISLE ROYALE (Houghton)—Mill closed down for Christmas; first interruption since July 4.

Iron District

SALISBURY (Ishpeming)—Two miners killed by fall of ground on Dec. 19. No explanation given for cave.

NEGAUNEE (Negaunee)—Three miners rescued Dec. 22 from caved drift in No. 2 workings after being entombed for 63 hours. Body of William Medlyn, who was instantly killed, was recovered.

NEVADA

Esmeralda County

GOLDFIELD MERGER (Goldfield)—Crosscut on 1350 level in ore. Spearhead discovery nearby said to strike into Sunflower claims; will prove ground from west crosscut on 1100 level.

SPEARHEAD GOLD (Goldfield) — Applied to Tonopah & Tidewater R. R. for spur to mine shaft. Will build ore bin. Expect to ship to United States S. and R. Co. at Kennett, California.

Lyon County

WESTERN NEVADA (Mason)—Nevada-Douglas Copper Co. shipping 100 tons sulphide ore daily. Hauled to railroad by motor truck.

MASON VALLEY MINES (Thompson)—November copper production was 1,073,400 pounds.

Mineral County

LOUISANA CONSOLIDATED (Mount Montgomery)—Examined by Samuel Newhouse with view to installing new machinery and reopening.

Nye County

GOLD-SILVER DISCOVERY reported at Mud Springs, 60 miles from Fallon. First claim located by "Diamondfield" Jack Davis. Shaft sunk 50 feet.

TONOPAH DISTRICT ore production for week ended Dec. 21 was 7651 tons, having a gross milling value of $130,067. Producers were Tonopah Belmont, 2088 tons; Tonopah Mining, 1100; Tonopah Extension, 2328; West End, 944; Jim Butler, 156; Montana, 245; Tonopah Divide, 300; MacNamara, 412; Rescue, 70, and miscellaneous, 9 tons.

MAYFLOWER CONSOLIDATED (Pioneer)—Controlling interest has changed hands, John H. Miller, of Hawthorn, being one of largest stockholders. Work resumed on 500 level of main shaft. Will drift on vein to connect with Starlight shaft, 1400 ft. away. W. J. Tobin, general manager.

REORGANIZED PIONEER (Pioneer)—Will sink main shaft, now 420 ft. deep, to 800 level. Lateral development on 170 level of K and K. claim has opened milling-grade ore.

Storey County

UNION CONSOLIDATED (Virginia City)—Assessment of 10c. per share levied upon capital stock on Dec. 11.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—November production was 1,278,116 lb. of copper, all from Kimberly operations. Of total, 543,912 lb came from Morris Brooks ore concentrated at Kimberly mill, 721,205 from direct smelting Alpha ore; and 12,999 from ore mined by lessees. Kimberly mill made 82% extraction for month. Development progressing at Alpha mine. Work delayed on 1300 level by heavy waterflow.

NEW MEXICO

Grant County

MANGANESE SHIPMENTS in November by Kirchman & Crawford and C. Amory Stevens, two operators, totaled 200 cars. Payroll for month was over $30,000.

HANOVER-BESSEMER (Hanover) — Shipments of iron ore to Colorado Fuel and Iron Co. at Pueblo continue at rate of 700 to 800 tons per day.

REPUBLIC (Hanover)—Shipping high-grade zinc sulphide to smeltery at rate of 12 cars per month. New shaft still in limestone.

UNITED STATES COPPER CO. (Hanover)—New shaft down 500 ft.

CHINO COPPER (Hurley) — Primary flotation being tried in section seven of mill. Initial results said to show better recovery than made in other sections where flotation follows gravity concentration.

HERMOSA COPPER (Santa Rita)—Holdings purchased by Chino Copper Co. About 10 claims included. Part of ground will be used by Chino for disposal of waste from stripping operations.

BLACK HAWK (Silver City)—Lease and bond secured on 14 claims in southwestern part of Hanover district. Will start development work at once. E. D. Lidstone, manager.

Lincoln County

VERA CRUZ LEASING (Carrizozo)—Mill to be enlarged to 100-ton capacity. Will add cyanide plant. R. B. Foster, of El Paso, president and manager.

Socorro County

JOHNSON (Mogollon)—Shipping high-grade ore to smeltery from new north and south vein recently cut. Main shaft at Socorro plant now down to 1200 level. Station and crosscuts started.

MOGOLLON MINES (Mogollon)—Milling ore opened on third level recently. Preparing to operate at Deadwood mine.

OAKS (Mogollon)—Work on ore bins, track grade to Central shaft, and hoist installation progressing for new tramway.

Taos County

R. & S. MOLYBDENUM (Questa)—Driving three tunnels in ore averaging 10% MoS_2. Flotation mill rebuilt, and to produce one ton 80% MoS_2 daily within 30 days. Forty men employed. New 100-ton flotation unit planned; survey completed, and work to start in spring. Will run by water power. Operators, M. B. Rapp and C. W. Savery. Information furnished by former.

OKLAHOMA

Joplin District

AMY T. (Miami)—Has reached ore in new shaft at 250-ft. depth.

ASSOCIATED (Quapaw)—Operation of new mill begun.

ST. LOUIS S. & R. (St. Louis, Okla.)—Installing hand jig plant on Weiss lease, south of Hockerville.

PENNSYLVANIA

Chester County

CRUCIBLE ROCK GRAPHITE (Chester Springs) — New electrostatic installation working satisfactorily on graphite.

TENNESSEE

Polk County

OCOEE COPPER (Ducktown)—Sinking shaft to orebody. Company incorporated in 1917, successor to Chattanooga Copper Co. E. Whiunen, superintendent; J. I. Carter, president. Headquarters, Chattanooga.

TEXAS

Brazoria County

FREEPORT SULPHUR (Freeport)—Will build topping plant of 3600 bbl. capacity at its property to skim Mexican crude oil, of which it uses 4000 bbl. per day. Will save 400 bbl. of distillates per day.

UTAH

Juab County

CENTENNIAL EUREKA (Eureka)—Preparing to follow ore on 1900 level below water level, which is at 2100 ft. Some old development on 2300 level.

CROWN POINT (Eureka)—Arranging to continue sinking from 800 level to 1000-ft. depth.

IRON KING (Eureka)—Shaft down 1200 ft. Will go to 1400 level instead of drifting at 1200 level, as intended. Will prospect for ore channel opened in Tintic Standard to south.

UNCLE SAM (Eureka)—Operated entirely by lessees.

Salt Lake County

SELK (Alta)—Working 12 men and shipping about carload of ore per week.

BINGHAM AMALGAMATED (Bingham Canyon)—Workings drained by connecting 400 level with Congor on the northwest, which is reached by raise from Montana-Bingham tunnel.

BIG COTTONWOOD CONSOLIDATED (Salt Lake)—Contract given to extend main tunnel 100 feet.

Summit County

NEW QUINCY (Park City)—New ore being developed by winze below 900 level. Fissure four feet wide and carries varying amounts of silver-lead ore, which is being saved.

CANADA

British Columbia

MAGNESITE discovery along railroad in Cariboo district, reported by A. Dean, 103 Carter-Cotton Bldg., Vancouver, B. C., who claims rock showing 83% magnesium carbonate is on surface.

W. G. TANNER developing copper property, four miles east of Agassiz, B. C., owned by Kennedy & Sullivan, Seattle. Building camp, including bins, light aërial tramway, and sleigh road. Work started in October.

MONITOR (Alberni)—Installing compressor plant and constructing bins, wharf, etc., on Alberni Canal. Copper property; Samuel Ryder, owner; James L. Skene, superintendent.

MOORE (Barkerville)—A. Moore and associates obtained control of old placer property this fall and have been preparing to operate.

BLUE GROUSE (Cowichan district)—Shipped two carloads of ore to Trail smeltery.

FIDDLER CREEK GOLD (Dorreen)—Reorganizing company. Expect to develop further in 1919 and install power plant and concentrator.

HARRIS (Hazelton)—Will start work at mine this winter. Duke Harris in charge.

ARLINGTON (Kaslo)—M. Davys, lessee, shipping high-grade ore to Trail smeltery. Expects to erect mill to treat lower-grade material.

SILVER STANDARD (New Hazelton)—Fifty-ton mill built last winter operated for last eight months. Ore high grade, concentrating about five to one. Products are high-grade lead concentrates, shipped to Trail smeltery, and zinc-silver concentrates, shipped to U. S. Zinc Co., Sand Springs, Okla. Mill run only one shift, owing to lack of men. Ore hauled from mine 2¾ miles by Packard 3½-ton truck. Principal owner, Brig. Gen. J. W. Stewart, director general of transportation for British Army. W. G. Norrie-Lowenthal is manager.

LUCKY FOUR (St. Elmo)—Building camp, including 10-mile road, prospecting and stripping copper ledge. Driving crosscut adit. Owners, Sperry & White, Seattle. Superintendent, A. S. Williamson.

SILVERSMITH (Sandon)—Returns on two carloads of crude ore and two of concentrates shipped to Trail smeltery netted $24,284, with 10% still due, pending final settlement.. Five other carloads also shipped. In storage at mill are 100 tons of silver-lead concentrates and 600 tons of zinc concentrates. All materials, except one carload, produced since mill was started on Oct. 5 last. Development pushed prior to that date.

BABINE-BONANZA (Smithers) — Will build tramway and small concentrator next spring. James Cronin is superintendent.

D. D. MANN (Stewart)—Has gold-silver property under bond on Salmon River. Prospected during last season.

IRON KING (Vancouver)—Construction of spur track to railroad finished Oct. 15. Installing steam shovel and other equipment for mining iron ore. Near Alta Lake on P. G. E. Ry. Owners, J. H. Thompson and associates.

LYNN VALLEY COPPER-GOLD (North Vancouver)—Building ore bins and camp buildings; also automobile road. W. F. Dunphy in charge.

Ontario

OTISSE (Fort Matachewan)—Will open up on more extensive scale. Only property in new camp on which much work has been done or is projected.

LAKE SHORE (Kirkland Lake) — Treated 1820 tons of ore in November and recovered $49,600.

JUPITER (Porcupine)—Control vested in McIntyre being wound up, under voluntary liquidation. General shareholders' meeting in Montreal Dec. 27.

PLENAURUM (Porcupine)—Under option to McIntyre. Work delayed by heavy flow of water and influenza. Option expired Dec. 31.

Manitoba

MANDY (Schist Lake)—Mined 10,000 tons last season, which will be hauled to head of navigation during winter and shipped by boat next summer.

MEXICO

Baja California

COMPAGNIE DU BOLEO (Santa Rosalia)—November production was 2,072,324 lb. of copper.

HONDURAS

OPTECA MINE, in Department of Comayagua will be opened up by American company. Will build dam across Humuya River for hydro-electric plant to supply power to mine and mill, three miles away. Work begun. Property silver-gold.

The Market Report

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec. Jan.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
26	4.7580	101⅛	..	30	4 7580	101⅛	48 7/16
27	4 7580	101⅛		31	4 7585	101⅛	48 7/16
28	4 7580	101⅛	48 7/16	1			

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec. Jan.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
26	*	†	5½	5.35	7.50 @7.60
27	*	†	5½	5.10	7.50 @7.60
28	*	†	5½	5.10	7.45 @7.55
30	*	†	5½ @5¾	5½ @5¾	7 47½ @7 52½
31	*	†	5¼ @5¾	5¼ @5¾	7.40 @7 50
1	....	...		.	. .

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

* No market. Producers ask 26c. No buyers.

† No market. Major supplies held for distribution at an arbitrary price of 72½c.

LONDON

Dec. Jan.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
26	(b)	...	...	...	.	. .	.	.
27	(b)	...	...	...	.	. .	....	
28	(b)	...	.	.		...	.	
30	112	100	122	250	243	40½	39½	56
31	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1	(b)	...	....	...	.	...	....	.

(a) Not received. (b) Holiday.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

The quotations for copper have come in a rather confused way this week. We have given the mean of the figures cabled. The figures will be subject to correction when more definite information is received.

Metal Markets

NEW YORK—Dec. 31, 1918

Conditions are very slow in clearing up. There was not much progress this week. Important developments are expected to begin, however, with the advent of the new year. With the expiration of the authority of the War Industries Board at the end of Dec. 31, all price-fixing agreements become illegal, except as they are permitted by the Webb Act, and the Government intimated that it will prosecute any infractions of the Sherman Law.

Europe makes no inquiries for metals in this market. There are shrewd suspicions that the European governments will arrange to use up their own stocks before they buy any more supplies.

The London metal prices for Dec. 24 are: Spot copper, £112; 3 mo., £100; spot tin, £264; 3 mo., £256; spot lead, £40½; 3 mo., £39½; spot zinc, £56.

Copper

Copper—The Export Association has announced 23c. as its price, but so far that is more a wish than a realization. There was, perhaps, some thought that this would be an intimation to domestic consumers, but the latter laughed at the idea of buying copper at present. In general, the same conditions as in the previous week continued to prevail, and we report simply "No market."

The selling committee of the Copper Export Association comprises Joseph Clendenin, chairman. T. Wolfson (Anaconda), C. A. Austin (Phelps Dodge Corporation), and F. S. Gourley (Calumet & Hecla). The office is at 60 Broadway, New York.

Copper Sheets—The base price of copper sheets is 35@36c. per lb. Copper wire is quoted at 25½c. per lb. f.o.b. mill, carload lots.

Lead

Lead—Lead was offered at lower prices from day to day, which offers resulted in only small business. On Dec. 30 the American Smelting and Refining Co. reduced its price to 6c. Since then there has been some irregularity, lead continuing to be offered at low prices from some quarters, while bids at higher prices, that were unaccepted, were received in other quarters, and actual transactions were made at a variety of prices. Such a temporary irregularity is not surprising, in view of the generally chaotic conditions.

Tin

Tin—No change in the general situation. Scarcely any outside business was done.

In London on Nov. 25 the public stocks of tin totalled 475 tons, made up as follows: Straits and Australian, 395 tons; Chinese, 5 tons; and English, 75 tons. In Liverpool on the same date the stocks were 1186 tons, as follows: Straits, 930 tons; Banca, 10 tons; English refined, 34 tons; common, 212 tons.

The British Ministry of Munitions recently announced the following stocks of imported metals (exclusive of old metal and scrap) in Great Britain and in possession of the ministry: Copper, 27,530 long tons; common spelter, 18,768 tons; refined spelter, 6544 tons; aluminum, 10,215 tons; pig lead, 40,111 tons; nickel, 1735 tons; antimony, 3303 tons.

Zinc

Zinc—Business was very light. What was reported was wholly for prompt and January shipment, which business was done at gradually declining prices, with 7.40@7.50c. being representative at the close. Producers would like to sell three-months contracts, but, while they would accept 7⅝c. for such, no actual business developed. While buyers in this market are conspicuous by their absence, there is no great pressure to sell.

The condition in the zinc market is also reflected in the reports from Platteville, Wis., and Joplin, Mo., where, in the first mentioned place, zinc ore is unquotable.

Zinc Sheets—Changed to $13 per 100 lb. from and after Jan. 1, 1919.

Other Metals

Aluminum—Unchanged at 33c. per lb.

Antimony—There was further weakness in this market, with offerings at 7¼c., which we quote at the close.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50@1.75 per pound.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Dull and unsettled at $115. No quotation from San Francisco was received today.

Silver and Platinum

Silver—Stationary at the fixed price. New York official, $1.01⅛ per oz. 1000 fine.

The demand for the East still continues. The mintage of the English silver coinage for the last year has been very large. The figures for the issue have not yet been released, but they will represent several million pounds sterling. London shipments week ended Dec. 28 were 520,000 ounces.

Mexican dollars at New York: Dec. 26, 77½; Dec. 27, 77½; Dec. 28, 77½; Dec. 30, 77½; Dec. 31, 77½. Jan. 1, ——.

Platinum—Refined ingot is quoted at $105.

Palladium—Quoted at $125.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 28—Zinc-ore market unquotable. One or two cars of premium-grade blende sold at $55 per ton. No sales of lead ore are reported. Shipments for the week were 979 tons blende and 52 tons sulphur ore. For the year to date the totals are 120,854 tons blende, 7791 tons galena and 39,575 tons sulphur ore. During the week, 2163 tons blende was shipped to separating plants.

Joplin, Mo., Dec. 28—Blende, per ton, high, $47.80; basis 60% zinc, premium, $55; Class B, $44; Prime Western, $42.50; sludge and flotation, $40@37.50; calamine, basis 40% zinc, $30. Average selling prices: Blende, $42.95; calamine, $36.33; all zinc ores, $42.47. Lead, high, $99.50; basis 80% lead, $80@65; average selling price, all grades of lead, $81.97 per ton. Shipments the week: Blende, 6109; calamine, 477; lead, 1202 tons. Value, all ores the week, $378,170. Shipment the year: Blende, 469,327; calamine, 22,133; lead, 75,588 tons. Value all ores the year, $31,881,240.

Producers have closed new arrangements with the manufacturers of rolled zinc for a base price of $55 for blende on a 15c. price for sheets. Some ore was purchased this week, and will be allocated for next week's delivery.

During four years ending with 1916 the average weekly tonnage of ore shipped was 5442. The following two years the average was 8790 tons per week. The production still continues around 8000 tons per week. Some are wondering if conditions warrant a continuation of this tonnage, with the war demand closed. Stock in the bins, partly sold, aggregates approximately 20,000 tons of blende.

Lead prices were lowered to $65 at the week-end, a drop of $15 per ton.

Other Ores

Manganese, Chrome and Tungsten—Unchanged.

Other Minerals

Pyrites—Spanish pyrites is quoted, subject to the raising of the embargo, at 16½c. on the basis of 10s. ocean freight. Restrictions still continue. Unchanged.

Iron Trade Review

NEW YORK—Dec. 31, 1918

The new year opens with fresh evidences of slackening activity throughout the steel trade, according to "Iron Age." In the holidays there have been many shut-downs for repairs, but resumptions this week at a number of mill centers have not been with full forces, and the prospects in some lines are that a further slowing down may come.

In every quarter the question of the readjustment of contracts to the lower prices adopted two weeks ago by leading sellers is uppermost. Pig-iron producers set out to hold to the old prices, but in the last week the calls upon them for the revision of contracts have grown in numbers and in urgency. Some furnace companies seem inclined to yield, while others strenuously insist that contracts be carried out as written. The falling off of foundry operations is a factor to which more consideration is being given, however, and the adoption of the lower basis for pig iron has found more favor than was indicated a week ago.

That some blast furnaces will not long operate with $3 taken from their market price is evident, and the readjustments in finished material will likewise impose some hard choices on high-cost mills which must buy their raw materials in the market.

The annual statistics of "Iron Age" show that 14 new openhearth steel furnaces were completed and put in operation in 1918, with an annual capacity of 1,945,000 tons, against 4,326,000 tons a year for that added in 1917. New steel capacity projected for 1919 or now under construction represents only 1,130,000 tons a year, and at that is more than the industry calls for under the present conditions. Blast furnace construction is more in line with steel requirements than for several years. Eight furnaces were completed in 1918, with a capacity of 1,440,000 tons a year while seven are now under construction, representing 1,260,000 tons a year.

PITTSBURGH—Dec. 30

The iron and steel market is extremely quiet in all its branches, with the exception of sheets, which have been moderately active. Although the season of the year would account of the dullness, the common view is that in large part it reflects the unsettlement caused by the war's ending and the delay that must occur before business can be resumed in full force. After about the middle of January, buying for ordinary requirements will probably be resumed, but heavy buying, in connection with construction jobs and other investments, must necessarily await the settlement of various matters.

Perhaps the most interesting feature of this dull market is the fact that the blast furnaces have not accepted the suggestion, involved in the schedule of price reductions that had been formulated for presentation to the War Industries Board Dec. 11, that pig-iron prices be reduced $3 a ton. Western Pennsylvania and Valley furnaces are nominally quoting the same prices as formerly. Practically they are quoting no prices, since there is no inquiry to speak of, and there is the circumstance that the furnaces having less freight to Pittsburgh than the Valley rate are disposed to quote on a Valley basis. Several Alabama furnace interests have reduced their quotations $3 a ton, to $31, Birmingham, for No. 2 foundry, but even this reduction does not make their iron competitive with northern, on account of the freight differentials, as the Birmingham-to-Pittsburgh rate is $5.70 making $31, Birmingham, equal to $36.70, Pittsburgh, whereas $34, Valley, is $35.40 Pittsburgh.

Steel mills have been shipping heavily against specifications previously filed, and most buyers are fairly well supplied with steel. In wire products, in particular, shipments have been such that jobbers are disposed to call a halt. The most promising branch of the finished steel trade is the sheet branch, which is in receipt of fairly heavy specifications, particularly from automobile makers, and expects to operate at about 85% capacity in January.

Steel

Steel—There are offerings of soft steel at the new prices, $13.50 for billets, $16 to $17 for sheet bars and small billets, and $16 for slabs, but there is hardly any buying. Discard steel is being offered rather freely. The Government has considerable quantities, arising out of adjustments upon the termination of shell contracts, but is trying to dispose of the material in such manner as to disturb the market as little as possible.

Ferroalloys

Ferroalloys—The ferromanganese market is a long way from finding a definite level. Consumers are thinking more of cancelling contracts than of making fresh purchases. Furnaces refuse to cancel except on the payment of heavy damages, one producer offering to cancel a contract calling for 70% at $250 by the payment of $100 cash per ton. Consumers desire that the manufacture of 80% alloy should be resumed but furnaces are opposed. Resale lots recently offered have been withdrawn, as they elicited no bids.

Coke

Coke—It seems to be established that the Fuel Administration's control of coke prices will be continued to Feb. 1 at least. If the limitation was withdrawn, coke would probably advance, as it is scarce.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan	56 775	75 630	88 702	26 960	36 682	44 356
Feb	56 755	77 585	85 716	26 975	37 742	42 792
Mar	57 935	73 861	88 082	27 597	36 410	43 620
April	64 415	73 875	95 346	30 662	36 963	47 215
May	74 269	74 745	99 505	35 477	37 940	48 980
June	65 024	76.971	99 500	31 060	39 065	48 875
July	62 940	79 010	99 625	30 000	40 110	48 813
Aug	66 083	85 407	100 292	31 498	43 418	49 077
Sept	68 515	100 740	101 125	32 584	50 920	49 500
Oct	67 855	87 332	101 125	32 361	44 324	49 500
Nov.	71 604	85 891	101 125	34 192	43 584	48 969
Dec	75 765	85 960	101 125	36 410	43.052	48.492
Year	65 661	81 417	96 772	31 315	40 851	47 516

New York quotations cents per ounce troy, fine silver. London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan	28 673	23 500	131 921	110 000	142 895	125 000
Feb	31 750	23 500	137 895	110 000	148.100	125 000
Mar	31 481	23.500	136 750	110 000	151 000	125 000
April	27 935	23 500	133.842	110.000	147 158	125.000
May	28 788	23 500	130 000	110.000	142.000	125 000
June	29 962	23.500	130 000	110.000	142 000	125 000
July	26 620	25 904	128.409	119.913	140.409	134 913
Aug	25 380	26 000	122.391	122.000	137.000	137.000
Sept	25 073	26 000	117.500	122.000	135 250	137.000
Oct	23 500	26 000	110 000	122 000	125 000	137.000
Nov	23 500	26.000	110.000	122.000	125 000	137.000
Dec	23 500	(a)	110.000		125.000	
Year	27 180	24 628	124 892		138 401	

(a) No Marked.

Tin	New York		London	
	1917	1918	1917	1918
January	44 175	85 500	185 813	293.227
February	51.420	92.000	198 974	311.525
March	54.388	(a)	207 443	318 875
April	55.910	(a)	220.171	329.905
May	63 173	(a)	245.114	364 217
June	62.053	(a)	242 083	331 925
July	62 570	(a)	242 181	360.347
August	62.681	(a)	243 978	380 900
September	61.542	(a)	244 038	343 905
October	61 851	(a)	247 467	335 543
November	74 740	(a)	274 943	323.550
December	87.120	(a)	298 556	
Av. year	61 802	88 750	237.563	....

(a) No average computed.

Lead	New York		St Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7 530	6 684	30 500	29 00
February	8.636	6 973	8 595	6 899	30 500	29 00
March	9 199	7 201	9 120	7 091	30 500	29 00
April	9 288	6.772	9 158	6 701	30 500	29 00
May	10.207	6.818	10 202	6 704	30 500	29 00
June	11.171	7.611	11 123	7 511	30 500	29 00
July	10 710	8.033	10 644	7 750	30 500	29 00
August	10 594	8 050	10 518	7 750	30 500	29 00
September	8 680	8 050	8 611	7 750	30 500	29 00
October	6 710	8 050	6 650	7 750	30 500	29 00
November	6 249	8.050	6 187	7 750	30 500	31 20
December	6 375	0.564	6 312	6.324	30 500	
Year	8 787	7 413	8 721	7 222	30 500	

Spelter	New York		St Louis		London	
	1917	1918	1917	1918	1917	1918
January	9 619	7 836	9 449	7 661	48 329	54 000
February	10 045	7 814	9 875	7 639	47 000	54 000
March	10 300	7 461	10.130	7 286	47 000	54 000
April	9 459	6 890	9 289	6 715	54 632	54.000
May	9 362	7 314	9 192	7 114	54 000	54 000
June	9 371	8 021	9 201	7 791	54 000	54 000
July	8 643	8 688	8 473	8 338	54 000	54 000
August	8 360	8.985	8 190	8 635	54 000	54 000
September	8 136	9 442	7 966	9.092	54 000	54 000
October	7 083	8 801	7 813	8 451	54 000	54 000
November	7 847	8 491	7 672	8 141	54 000	54 100
December	7 685	8 163	7 510	7.813	54 000	
Year	8 901	8 159	8 813	7 890	52 413	

New York and St Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh	Bessemer‡		Basic‡		No 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35 95	$37 25	$30 95	$33 95	$30 95	$33 95
February	36 37	37 25	30 95	33 95	30 95	33 95
March	37 37	37 25	33 40	33 95	35 91	33 95
April	42 23	36 15	38 00	32 95	40 06	33 95
May	46 91	36 20	42 81	33 00	43 60	34 00
June	64 22	36 36	50 05	33 18	50 11	34 16
July	57 45	36 60	53 90	33 40	63 95	34 40
August	51 17	36 60	50 37	33 40	63 95	34 40
September	46 10	36 60	42 24	33 40	48 58	34 40
October	37 25	36 60	33 95	34 40	33 95	35 40
November	37 25	36.60	33 95	34 40	33 95	35 40
December	37 25	30.60	33 95	34 40	33 95	35 40
Year	$43 57	36 67	$39 62	33.70	$40 83	34.45

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec 30
Alaska Gold M	3
Alaska Juneau	1
Am.Sm & Ref.,com.	74
Am.Sm. & Ref., pf.	106
Am.Sm.Sec., pf., A.	‡92
Am Zinc	11
Am Zinc, pf	41
Anaconda	59
Batopilas Min	1
Bethlehem Steel	60
Butte & Superior	17
Butte Cop & Zinc	5
Cerro de Pasco	33
Chile Cop	17
Chino	31
Colo Fuel & Iron	36
Crucible Steel	56
Crucible Steel, pf.	88
Dome Mines	11
Federal M. & S.	9
Federal M. & S., pf	37
Greater Nor., ore ctf	31
Greene Cananea	44
Gulf States Steel	59
Homestake	‡94
Inspiration Con	46
International Nickel	32
Kennecott	31
Lackawanna Steel	66
Mexican Petrol	167
Miami Copper	22
Nat'l Lead, com.	62
National Lead, pf	105
Nev. Consol	16
Ontario Min	7
Ray Con	20
Republic I & S, com.	73
Republic I & S, pf	‡97
Sloss-Sheffield	50
Tennessee C. & C.	13
U. S. Steel, com	94
U. S. Steel, pf	112
Utah Copper	72
Va. Iron C. & C.	57

BOSTON CURB*	Dec. 30
Alaska Mines Corp.	‡ 12
Boston Ely	90
Boston & Mont	53
Butte & Lon'n Dev.	.13
Calaveras	1
Chief Con	3
Contact	‡.05
Corbin	‡ 25
Cortez	.14
Crown Reserve	.27
Crystal Cop.	.27
Eagle & Blue Bell	2
First Nat. Cop	‡2
Houghton Copper	.30
Intermountain	‡ 05
Iron Blossom	.48
Iron Cap.	15
Majestic	.20
Mexican Metals	.32
Mines of America	‡.75
Mojave Tungsten	.05
Nat. Zinc & Lead	.10
Nevada-Douglas	.35
New Baltic	1
New Cornelia	16
Oneco	20
Pacific Mines	‡ 35
Rex Cons	‡ 05
Yukon Gold	‡1

SAN FRAN.*	Dec 29
Alta	‡ 03
Andes	03
Best & Belcher	01
Caledonia	01
Challenge Con	03
Confidence	05
Con Virginia	05
Gould & Curry	‡ 01
Hale & Norcross	01
Jacket-Cr Pt	06
Mexican	02
Occidental	40
Ophir	02
Overman	01
Savage	‡ 02
Sierra Nevada	08
Union Con	03
Utah Con	‡ 01
Belmont	2 50
Jim Butler	35
MacNamara	.31
Midway	19
Mont.-Tonopah	.13
North Star	07
Rescue Eula	‡ 07
West End Con.	‡1 20
Atlanta	04
Booth	13
Comb Frac	‡ 02
Florence	.12
Jumbo Extension	13
Kewanas	06
Nevada Hills	06
Nevada Packard	.31
Round Mountain	.24
Silver Pick	05
White Caps	09

COLO. SPRINGS*	Dec 29
Cresson Con	5 00
Doctor Jack Pot	04
Elkton Con	06
El Paso	14
Gold Sovereign	‡ 02
Golden Cycle	1 75
Granite	18
Isabella	06
Mary McKinney	07
Portland	1 00
United Gold M.	.14
Vindicator	44

BOSTON EXCH.†	Dec. 30
Adventure	‡ 60
Ahmeek	‡71
Algomah	‡.30
Allouez	41
Ariz Com	‡12
Arnold	‡ 20
Bingham Mines	9
Bonanza	‡.10
Butte-Balaklava	‡ 30
Calumet & Ariz	61
Calumet & Hecla	426
Centennial	‡14
Copper Range	40
Daly West	‡2
Davis-Daly	5
East Butte	9
Franklin	3
Granby	‡79
Hancock	5
Hedley	‡12
Helvetia	‡.20
Indiana	‡.80
Isle Royale	24
Keweenaw	‡1
Lake	4
La Salle	‡3
Mason Valley	‡2
Mass	4
Mayflower	3
Michigan	‡3
Mohawk	50
New Arcadian	‡1
New Idria	10
North Butte	10
North Lake	55
Ojibway	‡1
Old Dominion	33
Osceola	48
Quincy	59
St. Mary's M. L.	40
Santa Fe	25
Seneca	15
Shannon	2
Shattuck-Ariz.	14
So. Lake	‡1
So. Utah	10
Superior	5
Superior & Bost	3
Trinity	2
Tuolumne	.77
U. S. Smelting	44
U. S. Smelting, pf	47
Utah Apex	3
Utah Con	7
Utah Metal	1
Victoria	1
Winona	.90
Wolverine	18
Wyandot	‡ 50

N. Y. CURB†	Dec. 30
Big Ledge	[illegible]
Butte & N. Y.	[illegible]
Butte Detroit	.02
Caledonia	28
Calumet & Jerome	[illegible]
Con Cop. Corpn	2
Carlisle	‡2
Cashboy	.08
Con Ariz. Sm	1
Con Coppermines	6
Goldfield Con	21
Goldfield Merger	06
Greenmonster	[illegible]
Hecla Min	4
Howe Sound	4
Jerome Verde	‡ 50
Louisiana	[illegible]
Magma	25
Marsh	‡ 05
McKinley-Dar-Sa	‡ 47
Milford	‡ 75
Mother Lode	35
Nixon Nevada	43
Ohio Cop	‡.75
Rawley	‡2
Ray Hercules	3
Richmond	‡ 56
Rochester Mines	27
St Joseph Lead	11
Standard S L	.25
Stewart	16
Success	07
Tonopah	‡3
Tonopah Ex	2
Tribullion	[illegible]
Troy Arizona	‡ 10
United Eastern	4
United Verde Ext	‡35
United Zinc	[illegible]
Utica Mines	‡ 08

TORONTO*	Dec 30
Adanac	10
Bailey	04
Beaver Con	38
Chambers Ferland	10
Coniagas	‡3 00
Hargraves	02
Kerr Lake	5 37
La Rose	18
Lake Shore	90
Min Corp of Can.	‡2.00
Nipissing	8 75
Peterson Lake	.08
Temiskaming	31
Wettlaufer-Lor.	‡ 03
Davidson	‡ 60
Dome Exten	24
Dome Lake	17
Hollinger	6 00
McIntyre	1 62
Newray	12
Porcu. Crown	25
Teck-Hughes	.30
Vipond	21
West Dome	14

* Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

January 11, 1919

Volume 107

Number 2

Theodore Roosevelt

In the death of Theodore Roosevelt, not only did the United States of America lose its greatest citizen, its greatest man, but also the whole world lost a leader and a friend. Roosevelt was never greater than during the last four years, when he held no office; but certainly it has been truly said "if our soldiers were given the great privilege of turning the tide in France, if our ideals are now impressing themselves upon all the earth, it is because Theodore Roosevelt, by pen and voice, awakened us and compelled us to look and listen."

While America mourns its loss and at the moment does not know who will replace him, Roosevelt himself, if he had been able to communicate a parting message to his countrymen, would have repeated his words when he was shot and was in danger of death in 1912:

> It matters little about me, but it matters all about the cause we fight for. If one soldier who happens to carry the flag is stricken, another will take it from his hands and carry it on. One after another the standard bearers may be laid low, but the standard itself can never fall. You know that personally I did not want ever to be a candidate for office again, and you know that only the call that came to the men of the sixties made me answer it, in our day as they did more nobly in their day. And now, as then, it is not important whether one leader lives or dies. It is important only that the cause shall live and win. Tell the people not to worry about me, for if I go down another will take my place. For always the army is true. Always the cause is there, and if it is the cause for which the people care, it is the people's cause.

But, however inspiring be those noble words, this country cannot but mourn the untimely death of one of the greatest Americans of all time.

Introduction

We are precluded by the exigencies in connection with the issuance of the Annual Review Number, which months ago was preëmpted for special purposes, from paying the tribute that we should ordinarily to two distinguished Americans who have died since we last went to press. We refer, of course, to Theodore Roosevelt and Rossiter W. Raymond. Theodore Roosevelt died suddenly on Jan. 6. Dr. Raymond died, also suddenly, on Dec. 31. In our next issue we shall publish a biographical sketch of Dr. Raymond.

The successful completion of the Great War brought a realization of the vital importance of the metal industry as one of the fundamental requirements needed to combat oppression and to insure peace.

We regret the unavoidable limitation of the number of pages in the Annual Review Number and the resultant circumstance that the publication of a few additional papers and reviews must necessarily be deferred for future issues. At the same time, a glance at the index page will show that few subjects of importance or interest have not been presented in the succeeding pages.

The production of the more important metals is summarized in the table on this page. The details appear on subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this number in a few days leaves no time for leisurely comparison and revision to effect a careful coördination of all the data.

PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1916	1917	1918
Copper (*a*).....	Pounds.......	1,942,776,309	1,922,555,907	1,869,949,686
Gold (*b*)........	Dollars.......	92,590,300	83,750,700	68,493,500
Iron...........	Long tons.....(*f*)	39,434,797	(*f*) 38,621,216	38,820,000
Lead (*c*)........	Short tons.....	592,241	581,716	550,729
Nickel (*e*)......	Pounds.......	72,611,492	75,510,793	62,994,376
Silver (*b*).......	Troy ounces..	74,414,802	71,740,362	67,879,206
Zinc (*d*)........	Short tons....	680,018	682,411	525,122
Quicksilver (*g*)..	Flasks........	29,932	35,954	35,000
Tin...........	Short tons....	....	6,065	10,300

(*a*) Production from ore originating in the United States. (*b*) The statistics for 1916 and 1917 are the final and those for 1918 are the preliminary statistics reported jointly by the directors of the Mint and the U. S. Geological Survey. (*c*) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (*d*) Total production of smelters, except those treating dross and junk, exclusively; includes spelter derived from imported ore. (*e*) Imports; for 1918, first 10 months only. This nickel is refined in the United States for the production of metal, oxide and salts. (*f*) American Iron and Steel Institute. (*g*) U. S. Geological Survey.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1916	1917	1918
Coal, anth. (*a*)..	Short tons....	87,578,493	99,611,811	99,473,000
Coal, bitu. (*a*)...	Short tons....	502,519,682	551,790,563	585,883,000
Iron ore (*a*).....	Gross tons....	75,167,672	75,288,851	72,630,237
Magnesite (*a*)...	Short tons....	154,974	316,838	225,000
Petroleum (*a*)...	Barrels.......	300,767,158	335,315,601	345,500,000
Potash (*a*)......	Short tons....	9,720	32,573	60,000

(*a*) U. S. Geological Survey.

In general there were no great increases in the production of any of the major metals in 1918, either in the United States or in the world. Speaking of the United States, pig iron and lead were about stationary. Copper decreased a little and zinc a good deal. The noteworthy features in the world's statistics so far as available are the large decrease in gold production, a small decrease in copper production and a small increase in lead production. Gold mining suffered from causes peculiar to itself. The world's producing capacity for copper and lead was manifestly taxed to the utmost.

To all of the contributors who assisted in the preparation of this number, and also to the many who collaborated in the collection of statistical information, we tender our thanks. We also gladly thank the producers of copper, lead, spelter, and other metals, minerals, and ores who have communicated to us the amount of their output in 1918 and have thereby enabled a close approximation to the actual production of that year to be made by Jan. 8, 1919, the time at which this issue went to press.

Metal Markets

NEW YORK—Jan. 8, 1919

The metal markets this week have been rather chaotic, especially copper. On the other hand, lead seems to be beginning to find itself. A free market seems to be developing in American tin. Irregularities everywhere are only natural under the conditions of the markets, which are just emerging from state control.

Copper—On Jan. 2 electrolytic copper was offered for January-March delivery at 20½c., but that failed to develop business, and there were reports of several million pounds having been bought by a large manufacturer at 20c. On Jan. 3 business to the amount of several hundred thousand pounds for January delivery was certainly done at 20c., and sales were made at that figure on each day thereafter. At the same time 21c. was reported realized in some quarters, and even 23c., but as to the one sale reported at the last figure there were special conditions, wherefore it may be disregarded as an index of the market. The large producers, who are nominally asking 23c., made no sales. Such business as was done during the week was by small producers, of whom at least three made sales. The aggregate of their business was not more than 5,000,000 lb., which, of course, is insignificant in comparison with the amount of copper that has to be sold even to dispose of current production. We are unable at present to determine how the business of this week should be quotationally represented. At a later date, with further information, we may be able to supply figures for each day subsequent to Jan. 1 for the purpose of computing an average for the month. As yet there is no real market for copper in the ordinary sense. It can be bought, but it cannot be sold except in sporadic and limited ways. Even if producers should reduce their prices drastically, they would probably be unable at the moment to sell materially more copper than now. The market is still in a trance, out of which it has got to come and then find himself.

Cables were received from London today to the effect that the British government is offering its electrolytic copper to consumers at £105, which would be 22.25c. Freights are variously reckoned at 3 to 3½c., and insurance and other charges at ¼ to ½c., and the New York equivalent of the London price is computed to be 18½ to 19 cents.

Copper Sheets—The base price of copper sheets is 33c. per lb. Copper wire is quoted at 22½c. per lb. f.o.b. mill, carload lots.

Tin—This market was stagnant, but there were repeated offers to sell American tin 99% grade, and the indications are that an independent market has developed upon this basis. We resume tin quotations upon this basis.

Lead—After declining to 5½c., speculative interest seemed to be aroused, and sellers, being averse to seeing the metal pass into the hands of such interests at any such figure, withdrew their offers and demanded higher prices. This naturally stimulated the interest of consumers, who always buy on a rising market rather than on a falling, and some business was done with them, which, although small in the aggregate, was, nevertheless, considerably larger than the total of the previous week. Toward the close of this week the market exhibited a fair degree of stability around 5¾c., New York.

The reason for the advance in lead in London on Nov. 25 from £29 net to £40 net was solely the desire of the British government to establish the market values at or about cost. All the lead imported into England, making due allowance for freights, war risk and other insurances, exchange as well as financial arrangements, cost the government much above the figure of £29 at which the metal was released for war purposes. There are now no war purposes, and the necessity for the government maintaining the lower level ceased to exist. The London market will sooner or later return to the control of normal trading conditions.

Zinc—This market continued to slide off on relatively small business. High-grade spelter, guaranteed 99.9%, was sold at 8½c., and this had an effect upon the market for common spelter. Indeed, the situation in high-grade spelter has been for six weeks back dominating the market for common spelter to a greater degree than has commonly been appreciated.

Zinc Sheets—Price now $13 per 100 lb.

SILVER AND STERLING EXCHANGE

		Silver				Silver	
Jan.	Sterling Exchange	New York, Cents	London, Pence	Jan.	Sterling Exchange	New York, Cents	London, Pence
2	4 7585	101⅛	48 7/16	6	4 7580	101⅛	48 7/16
3	4 7585	101⅛	48 7/16	7	4 7580	101⅛	48 7/16
4	4.7580	101⅛	48 7/16	8	4 7580	101⅛	48 7/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Jan.	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
2	*	68½	5¾ @5⅞	5½ @5.60	7 35 @7 45
3	*	68½	5⅝ @5¾	5½ @5 60	7 30 @7 40
4	*	68½	5⅝ @5¾	5.60 @5.70	7 30 @7 40
6	*	68½	5¾	5.60 @5.70	7 30 @7 40
7	*	68½	5¾	5.60 @5.70	7 30 @7.35
8	*	68½	5¾	5.60 @5 70	7.25 @7 30

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

* Undetermined.

† For American tin of 99% grade.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
Jan.	Spot	3 M		Spot	3 M.	Spot	3 M.	Spot
2	112	90	(a)	235	231	40	35	56
3	(a)	89	122	236	232	40	35	57
4-5								
6	91	87	122	242	236½	40	35	56
7	95	87	105	256	248	40	35	56
8	92	87	105	257	247½	40	35	56

(a) Not received.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Other Metals

Aluminum—Unchanged at 33c. per lb.

Antimony—Very dull, with a little business done at 7½c., which we quote.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50@1.75 per pound.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Weak at $110. No quotation received from San Francisco.

Silver and Platinum

Silver—The demand for silver is still for India chiefly, although London's requirements are about 1,000,000 oz. weekly. Some moderate orders are occasionally in the market for France. Silver for Scandinavian ports has not yet been released, although there are orders in hand for that section for about 500,000 oz. Shipments for last week to London were 1,038,000 ounces.

Mexican dollars at New York: Jan 2, 77½; Jan. 3, 77½; Jan. 4 77½; Jan. 6, 77½; Jan. 7, 77½; Jan. 8, 77½

Platinum Refined ingot is quoted at $105. The U. S Assay Office is reported to be no longer offering.

Palladium—Unchanged at $125.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 4—Blende, per ton, high, $57.60; basis 60% zinc, premium, $50; Class B, $45; Prime Western, $45@42.50; sludge, $42.50@40; flotation, $40@37.50; Calamine, basis 40% zinc, $35@30. Average selling prices: Blende, $43.88; calamine, $34.40; all zinc ore, $43.76.

Lead ore, high, $83.25; basis 80% lead, $80@65; average selling price, all grades of lead, $67.90 per ton.

Shipments the week: Blende, 8837; calamine, 120; lead, 1212 tons. Value, all ores the week, $474,220.

Sales were made last week on a schedule basis for premium ore of $55 for premium blende, but advices this week from the U. S. Attorney General notified buyers and sellers that no price arrangements would be longer permitted by the Government after Jan. 1, and the buyers of premium ore purchased this week on the open market on a basis of $50.

On account of the mines having been forced to close, and a strong demand coming for concentrates, a number of buyers withheld their ore on $42.50 offerings and were later awarded a $45 basis.

Other Ores

Manganese and Chrome Ore—Unchanged.

Tungsten Ore—High-grade wolframite and scheelite offered at $16@17 per unit.

Pyrites—Spanish pyrites is quoted subject to the raising of the embargo, at 16½c. on the basis of 10s. ocean freight. Restrictions still continue. Unchanged.

Iron Trade Review

PITTSBURGH—Jan. 7

The whole iron and steel market is extremely dull. Furthermore, there are no indications that the market will pick up in the near future. No one expects any activity within three months, and already there are those who do not see how a revival can occur in less than six months.

There is a large volume of contract business on the books of steel mills, and it is in specifications against such contracts, rather than in strictly new buying, that activity would be expected to be developed first. The mills are now running chiefly on business that was entered during the war or in the first few weeks afterward, when buyers enjoyed the novel experience of being able to place specifications and orders with knowledge that they would be filled promptly. A few mills are operating at 80 to 90% of capacity, but many are operating at 70% and some at less, so that the average for the whole industry is under 70%, with prospects of still lighter operations within 30 days.

Shipments of finished-steel products under contracts are being made chiefly at the reduced prices that were named last month. In some quarters there are rumors that even before the armistice was signed some mills went out quietly and sold a round tonnage of material at greater cuts below the Government prices than were made openly last month.

There is considerable talk about adoption of the new contract form, which provides for reciprocal damages in case of failure to carry out the contract. Most of the mills state that they will "adopt" the new contract, but whether they would enforce it is another matter. At the present time buyers are quite indisposed to sign the old form of contract, much less the tighter form now proposed.

Pig Iron—The majority of furnaces are strong in their determination to enforce their contracts, chiefly at Government prices, despite the $3 reduction that has now become general. The contracts are legally enforceable, but a question of policy intervenes. Requests for cancellation have been numerous, probably covering more than half the contract business on books. On light sales a market has been established at $3 under the old Government limits, this being in line with the reduction named in the general schedule of reductions that was formulated for presentation to the War Industries Board Dec. 11, but which the board refused to receive. The steel producers adopted the steel reductions at once as already reported, the blast furnaces holding off for a time. We now quote: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. basing point, freight from Valleys to Pittsburgh being $1.40.

Gold and Silver

THE production of gold was checked further in 1918 in all parts of the world, owing to the greatly increased costs for labor and material. In 1918 the plight of the gold miners became very serious, and among them there was clamor for Governmental relief, which demand had a certain sound economic ground, in that the governments had practically impounded gold and prevented a free flow of it, either into commerce or into industry. The British government appointed a commission, and the American Government a committee, to consider this subject; but the advent of peace, with the prospect of declining prices for commodities and labor, will probably remove the necessity of considering the case of the gold miners.

GOLD PRODUCTION OF THE WORLD (a)

	1916	1917	1918
United States	$92,590,300	$83,750,700	$68,500,000
Canada	19,235,000	15,200,000	14,000,000
Mexico	7,690,700	9,000,000	10,000,000
Russia	22,500,000	18,000,000	10,000,000
India	11,206,500	10,756,800	10,100,000
South Africa	192,182,900	186,503,400	176,000,000
South America	15,188,400	14,634,600	15,000,000
Australasia	40,475,800	35,945,500	26,700,000
All other countries	53,106,900	49,799,200	47,000,000
Totals	$454,176,500	$423,590,200	$377,300,000

(a) Figurea for 1916 and 1917 are from the Director of the Mint; 1918 figures are our own estimates.

GOLD PRODUCTION OF THE WORLD FOR 20 YEARS

1899	$311,505,947	1909	$459,927,482
1900	258,829,703	1910	454,213,649
1901	260,877,429	1911	459,377,300
1902	298,812,493	1912	474,333,268
1903	329,475,401	1913	462,669,558
1904	349,088,293	1914	451,582,129
1905	378,411,754	1915	473,124,590
1906	405,551,022	1916	(a) 454,176,500
1907	411,294,458	1917	(a) 423,590,200
1908	443,434,527	1918 (estimated)	377,300,000

(a) As reported by the Director of the Mint.

At this early date the gold production of the world in 1918 can be only approximated. We have the statistics of the Director of the Mint and United States Geological Survey for the United States, and official figures for the British colonies for 10 or 11 months. We can do no more than guess at the production in other countries. However, their aggregate is a minor part of the total. In making the estimate for Russia, we have had the assistance of experts in gold mining in that country.

GOLD AND SILVER PRODUCTION OF THE UNITED STATES (a)

(Gold, Value; Silver, Fine Ouncea)

	Gold		Silver	
	1917	1918	1917	1918
Alabama	$2,200	$700	....	2
Alaska	14,671,400	9,108,500	1,207,164	796,863
Arizona	5,180,600	5,760,200	6,962,257	6,771,490
California	20,929,400	17,207,000	2,107,107	1,555,417
Colorado	15,974,500	12,853,500	7,291,495	6,982,313
Georgia	6,500	3,500	....	41
Idaho	754,800	636,000	11,402,542	10,188,056
Illinois	....	....	7,116	8,939
Maryland	....	....	538	164
Michigan	....	....	684,225	491,939
Missouri	300	200	63,344	40,948
Montana	3,673,200	3,170,600	14,555,034	15,341,793
Nevada	6,932,500	6,662,000	11,217,654	10,113,405
New Hampshire	....	....	....	....
New Mexico	1,085,400	638,200	1,535,807	763,758
North Carolina	10,800	800	590	9
Oregon	1,687,300	1,260,000	172,152	150,207
South Carolina	1,700	....	....	....
South Dakota	7,372,900	6,786,700	190,382	165,865
Tennessee	5,500	5,400	106,975	131,931
Texas	100	100	587,945	612,436
Utah	3,522,100	3,142,500	13,360,905	13,439,811
Vermont	100	800	403	5,117
Virginia	1,300	400	4,500	2,967
Washington	488,200	342,300	266,112	302,446
Wyoming	3,700	400	3,400	719
Continental U. S.	$82,304,500	$67,579,800	71,727,647	67,866,609
Philippinea	1,446,100	913,700	12,715	12,597
Porto Rico	100	....	....	....
Total	$83,750,700	$68,493,500	71,740,362	67,879,206

(a) As reported by the directors of the United States Mint and the Geological Survey.

Without any doubt the world's production of gold in 1918 declined in the neighborhood of $50,000,000; while the decline in 1917, as compared with 1916, was about $25,000,000.

The gold and silver production of the United States for 1918, given in the table, are preliminary estimates. Revised figures will be published later in the year.

Silver in 1918

BY EDWARD BRUSH*

IT IS MORE than usually difficult to estimate the production of silver during 1918, for the reason that the statistical reports as to the commerce of the United States include considerable quantities of coin imported and very large quantities of silver bars exported. These bars were derived from the melting of the Sherman Law dollars held in the Treasury of the United States, and represented by silver certificates in circulation. These statistics prove nothing, therefore, as to the production of silver from the mines of this country or of such countries as largely import their silver product into the United States.

The normal effect of an increased value would be to increase production. The average New York quotation for bar silver during the year 1917 was 89½c. per oz., and for the year 1918 approximately 97⅜c. Here again the normal deductions cannot be depended upon, as the well-known increase in cost of production undoubtedly more than offset the effect of the increase in value.

We must not fail, also, to consider that the value of lead and copper has nearly as great an effect on production as that of silver itself. Taking all of these forces into account, and with the knowledge which has come to the writer regarding the production of many representative mines, it is safe to believe that the silver production of the United States for the year 1918 will not be more than 4,000,000 oz. below that of the year 1917, which was reported by the Director of the Mint as amounting to 71,740,400 ounces.

There are many reasons for the belief, however, that the production of the world has shown an increase. The value of the imports of silver into the United States for the first ten months of 1917 is reported as $38,099,586, whereas for the same period of the year 1918 it is reported as $61,549,381, fully 70% of which was received from Mexico. It would seem safe to estimate the total imports for the entire year from Mexico at $52,500,000, or approximately 50,000,000 oz. The Director of the Mint reports the silver production of Mexico for 1916 as 22,838,400 oz. and for 1917 as

---

*Vice-president American Smelting and Refining Co., 120 Broadway, New York.

31,214,000 oz. Both of these amounts are much below the yearly production previous to the Madero administration, the cause being the unsettled condition of the country. It is well known that many mines in Mexico, which had not produced or had produced only to a minor extent during 1917, were able to produce during 1918.

But these facts will hardly account for an increased production from 31,000,000 oz. to 50,000,000 oz. Mexico, however, has been denuded of her silver circulation, except that of the minor coins, and many pesos have been imported and are included in the imported values quoted above. If we assume that, of the increased importations, approximately one-half were pesos, it would seem safe to estimate the production of Mexico for 1918 as 40,000,000 ounces.

The importations from Canada, Central America, and South America also show notable increases. A world production for the year 1918 of 180,000,000 oz. would be a fair estimate, against 164,000,000 oz. for 1917.

On Apr. 23, 1918, there was approved an act of Congress entitled "An act to conserve the gold supply of the United States; to permit the settlement in silver of trade balances adverse to the United States; and for the above purpose to stabilize the price and encourage the production of silver." Since the passage of this act, there has been no free market for silver in this country or in London. From Apr. 25 to Aug. 19, New York quotation only varied from 99½c. to 99¾c., and from August there was no change in the quotation of $1.01⅛ per oz. to the end of the year. Previous to the passage of this act, the New York quotation was fixed at the parity of the London quotation, but since Aug. 19 last, the New York quotation has controlled, and the London quotation has been derived by adding the transportation and insurance expense of shipment to London to the quotation made at New York.

MONTHLY AVERAGE PRICE OF SILVER (a)

	New York			London		
Month	1916	1917	1918	1916	1917	1918
January	56.775	75.630	88.702	26.960	36.682	44.356
February	56.755	77.585	85.716	26.975	37.742	42.792
March	57.935	73.861	88.082	27.597	36.410	43.260
April	64.415	73.875	95.346	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.940	79.010	99.625	30.000	40.110	48.813
August	66.083	85.407	100.292	31.498	43.418	49.077
September	68.515	100.740	101.125	32.584	50.920	49.500
October	67.855	87.332	101.125	32.361	44.324	49.500
November	71.604	85.891	101.125	34.192	43.584	48.969
December	75.765	85.960	101.125	36.410	43.052	48.492
Year	65.661	81.417	96.772	31.315	40.851	47.516

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

(a) *Engineering and Mining Journal* prices

The desire of the Director of the Mint and of the Reserve Bank that such an act should be passed was known to the writer when compiling the article on "Silver in 1917," printed in the *Journal* of Jan. 12, 1918, through various consultations with representatives of the Reserve Bank, the Director of the Mint, as well as senators and members of the House of Representatives. Reference was made to these plans as follows: "The only source of supply of spot silver in any quantity is the silver dollars held in the United States Treasury as security against the circulation of silver certificates. The subject is being seriously considered on the part of various governmental departments, on account of the war needs in connection with India products, whether proper legislation can be obtained whereby the temporary use of this silver in dollar coins can be authorized, the silver to be returned through Government purchases at a maximum price which it is expected will make possible an increased production of silver." On account of these plans being confidential at that time, no more specific reference was expedient. Although the negotiations began in October, 1917, the act was not presented to Congress until April, 1918, but was immediately passed and without opposition. Whether this fact means the permanent burial of the historic gold-versus-silver feud is beyond our ken, but it was certainly notable that the act was of equal interest to both parties to the currency disputes of the Bryan campaigns. The negotiations preceding the drafting of the act were between representatives of the Reserve Bank and of the British government. The latter were the buyers of the silver needed by India, and at first were unwilling to pay more than 85c. per oz. At this price, they doubtless could have purchased the major portion of the annual production of the country. But this production was not sufficient to meet the needs which were in sight for the coming year. The coined dollars were the only supply of spot silver which could fill the crying demand, but they could not be used without legislation, the passage of which at first seemed very doubtful. Many senators representing the silver-producing states insisted that the old ratio value of $1.29 per oz. should be reëstablished, but this price undoubtedly could not have been paid by Great Britain. Even if the price could have prevailed for a while, due to war necessities, the act would have undoubtedly soon fallen by its own weight, as was the case with the Sherman Silver-Purchase Act.

The agreement to fix the price at $1 per oz. was reached very largely through the conservative judgment, the political sagacity, and the indomitable perseverance of Governor Emmet D. Boyle of Nevada. I have taken much space to relate the history of this act of Apr. 23, 1918, as it undoubtedly is the most notable legislation with reference to silver since the repeal of the free-coinage acts of France and India. So far as can be seen at this writing, this act should hold the price of silver for many years at $1 per oz. The act authorizes the sale of 350,000,000 one-dollar coins, and to the end of the year 1918 there had been sold approximately 160,000,000 coins, or somewhat less than one-half the number provided for. The sale of dollars was limited by the act to an equal retirement of silver certificates, and also, inferentially, to the issuance of Federal Reserve bank notes. These two requirements have no doubt largely, and perhaps permanently, reduced the sale of dollars. At first, it was found difficult to withdraw the silver certificates from circulation, and later the delays in engraving the plates for Reserve bank notes and the printing of them were both unexpected and unfortunate.

With the cessation of the war, there has come to India a serious failure of fall rains, and large sections of country are facing famine. The India government has prohibited the exportation of wheat and other grains, and London has ceased the sale of drafts on India. It becomes doubtful, therefore, as to how much longer the British government will continue to purchase dollar coins, in addition to the entire surplus current production, together with imported coins. In the opinion of the best judges, the purchases are likely to continue for three months longer, and the total shipments of dollars will not exceed 200,000,000. As the Director of the Mint is compelled to purchase at $1 per oz. all the silver which is offered to him, and as only the surplus not needed for coinage or commercial purposes can be offered, it does not seem probable that the director will be likely to complete the purchase of 200,000,000 oz. for many years to come.

The next serious question to be decided, which may have even a greater effect on silver prices, and consequently on silver production, than all that has happened during the year 1918, is whether the free distribution of gold throughout the world will again be permitted. The gold production of the world is very largely in the hands of the United States and Great Britain and her colonies. Both nations are creditor nations, and, therefore, able to restrict the exportation of gold. The exigency of war has brought home to every one the fact that at least there has been no surplus of gold in the world. With the greatly increased international business which is expected to be done in the coming years by these two leading countries, is there not going to be a continued shortage of the yellow metal, especially in connection with its decreased production? The greatest absorber of the world's production of gold has been India. In the article on Silver in the *Journal* of Jan. 12, 1918, it was mentioned that India had imported, previous to the war, $150,000,000 yearly in gold, leaving only a similar amount of new production for the coinage and bank reserves of the whole world. Will Great Britain permit this condition to prevail again? It hardly seems probable. But if she does not, then silver must be substituted if it can be found or produced.

YEARLY DEMAND FOR SILVER

	Ounces
For India	150,000,000
For Africa	25,000,000
For the arts	75,000,000
For subsidiary coinage	60,000,000
For China, etc.	40,000,000
Total	350,000,000
Production	180,000,000
Shortage	170,000,000

The use of silver for subsidiary coinage is also likely to largely increase. Gold has completely left many countries, and it is not probable that it can be restored to circulation for many years. At the same time, the paper currency has been greatly increased, and silver will be required as a basis. This plan will be much more conservative on account of the fact that the price of silver is fixed by the act of Apr. 23 last than would have been the case previous to the war. With the possibility of gold being withheld from India, a conservative estimate as to the yearly demands for silver is shown in the accompanying table.

There seems to be abundant room for an increased production, which can be brought about only by an increased price.

Necrology

Among the noted men identified with the mining and metallurgical industries who died in 1918 were:

William Hague	Jan. 1
A. A. Blow	Jan. 2
Thomas L. Livermore	Jan. 9
Edward McKim Hagar	Jan. 19
F. W. Matthiessen	Feb. 11
Thomas F. Noon	Mar. 2
Grove Carl Gilbert	May 1
Edgar A. Collins	June 3
William B. Phillips	June 7
James Douglas	June 25
John Duer Irving	July 26
Adolph Faber du Faur	Aug. 18
Charles Richard Van Hise.	Nov. 19
Rossiter W. Raymond	Dec. 31
DuBois, Howard W.	Nov. 1

Bituminous Coal and Coke

The estimated production of 585,883,000 net tons of bituminous coal and lignite in the United States in 1918, according to the U. S. Geological Survey, sets a new high record, with an increase of 34,000,000 tons or 6.2%, over 1917. Production in 1918 was more than sufficient to meet the needs of the country. By Nov. 11 the average stocks over the United States were sufficient for seven weeks, and the cessation of war activities and warm weather in November and December made it seem advisable to many consumers to begin using storage coal earlier than is usual.

Although the bituminous coal mines lost to the military service and to other lines of industry in 1917 and 1918 more than 125,000 men, the loss has been largely made up, in numbers if not in effectiveness, by addition to the forces, and it is not believed that for the country as a whole the number of men employed in 1918 will show any noticeable decrease below the 603,000 in 1917. It is estimated that the bituminous mines worked on an average 255 days in 1918, compared with 243 in 1917 and 230 in 1916.

The production of coke in 1918 is estimated at 56,670,000 net tons, compared with 55,606,828 tons in 1917, an increase of 1,603,000 tons, or 3%. Byproduct-coke production is estimated at 26,264,000 tons, an increase of 3,825,000 tons, or 17%, compared with 1917. Beehive coke is estimated to have decreased 2,762,000 tons, or 8%, from 33,167,548 tons in 1917 to 30,406,000 tons in 1918. The largest gain in output of byproduct coke was in Ohio, 1,737,000 tons, followed by Pennsylvania, with 595,500 tons. Indiana produced 3,870,000 tons of byproduct coke, an increase of 329,000 tons. Colorado was added in 1918 to the list of states producing byproduct coke with the starting up of the plant of the Colorado Fuel and Iron Company at Pueblo. In 1917 byproduct coke represented 40% of the total output; in 1918, 46%. In October the production of byproduct coke exceeded that of beehive, and from that date forward it is expected that the proportion of coke from the new type of ovens will continue to increase. The year 1918 should definitely and finally record the passing of supremacy from the beehive coke oven to the byproduct oven.

Petroleum in 1918

Preliminary estimates by John D. Northrop, of the U. S. Geological Survey, Department of the Interior, indicate that the quantity of crude petroleum marketed from oil wells and field storage tanks in the United States in 1918 reached the record-breaking total of 345,500,000 bbl., an apparent gain of 3% over the former record of 335,315,601 bbl., established in 1917. The output is apportioned among the major fields as follows:

OUTPUT OF PETROLEUM IN UNITED STATES IN 1917 AND 1918

Field	1917	1918
Appalachian	24,932,205	25,300,000
Lima-Indiana	3,670,293	3,100,000
Illinois	15,776,860	13,300,000
Oklahoma-Kansas	155,043,596	139,600,000
Central and North Texas	10,900,646	15,600,000
North Louisiana	8,561,963	13,000,000
Gulf	26,087,587	21,700,000
Rocky Mountain	9,199,310	12,600,000
California	93,877,549	101,300,000
Alaska and Michigan	10,300	....
Totals	335,315,601	345,500,000

The Quicksilver Market

At the beginning of 1918 the price for quicksilver was $115, San Francisco, and $130, New York, the latter market being at a rather large premium owing to the shortage of spot supplies. The deficiency was soon relieved, however, and the New York price declined to $125. During the remainder of 1918 the quotations were pretty steadily $115, San Francisco, and $125, New York, the fluctuations above and below those figures being but trifling.

AVERAGE MONTHLY PRICE OF QUICKSILVER

(Per Flask of 75 Lb.)

Month	1917 New York	1917 San Francisco	1918 New York	1918 San Francisco
January	$81.04	$80.20	$126.7708	$115.5769
February	120.90	116.25	119.8863	116.9565
March	113.30	112.50	121.6346	115.8269
April	115.64	115.00	121.8654	115.4615
May	105.98	105.00	118.9730	113.3076
June	84.34	86.20	122.6600	113.4800
July	107.80	102.18	126.6346	116.6923
August	115.00	111.10	125.5555	118.3333
September	112.21	110.90	127.8125	119.0000
October	100.94	100.62	127.1759	119.3333
November	102.50	100.75	124.9130	118.9130
December	115.90	111.65	117.7000	115.6000
Year	$106.30	$104.36	123.4651	116.5401

In April the Government made arrangements with the producers for the supply of its requirements at $105, basis San Francisco, the producers delivering supplies pro rata. Otherwise the market was left free. In December the price declined to $115, New York, the San Francisco price remaining at $115.

Average Monthly Prices of Palladium*

(In Dollars per Ounce)

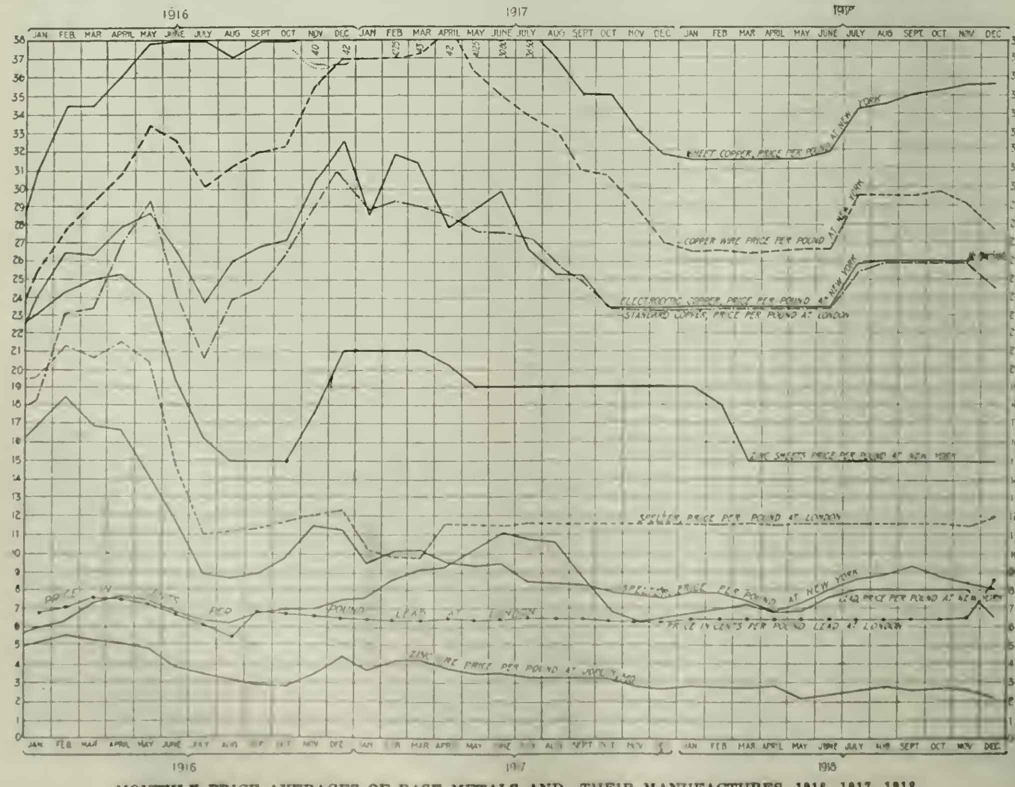
	1917		1917
January	73.00	July	113.60
February	88.32	August	120.00
March	88.05	September	123.44
April	93.70	October	121.92
May	104.00	November	126.87
June	108.29	December	130.60
Year			107.65

	1918		1918
January	135.00	July	135
February	137.50	August	135
March	144.0386	September	135
April	150.00	October	135
May	142.3076(a)	November	135
June	135.00	December	128.6
Year			137.2871

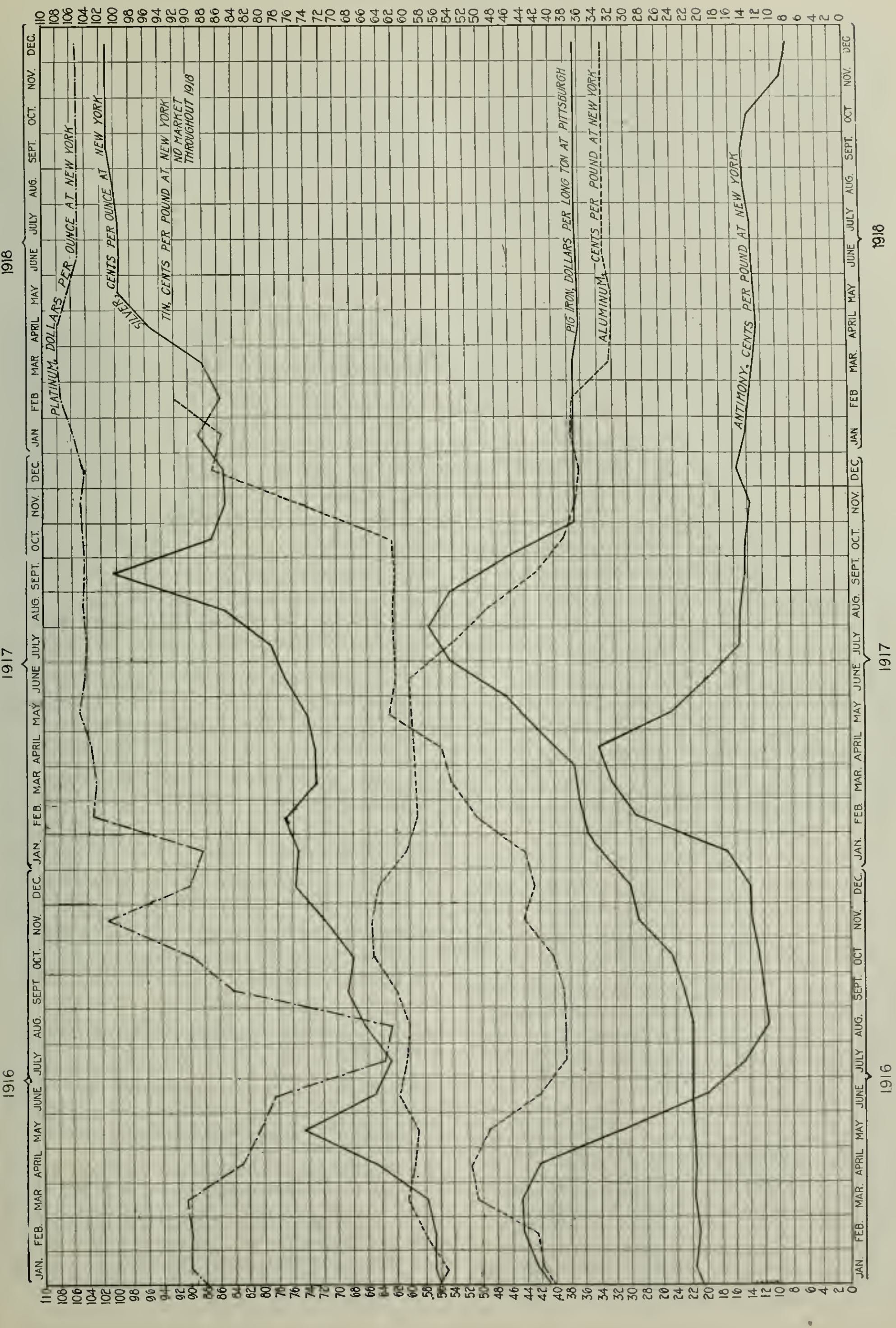
* *Engineering and Mining Journal* quotations. (a) Fixed May 14 at 135.

Feldspar During 1918—The production of feldspar in 1918 was the largest ever recorded, according to the U. S. Geological Survey, and that of 1917 was 141,924 short tons, or 7% greater, than was produced in 1916. Of the 1917 production, 84% was utilized in the manufacture of pottery, chinaware, porcelain, tile, enameled brick and similar products; 6% was consumed in the manufacture of roofing material, artificial stone, artificial marble, and the surfacing of concrete; and 5% was used in the manufacture of cement for the purpose of increasing the percentage of the potash in the flue dust, which is treated in some cases by the Cottrell and Steer electrostatic processes.

The New York price for crude feldspar in 1918, as reported to the U. S. Geological Survey, was about $5 per long ton, as compared with $3.40 in 1917. The price of ground feldspar averaged, in 1918, $12 per short ton, as compared with $10.15 in 1917, and $9.30 in 1916.



MONTHLY PRICE AVERAGES OF BASE METALS AND THEIR MANUFACTURES, 1916, 1917, 1918



MONTHLY AVERAGES OF METAL PRICES, 1916, 1917, 1918

Copper

THE principal statistics for 1918 are given in the accompanying tables, which tell their own stories. They afford opportunities for numerous studies, but, completed, as they have been, by telegraph and cable within the last two days, we do not venture hastily to make any deductions.

We are glad to be able to make within a week after the end of the year an estimate of the world's production of copper which experience has shown to be only 1 or 2% out of the way, as compared with the revised figures. We have had complete returns from the producers of the United States, Mexico, Canada, and Cuba. Peru and Chile cabled their figures for 12 months and Japan its official figures for 10 months. We received from London, where are the offices of the principal producers, the best possible estimate of the production of Spain and Portugal, and from Melbourne the best for Australia. We had returns from the principal producers in South Africa for 11 and 12 months, and for most of the smaller producers for the major part of the year. For some countries—Bolivia, Russia, etc., and, of course, Germany—we had to make simple guesses, but their totals do not amount to much anyhow.

SMELTERS' PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1915	1916	1917	1918
Alaska	72,621,844	115,933,315	92,094,023	59,326,000
Arizona	444,089,147	692,630,286	704,156,391	765,744,496
California	37,935,893	51,358,334	46,824,320	57,576,860
Colorado	8,126,000	9,802,183	11,894,900	4,596,200
Idaho	5,602,000	6,741,001	6,401,988	5,068,500
Michigan	241,123,404	270,058,601	274,936,224	216,759,810
Montana	268,027,557	351,995,058	277,362,886	324,970,446
Nevada	66,394,906	100,143,431	115,436,671	86,361,023
New Mexico	75,515,138	83,013,805	110,020,997	91,462,362
Utah	180,951,174	225,396,808	244,443,071	230,019,737
Washington	(a)	(a)	2,152,560	2,189,030
East and South	18,858,677	20,018,261	18,704,304	16,630,377
Other states and undistributed	4,452,420	15,685,226	18,127,568	9,264,845
Totals	1,423,698,160	1,942,776,309	1,922,555,903	1,869,949,686

SMELTERS' TOTAL PRODUCTION

(In Pounds)

Source	1915	1916	1917	1918
North American ore	1,612,450,828	2,187,328,864	2,161,627,729	2,179,825,960
Foreign ore	44,749,105	73,391,517	74,410,422	37,334,001
Scrap	29,827,203	37,380,759	41,821,811	37,903,934
Totals	1,687,027,136	2,298,101,140	2,277,859,962	2,255,063,895
To foreign refiners	39,734,120	38,423,577	33,261,435	34,088,084
To American refiners	1,647,293,016	2,259,677,563	2,244,598,527	2,220,975,811
Crude copper imported	140,415,341	152,770,536	274,813,001	268,746,428
Total crude copper	1,787,708,357	2,412,448,099	2,519,411,528	2,489,722,239

WORLD'S PRODUCTION OF COPPER (a)

(In Metric Tons)

Country	1915	1916	1917	1918
United States	646,212	881,237	872,065	848,203
Mexico	30,969	55,128	47,503	75,529
Canada	47,202	47,985	50,626	52,693
Cuba	8,836	7,816	10,313	12,337
Australasia	32,512	35,000	38,100	33,838
Peru	(d) 32,410	(d) 41,625	(d) 45,620	(d) 44,800
Chile	47,142	64,636	(d) 83,100	(d) 85,850
Bolivia	(e) 3,000	(e) 4,000	(e) 4,000	(e) 4,000
Japan	(b) 76,039	(b) 101,467	(c) 111,256	(c) 95,800
Russia	25,881	20,887	(e) 16,000	(e) 5,000
Germany	(e) 35,000	(e) 45,000	(e) 45,000	(e) 40,000
Africa	27,327	34,572	45,138	31,110
Spain and Portugal	(e) 46,200	(e) 42,000	(e) 42,000	(e) 41,000
Other Countries	(e) 25,000	(e) 25,000	(e) 25,000	(e) 25,000
Totals	1,083,730	1,406,353	1,435,721	1,395,160

(a) The statistics in this table are our own compilations, except where specially noted to the contrary (b) As officially reported (c) Privately communicated to us from Japan (d) From L. Vogelstein & Co (e) Estimated.

The world's total for 1918 was not very different from that for 1917. A few countries showed small increases, but many showed large decreases. The latter was especially the case with the more remote countries—Australia, South Africa, and Japan. Owing to transportation conditions, Great Britain and France found it preferable to get their supplies from nearer countries. Also, it was said last summer that Japan did not care to sell at the price officially fixed.

During the first eight months of 1918 Japan exported 21,800 long tons of copper, compared with 53,750 tons in the same period of 1917. Although the production of Japan declined considerably, the export figures rather indicate a stock there. Similarly, the exportation of only 7900 tons of blister copper from Spain during the first nine months of 1918, compared with 13,579 in the corresponding period of 1917, leads to the conjecture of a small stock there. Australia has about 25,000 tons, and South Africa has some unshipped supplies. America probably had about 1000 million pounds at the refineries and on the way to them. This situation, together with the cessation of copper consumption for munitioning and the natural delay in making arrangements for the resumption of ordinary industrial work, created a difficult situation for producers, who were bound to institute curtailment of output in order to check further increase in their financial burden. This curtailment was begun at the mines during December.

IMPORTS OF COPPER DURING FIRST TEN MONTHS

(In Pounds)

	1916	1917	1918
Ore, matte, etc., contents	150,962,096	142,483,807	131,620,644
Unrefined, blister copper, etc.	229,578,498	294,253,505	324,172,156
Refined bars, plates, etc	8,411,163	6,045,747	32,267,821
Old and miscellaneous	8,643,233	17,997,760	1,181,916
Totals	397,594,990	460,078,819	489,242,537

EXPORTS OF COPPER IN FIRST TEN MONTHS

(In Pounds)

	1916	1917	1918
Ore, matte, etc., contents	4,676,049	4,873,733	3,198,339
Unrefined, blister, etc	11,326,996	10,198,256	14,015,713
Refined ingots, bars, etc	610,968,882	871,449,230	600,746,005
Plates and sheets	12,338,816	33,372,534	14,542,622
Wire, except insulated	20,049,866	21,024,056	13,388,066
Old and scrap	785,157	949,556	235,003
Composition metal, copper chief value	....	(a)1,196,947	133,616
Copper pipes and tubes	....	(a)6,165,449	3,366,445
Totals	660,145,766	949,229,761	649,625,809

(a) Figures cover period beginning July 1.]

REFINED COPPER PRODUCTION IN THE UNITED STATES, 1918

(In pounds, according to figures of Copper Producers' Association)

January	152,557,010	May	212,955,831	September	203,509,819
February	152,397,014	June	206,892,064	October	173,133,522
March	190,350,369	July	223,994,742	November	210,838,108
April	205,441,430	August	201,462,134	December (est.)	215,520,000

Total production in 1918 2,349,054,043

Total production in 1917 2,350,240,606

Copper-Smelting and Refining Works Of North America

The accompanying tables, corrected up to Dec. 1, 1918, give the names of the companies engaged in copper smelting and refining in the United States, Canada, and Mexico and the situation of their works. In the case of the smelteries, the number of their smelting furnaces and the estimated annual capacity in terms of tons of charge, meaning ore and flux, but not including fuel, are given. It should be noted, however, that not all of the furnaces reported are in operation all the time. In most cases the data have been communicated to the *Journal* by the operating companies. However, the figures should be taken as only approximately correct. Some companies may have figured their annual capacity on the basis of the year of 365 days, and others on the basis of 350 days, or something else. Anyway, annual capacity is a rather variable figure. In modern practice a rather large quantity of ore is reduced directly to copper by charging it into the converter along with matte, this being shown separately in some cases by the last column of the table.

The smelting companies of Lake Superior, reported in the table, treat copper concentrate, which is chiefly metallic copper, produced by the ore-dressing works of that region.

The plant of the United Verde Extension Mining Company, in Arizona, was completed and placed in operation during 1918. No works were permanently closed down, although several were idle at the end of the year.

COPPER-SMELTING WORKS OF NORTH AMERICA

Company	Situation of Works	No. of Blast Furnaces	Annual Capacity	No. of Reverberatory Furnaces	Annual Capacity	No. of Converters	Annual Capacity in Ore (*a*)
American Smelting and Refining Co	Aguascalientes, Mex	6	480,000	..	......	4	(*b*)
American Smelting and Refining Co	Perth Amboy, N. J	1	90,000	..	......	3	(*b*)
American Smelting and Refining Co	Omaha, Neb	..	......	..	......	2	(*b*)
American Smelting and Refining Co	El Paso, Tex	4	400,000	4	580,000	4	(*b*)
American Smelting and Refining Co	Matehuala, S.L.P., Mex	4	435,000	..	......	..	......
American Smelting and Refining Co	Hayden, Ariz	.	......	4	580,000	4	(*b*)
American Smelting and Refining Co	Sasco, Ariz	2	300,000	..	......	2	......
American Smelters Securities Co	Garfield, Utah	4	800,000	7	1,022,000	9	(*b*)
American Smelters Securities Co	Tacoma, Wash	3	560,000	1	144,000	4	(*b*)
American Smelters Securities Co	Velardeña, Dgo., Mex	3	250,000	..	......	..	......
Anaconda Copper Mining Co	Anaconda, Mont	3	1,750,000	9	1,980,000	7	105,000
Anaconda Copper Mining Co	Great Falls, Mont	4	675,000	2	210,000	2	49,000
Arizona Copper Co	Clifton, Ariz	..	......	3	360,000	3	......
Compagnie du Boleo	Santa Rosalia, Mex	7	700,000	..	......	..	......
Calumet & Arizona Mining Co	Douglas, Ariz	2	633,500	5	997,500	6	350,000
Canada Copper Corpn (*f*)	Greenwood, B. C	3	912,500	..	......	2	52,000
Cananea Consolidated Copper Co	Cananea, Son., Mex	8	868,000	2	153,000	..	......
Consolidated Arizona Smelting Co	Humboldt, Ariz	1	90,000	1	160,000	6	35,000
Consolidated Mining and Smelting Co	Trail, B. C	4	207,000	..	......	2	5,000
Copper Queen Branch, Phelps Dodge Corpn. (*c*)	Douglas, Ariz	.	......	..	......	..	......
Detroit Copper Mining Co. (*c*)	Morenci, Ariz	.	......	..	......	..	......
Ducktown Sulphur, Copper and Iron Co	Isabella, Tenn	2	150,000	..	......	..	......
East Butte Copper Mining Co	Butte, Mont	2	225,000	..	......	4	5,000
Granby Consol. Mining, Smelting and Power Co	Grand Forks, B. C	8	1,400,000	..	......	3	7,000
Granby Consol. Mining, Smelting and Power Co	Anyox, B. C	4	1,330,000	..	......	5	110,000
International Nickel Co. of Canada (*e*)	Copper Cliff, Ont	8	1,166,000	1	174,000	6	64,500
International Smelting Co	Tooele, Utah	..	......	5	500,000	5	50,000
International Smelting Co	Miami, Ariz	..	......	4	700,000	5	50,000
Ladysmith Smelting Corpn. (*f*)	Ladysmith, B. C	2	236,250	..	......	..	......
Mammoth Plant, U. S. Smelting, Refining and Mining Co	Kennett, Calif	5	700,000	.	......	2	28,500
Mason Valley Mines Co	Thompson, Nev	2	419,192		......	2	16,930
Mazapil Copper Co	Concepcion del Oro, Zac., Mex	2	144,000		......	..	......
Missouri Cobalt Co	Fredericktown, Mo	1	35,000	..	......	..	......
Mond Nickel Co	Coniston, Ont	4	700,000	..	......	4	60,000
Mountain Copper Co	Mococo, near Martinez, Calif.		......	1	60,000	2	5,500
Nevada Consolidated Copper Co	McGill, Nev	.	......	5	900,000	4	20,000
Nichols Copper Co	Laurel Hill, N. Y	1	100,000	..	......	4	......
Norfolk Smelting Co	West Norfolk, Va	1	87,500	..	......	2	5,250
Phelps Dodge Corpn., Copper Queen Branch	Douglas, Ariz	10	1,596,000	3	490,000	8	106,400
Phelps Dodge Corpn., Morenci Branch	Morenci, Ariz	1	193,200	.	......	3	9,800
Old Dominion Co	Globe, Ariz	3	450.000		......	2	8,500
Orford Works, International Nickel Co	Constable Hook, N. J	2	94,500		...	3	...
Penn Mining Co	Campo Seco, Calif	.	......	2	72,000	1	42,000
Santa Fe Gold and Copper Co	San Pedro, N. M	1	45,000		......	..	......
Shannon Copper Co	Clifton, Ariz	2	400,000		......	2	5,612
Swansea Consol. Gold and Copper Mining Co. (*f*)	Bouse, Ariz	1	190,000		......	2	......
Tennessee Copper Co	Copperhill, Tenn	5	1,000,000		......	2	15,000
Teziutlan Copper Mining and Smelting Co	Teziutlan, Puebla, Mex	2	350,000		.	3	......
Cia. Metalurgica de Torreon	Torreon, Coah., Mex	2	175,000			2	......
U. S. Metals Refining Co	Chrome, N. J	2	200,000			3	(*b*)
U. S. Smelting Co. (*f*)	Midvale, Utah	..	......	.	......	..	
United Verde Copper Co	Clarkdale, Ariz	4	685,000	3	400,000	6	50,000
United Verde Extension Mining Co	Clarkdale, Ariz	1	175,000	1	175,000	3	350,000
Wanakah Mining Co. (*d*)	Ouray, Colo	2	105,000	..	......	.	....
Western Smelting & Power Co	Cooke, Mont	1	110,000	..	......	..	......

(*a*) Raw ore smelted as flux. (*b*) Included in furnace tonnages. (*c*) See Phelps Dodge Corporation. (*d*) Plant sold to Ouray Smelting and Refining Co. (*e*) Formerly Canadian Copper Co. (*f*) Not in operation.

LAKE SUPERIOR SMELTING WORKS

Company	Situation of Works	No. of Blast Furnaces	Annual Capacity	No. of Reverberatory Furnaces	Annual Capacity
Calumet & Hecla Mining Co	Hubbell, Mich	1	75,000	21	150,000
Lake Superior Smelting Co	Dollar Bay, Mich	1	50,000	7	75,000
Michigan Smelting Co	Houghton, Mich	1	45,000	5	85,000
Quincy Smelting Works	Hancock, Mich	1	20,000	4	35,000

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES AND CANADA

Works	Situation	1915 Capacity, Pounds (*a*)	1916 Capacity, Pounds (*a*)	1917 Capacity, Pounds (*a*)	1918 Capacity Pounds (*a*)
Nichols Copper Co	Laurel Hill, N. Y.	400,000,000	450,000,000	500,000,000	500,000,000
Raritan Copper Works	Perth Amboy, N. J.	400,000,000	460,000,000	460,000,000	460,000,000
Baltimore Copper Smg. and Rolling Co	Canton, Md.	354,000,000	600,000,000	720,000,000	720,000,000
American Smelting and Refining Co	Maurer, N. J.	240,000,000	240,000,000	288,000,000	288,000,000
United States Metals Refining Co	Chrome, N. J.	200,000,000	250,000,000	250,000,000	250,000,000
Balbach Smelting and Refining Co	Newark, N. J.	48,000,000	48,000,000	48,000,000	48,000,000
Anaconda Cop. Min. Co. (old plant)	Great Falls, Mont.	65,000,000	65,000,000	65,000,000	65,000,000
Anaconda Cop. Min. Co. (new plant)	Great Falls, Mont.	(*b*)	180,000,000	180,000,000	180,000,000
Tacoma Smelting Co	Tacoma, Wash.	120,000,000	130,000,000	204,000,000	204,000,000
Calumet & Hecla Mining Co	Hubbell, Mich.	65,000,000	65,000,000	65,000,000	65,000,000
Consolidated Mining and Smelting Co	Trail, B. C.	(*b*)	8,400,000	14,000,000	14,000,000
Totals		1,892,000,000	2,495,400,000	2,794,000,000	2,794,000,000

(*a*) Official figures furnished by the respective companies. (*b*) New works put into operation in 1916.

The Copper Market in 1918

At the beginning of 1918 the United States and foreign governments were requiring a good deal of copper, as were also domestic manufacturers, especially the wire drawers, who were working more or less directly for Government purposes. The chief feature of interest at this time was the growing appreciation of how transportation difficulties and coal shortage might diminish the production of the refineries. Even as early as this, important plants were losing time owing to lack of coal, and it was anticipated that they would suffer further from the non-delivery of raw material; in fact, both of these fears were realized, besides which there were many other difficulties. Among these was the tardiness of the Government in making payment to the producers, which was due to the embarrassments of red tape. At about this time no less than $16,000,000 was owed to the copper producers. The War Department was the chief offender. Relations with the Navy Department were relatively satisfactory.

MONTHLY AVERAGE PRICE OF COPPER

	New York				London Standard			
Month	1915	1916	1917	1918	1915	1916	1917	1918
January	13.641	24.008	28.673	23.500	60.756	88.083	131.921	110.000
February	14.394	26.440	31.750	23.500	63.494	102.667	137.895	110.000
March	14.787	26.310	31.481	23.500	66.152	107.714	136.750	110.000
April	16.811	27.895	27.935	23.500	75.096	124.319	133.842	110.000
May	18.506	28.625	28.788	23.500	77.600	135.457	130.000	110.000
June	19.477	26.601	29.962	23.500	82.574	112.432	130.000	110.000
July	18.796	23.865	26.620	25.904	76.011	95.119	128.409	119.913
August	16.941	26.120	25.380	26.000	68.673	110.283	122.391	122.000
September	17.502	26.855	25.073	26.000	68.915	113.905	117.500	122.000
October	17.686	27.193	23.500	26.000	72.601	122.750	110.000	122.000
November	18.627	30.625	23.500	26.000	77.744	134.659	110.000	122.000
December	20.133	31.890	23.500	(a)	80.773	145.316	110.000	118.447
Year	17.275	27.202	27.180	24.628	72.532	116.059	124.892	115.530

New York, cents per pound. London, pounds sterling per long ton of standard copper. (a) No market.

On Jan. 10 the copper producers held a meeting, at which they discussed the matter of a new agreement with the Government as to price. It was well known among them that many of the smaller producers were having not altogether an easy time, the increase in the cost of production since September being variously estimated at from 1c. to 3c. per pound.

The meeting with the War Industries Board occurred on Jan. 22, at which time it was announced that the 23½c. price would be continued until June 1. Although the producers were disappointed by this decision, they continued to push production as energetically as they could. The requisitions for copper continued unabated, except that during February there was a lull in shipments to Europe, many ships being tied up here on account of lack of coal, and shipping room being required for the carriage of supplies that were more urgently needed. The refiners in the vicinity of New York had great difficulty in getting both coal and crude copper to their works, and several of them were in imminent danger of being obliged to suspend production. The situation was even more dangerous than in the previous year, for not only was the interference with traffic worse, but also manufacturers in Connecticut, who were now relying upon governmental supply, did not carry in their yards the amount of reserve stock that they did formerly. However, about the middle of February, the settlement of the longshoremen's strike and freer deliveries of blister copper for the railways relieved the situation at the copper refineries, and soon they began to be troubled rather by crude copper coming in more rapidly than they could handle it, which condition prevailed during the remainder of the year. About the middle of March, the refineries were operating at about four-fifths the average rate of production in 1917. By the end of March, the immediate difficulties of the refineries had been pretty well overcome, but at no time during 1918 were they able to operate at full capacity. Many times the prospect seemed fair for increased rates of production, but invariably something happened that upset the calculations.

During the second quarter of 1918 there was no event of special importance, but the insatiable demands of labor, the increasing inefficiency of labor, and the unwillingness of a portion of the force to work more than one-third of the time restrained production and increased costs so that refiners who were operating on the basis of tolls fixed under pre-war conditions found themselves in a serious predicament. Some of the producers in the high-cost districts, such as Lake Superior and Clifton-Morenci, also found conditions very troublesome. There was considered to be such good grounds for an advance in the price for copper that it was confidently expected that something would be granted by the War Industries Board in May. At the meeting on May 22, however, which was largely attended by the copper producers, some of whom had come as far as from the Pacific Coast, it was calmly announced at the end of a long day of discussion that the board had made up its mind on the previous day to keep the price at 23½c. until Aug. 15. This led to some acrimonious remarks by the producers, who refused to assent to an "agreement" to that effect, and some rather hard feeling resulted. In the meanwhile, the refiners were hard pressed to furnish the full quantity of copper that was required and were steadily far behind in filling their orders. Melting and molding was one of their particular troubles; to help in this brass-makers were induced to use cathodes to some extent instead of ingots.

However, it soon became whispered that the War Industries Board knew that it had made a mistake on May 22, that it would soon be rectified, and in the meanwhile none of the producers was willing to book any order on conditions otherwise than that it would be subject to a new price. In fact there was a suddenly called meeting with the War Industries Board on July 2, when the price was raised to 26c., effective immediately. This did no more, however, than compensate for the advance in freight rates on July 1 and permit the mining companies to grant an allowance to the refiners covering their increased costs. Really the mining companies were worse off than they had been previously, for they had to concede a further advance in wages to their miners. Moreover, there arose complications, both with the Government and private consumers, over orders placed previously to July 2 and not filled. With the Government the producers were forced to compromise a large part of these on the 23½c. basis, so even the 26c. price did not turn out to be all that it looked.

As Aug. 15 approached everybody was expecting a further advance. The high-cost producers were clamoring for special consideration, and there was some absurd talk about making two prices for copper. At the meeting on Aug. 7 the War Industries Board decided simply, however, to maintain the 26c. price until Nov.

1. After this the meetings in Washington lost interest, and that scheduled in October was abandoned and continuance of the price to Jan. 1, 1919, was arranged by correspondence. During the fall the draft, the influenza and the explosion near Perth Amboy added to the troubles of the producers, especially the refiners.

AVERAGE MONTHLY PRICES OF COPPER MANUFACTURES

(In Cents per Pound, f. o. b., Mill)

	1916		1917		1918	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
January	25.70	31.00	37.00	42.00	26.50	31.50
February	28.66	34.50	37.00	42.12	26.56	31.50
March	29.13	34.50	38.11	43.00	26.43	31.50
April	31.10	36.00	38.20	42.20	26.50	31.50
May	33.75	37.88	36.56	40 30	26.62	31.50
June	32.50	38.00	35.00	38.75	26 64	31.90
July	30.25	38.00	34.12	38.22	29.50	34.25
August	31.38	37.00	32.85	36.85	29.50	34.50
September	32.00	38.00	31.00	35.00	29 50	35.00
October	32.35	38.00	31.00	35.00	29.75	35.25
November	35.56	40.37	28.83	33.17	29.00	35.60
December	37.00	42.00	26.84	31.74	27.70	35.65
Year	31.61	37.10	33.87	38.19	27.85	33 30

The armistice on Nov. 11 caught the copper producers with no very large orders on their books. Some large orders that were pending were, of course, suspended. A committee went to Washington on Nov. 15 and made an agreement with the War Industries Board for maintenance of the price at 26c., the producers agreeing to maintain production and wages. This agreement meant nothing more than official sanction of the producers concertedly asking 26c. and getting it if they could. They found that they couldn't. During November they received a few belated and absolutely trifling orders that they filled at 26c., but from Dec. 1 onward they got nothing, and "26c. asked" was merely a fiction in so far as any indication of the market was concerned, for there was no market, and on one side nobody would pay 26c., while on the other side nobody thought anybody would. However, the agreement among the producers themselves prevented any attempt to make a market until after Jan. 1, 1919. Late in December the producers organized an export association under the authority of the Webb law, and announced an asking price of 23c. for the first quarter of 1919, but this was regarded as a feeler rather than as a real hope.

The Butte District

By B. B. Thayer*

The Butte district, in common with every large producing center, was greatly hampered throughout 1918 by a shortage of labor, due to the selective draft, influenza, and labor disturbances, and though the activities were probably the greatest in the history of the district, the output in pounds of copper was far below that of some normal years. Each and every one of the producing companies, spurred by the war's necessities, aside from the consideration of corporate benefit to be derived, felt it a patriotic duty to make the greatest production possible of the metals so necessary for the successful conduct of the war.

Butte has for many years been one of the banner producing districts of the copper metal, and with the last five years has taken an enviable position among the zinc-producing districts of the world. When war was declared, it was a well-known fact that a great shortage of manganese ores, so essential to the successful production of steel, existed, and, prompted purely by patriotic motives, the Butte companies started in to see if by their endeavors another metallic star might not be added to Montana's service flag. The endeavors were most successful, and the Butte district during 1918 made an output of manganese ores, the beneficial effect of which was materially felt in the steel-producing districts of this country. The development work in the Emma mine, the property of the Butte Copper and Zinc Co., disclosed large bodies of manganese ores of a commercial grade, and during the entire period of the war heavy shipments to the Eastern steel works were maintained from this property. A considerable amount of manganese ores was also shipped from properties in the western part of the district.

In addition to the manganese ores extracted from the Emma mine, a fair tonnage of zinc ores was shipped from this property to the reduction works of the Anaconda Copper Mining Co. at Great Falls.

In the early part of 1918 the Anaconda Copper Mining Co. undertook the erection of a ferromanganese plant at Great Falls. This plant, composed of electric furnaces, was put into successful operation a short time prior to the cessation of hostilities. Every effort was likewise made to produce the greatest amount of arsenic possible, this product being so esential in the activities of the Food Administration and the War Department.

The city of Butte had one of the most prosperous years in its existence, and, judged from a patriotic standpoint, contributed more than its quota in men, money, and metals to the service of the country.

The development work at the various mines in Butte, though somewhat lessened on account of the shortage of man-power, proved quite satisfactory. There were no developments, outside of the manganese production previously mentioned, worthy of note, but, taken as a whole, the Butte district is in a most satisfactory condition, showing no likelihood of a diminution of output, so far as its mines are concerned, and with ample unexplored territory to warrant the belief that upon the return of normal conditions increased development work may bring into production properties which at the present time are unknown.

Copper Production in Arizona

By Walter Douglas*

In marked contrast with conditions prevailing during the previous year, the copper industry of Arizona was practically free from labor disturbances in 1918. This most desirable result was to a large extent due to the able and intelligent control and supervision exercised by Hywell Davies and Joseph S. Myers, Federal Mediators of the Bureau of Labor. With the Government demanding a maximum output of metal, the production reached record proportions, but at the expense, through shortage of skilled labor, of development and exploration in the mines, and proper maintenance of the plants and mechanical equipment.

The production in Arizona for 1918 (the month of December being estimated) will probably attain the high figure of 760,000,000 lb. or approximately 100,000,000 lb. more than in the previous year.

---

*Vice-president, Anaconda Copper Mining Company.

*President, Phelps Dodge Corporation, 99 John St., New York.

The 23½-c. price agreed upon between the copper producers and the price-fixing committee on Sept. 21, 1917, remained in force until July, 1918, when an increase of 2½c. per lb. was permitted, to take care of increased costs created by the raise in freight rates and higher tolls demanded by the refiners. A wage increase, amounting to 75c. per day, was also at that time granted to all classes of labor in the industry as a compensation for the increased cost of living. The average copper quotation for the year will, therefore, approximate 2½ c. per lb. less than in 1917; though the cost of production, owing to the above factors, together with marked decrease in labor efficiency, increased greatly.

The most notable contributors to the grand total for the year are the New Cornelia, which completed its first calendar year of regular operation; the Inspiration, the United Verde, the Miami, and the Phelps Dodge Corporation, all of which were retarded in 1917 by strikes which prevented their attaining maximum output. Certain other large producers showed small decreases, due to local conditions, which did not affect the industry as a whole. The new smeltery of the United Verde Extension Mining Co., in the Jerome district, was placed in operation in July, and thereafter that company treated all its own ores and ceased shipments to the custom smelters.

For the first time in many years, it is not possible to report new additions to the number of the larger mines; nor is there immediate prospect of any accession to the list of important copper producers in the state.

For the last four years every property has been pushed to its capacity to get out the maximum tonnage of ore, and has thus been compelled to neglect or postpone its development and exploratory work, so that it is probable that with the pressure removed, the metal production in 1919 will show a very material decrease. Inability to obtain material for construction or repairs has seriously affected the efficiency of the plants, and it will probably take at least six months or a year of heavy expenditures of capital and labor to restore their physical condition to that of the pre-war period, both above and below ground.

With the prospect of a record-breaking demand for the red metal within the next few months, or when satisfactory financing has been arranged, the present situation is ideal to bring operating conditions to a standard which will permit of maximum output within a reasonable time. Producing, as the United States does, nearly 80% of the copper supply of the world, the country will be called upon to furnish the requirements not only of the domestic market but of the large tonnage which will be needed for the rehabilitation of the industrial sections of northern France and Belgium. If, as is estimated, 80% of the copper production in the last three years has entered into the manufacture of essentially war material, the majority of which has been a total loss, there has been only 20% applicable to the peace industries of the world. It is obvious, therefore, that to furnish the necessary supply for normal industrial requirements, replacements, and deferred extensions, the mines of the world will be called upon in the near future for an output that will be inadequate to meet the demand.

With an improved labor supply and a reasonable time in which to prepare, Arizona mines can be confidently counted upon for an increasing output of copper for many years.

Lake Superior Copper Industry in 1918

By James MacNaughton*

The history of the copper industry of the Lake Superior district for the year 1918 might be epitomized in a few words as being the struggle of the producers to maintain a production requisite for the needs of the Government with a constantly decreasing force of men. To accomplish this, it was necessary to stop, as far as possible, all construction work. It was not difficult to do this, because of the impossibility of obtaining materials for construction even where the labor was available. It was also necessary gradually to decrease underground development in the producing properties and to place all labor, as far as practicable, upon the actual production of copper for war material. There was no occasion to place artificial restriction upon the development of new properties, because the high cost of labor and its scarcity made it about impossible for the developing companies to continue at their work.

All told, 18 companies have ceased development work in this district since April, 1917, and the close of 1918 finds search for profitable lodes of importance being made only by the Seneca Copper Corporation and the Mayflower-Old Colony Mining Co. The properties of these companies are situated near large communities, and because of this fact and their treasury balance they have been able to continue this work. It has not been necessary for any of the producing companies to cease production because of the rising costs, but the smaller companies have had a constant struggle to get back a new dollar for an old one, in spite of the high price of copper.

Such development underground as may be recorded was in the direction of power tramming to replace the decreasing man-power. Fortunately some of the companies had ordered electric locomotives in ample season, so that the falling off in production was not in proportion to the decrease in the number of men.

As nearly as may be estimated from the report of the mine inspector, the supply of labor decreased between 25% and 33⅓%, with a falling off of underground labor to a still greater extent than is shown by these figures. There was, however, increased individual production on the part of the men, due not so much to personal efficiency as to mechanical aids, so that the copper production of the district will not show a decrease of 20 per cent.

At the metallurgical plants, no new features of great interest are to be noted. Flotation was being used at the end of 1918 only by the Calumet & Hecla Mining Co. and the White Pine Copper Co., and both these companies had small installations operating. The final capacity of the Calumet & Hecla plant is placed at 4000 tons daily. The Winona Copper Co. is installing a 600-ton plant in its mill, this being the only company with faith in the commercial possibilities of flotation on amygdaloid. The only other metallurgical improvement in prospect is by the Quincy Mining Co., which is extending its fine-grinding sections.

---

*Vice-president and general manager, Calumet & Hecla Mining Co., Calumet, Michigan.

The "rock" of the district is gradually working lower, almost all the companies showing the same tendency. This is chiefly a factor of depth, although the high price of the metal permits of treating lower-grade "rock." The mines on the Kearsarge Lode are conspicuous in this regard, and Ahmeek, Allouez, Wolverine, and South Kearsage will show a decided decrease in copper content.

With the end of the war the supply of labor became more plentiful, and the "rock" output is again on the increase. Wages were at their highest, and supplies likewise, at the close of 1918, so that the cost per pound of copper produced was at a figure resembling a selling price of previous years. The future of the industry depends upon a continuance of the present high price for the metal or else a decided decrease in the cost of labor and materials, coincident with a lower price for copper.

The Asbestos Industry

Although asbestos has until recently been classed as a "war mineral," the industry is not likely to feel the effect of the cessation of hostilities. This substance is largely used in the construction of ships, and the shipbuilding programs of the various countries insure an active market for asbestos for a long time. During 1918, the demand was strong, and though the supply of domestic asbestos was greater than in 1917, the greater portion of the total amount sold in the United States, as in previous years, came from Canada.

Arizona was the largest and most important producer of asbestos in the United States in 1918, and it is reported that three companies were the chief producers, working in the Ash Creek district, north of Globe. A few prospectors worked their claims, but their properties were not opened up sufficiently to judge further possibilities. In Maryland, residual deposits of amphibole asbestos were worked to some extent, and this product supplied the demand for asbestos in filters, which formerly had been secured by import supply. In California, the Sierra Asbestos Co., near Nevada City, operated a mine and a 100-ton mill, shipping the product to the John D. Hoff Asbestos Co., of San Francisco, general agents for the distribution of this material. The process of fiberizing which that company utilizes is new and efficient, and consists of a jaw crusher, and a 20-stamp mill of 1200-lb. stamps, crushing to ⅛ mesh. The material is then conveyed to a double shaking screen, and the fiber is taken off the screen by means of suction blowers. The screenings go to a Canadian fiberizer, and, by suction, the fiber is carried to separators and a revolving screen for grading into No. 1, No. 2, and No. 3 mill grade, free from sand. The mine is operated as a quarry, tunnel, and gloryhole system, the ore being taken to the mill by a 1000-ft. aërial tramway. The entire plant is operated by water power.

Several other deposits of crysotile asbestos have been found in California and are being prospected. Amphibole asbestos in California consists of bunches and lenses of ore, but little of it was produced in 1918. The Asbestos and Mineral Corporation of New York deals extensively in asbestos and, incidentally, possesses a splendid collection of asbestos specimens from various countries.

The Canadian asbestos industry was active throughout 1918. Demand was keen, and production was limited only by shortage of labor and shipping facilities. The asbestos-producing districts in Canada are confined to the Province of Quebec, the five centers being Thetford Mines, Black Lake, Robertsonville, East Broughton, and Danville. The first four of these are situated on the Quebec Central Ry., which connects Quebec and Sherbrooke, and the fifth is on the Grand Trunk Ry., 85 miles southwest of the city of Quebec.

During the first nine months of 1918, the Canadian production of asbestos of all grades amounted to approximately 116,000 tons, valued at $6,000,000. For the 12 months of 1917, the figures were 137,000 tons, valued at $7,200,000. The progress of the industry may be gathered from the fact that 10 years ago the yearly production was 65,000 tons, valued at $2,500,000.

As the grading of asbestos has not been standardized, it is difficult to compare prices, except as between the same grades of the same producer. This is aggravated by the fact that the grades are numerous, passing gradually from one to the other, and they vary in value from $5 a ton for low-grade mill stock, very short fiber, to $1500 a ton for selected "Crude No. 1" of fiber of over one inch in length. Average prices for "paper stock" during the last six years have been: 1913, $28 per ton; 1914, $27; 1915, $31.50; 1916, $39; 1917, $53, and 1918, $60 per ton. By far the greater part of the Quebec asbestos is exported to the United States. Next in importance as a consumer of asbestos is England, followed by Japan, France, Italy, and other countries.

The main feature of the Canadian asbestos-mining industry in 1918 was the introduction of the gloryhole method and hoisting by shaft at one of the large mines, that of the Jacobs Asbestos Co., at Thetford, to replace the open-pit method; and the elimination at the Jeffery mine of cable-derricks for hoisting the rock, which is now loaded at the bottom of the open pit by steam shovels on cars which are hauled to the mill in trains. The Quebec Asbestos Co., at East Broughton, has restored its mill after the fire of last spring and is treating about 350 tons daily. The Frasier mine of the Asbestos Corporation completed a mill, and the Montreal property, under option to a Boston syndicate, has begun construction of a mill, which will be completed in the spring. The Regina Asbestos Co. and the Berlin Asbestos Co., at Robertson Station, and the Imperial Chrome and Asbestos Co., at Black Lake, have shown considerable activity. The new milling plant of the Windsor Asbestos Co., at Coleraine Station, was recently burnt to the ground. During 1918, 18 mines were in operation in the Quebec district. The question of cheap handling of the asbestos rock is a vital one, as about 2¾ million tons are hoisted yearly at the present rate of production.

A new supply of asbestos has been found in South Africa in the Asbestos Mountains, in the lower Griquatown beds. The deposits here have been developed as far north as the Bechuanaland Protectorate. The work is carried on by the aid of Kafir labor, and the fiber produced averages 25% of 1 in. or over. For the first seven months of 1918, production of Rhodesian asbestos was 7,834,397 lb., and the 1917 production was 19,932,281 pounds. Rhodesian production has shown a steady increase for the last four years.

Lead

THE production of lead in the United States and in the principal lead-producing foreign countries is given in the accompanying tables. These statistics are based on the production of refined pig lead in the several countries, except that the major part of the lead produced in Mexico is refined in the United States. The second table is not very far from the total production of the world outside of Germany and Austria. The principal omissions are the productions of Great Britain, Greece, and France. French and British smelters ordinarily derive considerable ore from Spain and Australia, but during the last two years very little could come from Australia. Burma supplied India and the Orient. Australia supplied the Orient and Great Britain. France got its lead chiefly from Spain, but some of the Spanish lead went to Great Britain. Most of the Mexican lead, and in the latter half of 1918 all of it, went to Great Britain, except the small quantity that is consumed in Mexico.

PRODUCTION OF LEAD (REFINERY STATISTICS) (a)
(In Tons of 2000 Lb.)

Domestic:	1914	1915	1916	1917	1918
Desilverized.	318,697	305,160	330,189	319,015	282,205
Antimonial...	17,177	24,601	22,819	16,265	15,833
S. E. Missouri	177,413	185,849	206,105	205,861	189,063
S. W. Missouri	25,448	20,312	33,128	40,575	63,628
Totals.	538,735	535,922	592,241	581,716	550,729
Foreign:					
Desilverized	28,475	43,301	17,832	50,962	107,531
Antimonial...	1,119	2,883	3,304	2,991	1,628
Totals	29,594	46,184	21,136	53,953	109,159
Grand totals....	568,329	582,106	613,377	635,669	659,888

(a) These figures include the lead derived from scrap and junk by primary smelters.

IMPORTS OF LEAD DURING FIRST TEN MONTHS

	1916	1917	1918
Lead ore, long tons	90,735	74,769	78,812
Lead contents, lb..............	29,648,109	37,080,482	34,784,290
Lead in bullion, lb.............	16,192,013	67,470,096	124,115,162
Lead, pigs, bars and old, lb.......	10,522,980	6,875,138	10,479,331

EXPORTS OF LEAD DURING FIRST TEN MONTHS

	1916	1917	1918
Pigs, bars, etc., from domestic ore, lb......	176,593,359	75,996,536	115,176,369
Pigs, bars, etc., from foreign ore, lb.	16,244,637	41,429,855	49,864,777

The Spanish exports of lead for the first nine months of 1918 were 115,105 metric tons, compared with 112,274 in the same period of 1917.

At the end of 1918 there were large accumulations of lead in all quarters. In the United States producers and the munitions contractors had about 50,000 tons. Trail had 8000, besides which the Canadian government held a good deal. The British Munitions Minister declared 55,000 tons in November, which was probably somewhat diminished by Dec. 31. France and Italy undoubtedly had considerable supplies. Australia was supposed to have a good deal that had not been shipped.

PRODUCTION OF LEAD BY THE PRINCIPAL COUNTRIES
(In Metric Tons)

	1916	1917	1918
United States (a)	537,277	527,729	499,618
Canada.....	19,550	14,515	19,169
Mexico (b)	22,000	52,937	88,670
Australia ..	139,000	160,000	175,000
Spain (c)	147,406	180,000	170,000
Burma	11,266	17,137	21,107
Italy...	24,362	25,000	25,000
Totals	900,861	977,318	998,564

(a) Production of domestic ore. (b) Production of pig lead in Mexico. Lead smelted from Mexican ore in the United States is not included in this table either under Mexico or the United States. (c) Total production, including Spanish lead smelted abroad.

The statistics of production do not show any great changes in the several countries, except in Mexico, where arrangements were made in 1918 that permitted more general mining and smelting. In the last quarter of the year, however, Mexican production was curtailed, and in the last six weeks a drastic curtailment was put into effect by most of the American producers.

The Lead Market in 1918

At the beginning of 1918 lead was quoted at 6½c., New York. The market at that time was exhibiting strong signs of recovery from the depression in the latter part of 1917. The freight congestion had already become an important factor, and premiums were paid locally for lead on the spot or what could be supplied from near-by refineries. By the middle of January the price had advanced from 6¾ to 7c. and the situation had become very tight. Lead was two months in coming from the Mississippi River to the Atlantic seaboard, compared with a normal time of about six weeks, indicating a stock of about 100,000 tons on wheels, against a normal of 25,000 to 30,000. With the advent of February, deliveries by the railways became a little freer. However, the market continued strong on both domestic and foreign buying, February closing with a quotation of 7¼ cents.

There seemed to be strong prospects that lead would go higher, but producers received intimations from the War Industries Board that no advance above 7¼c. would be permitted. Learning of this, consumers made up their minds that they were in no danger of a squeeze, and, their previously purchased supplies of lead being delivered more freely by the railways, they withdrew from the market, and in consequence thereof the price declined to 6½c., which was registered at the end of April. However, their withdrawal from the market was really a mistake, for the statistical position of the metal was strong, and, asserting itself, the market advanced rapidly. By the middle of June there was no doubt in the mind of anybody respecting the stringency of the situation. At the request of the War Industries Board a lead producers' committee, under the chairmanship of Clinton H. Crane, was organized to take charge of the business. However, the War Industries Board would not permit the price to go above 7¾c. New York. While there was no formal fixing of price, to all intents and purposes there was. The only difference between the situations in lead and copper was the absence of formal hearings, agreements, etc., which made it easier to negotiate modifications when necessary. Indeed, one modification became immediately necessary owing to the advance in freight rates on July 1, following which the

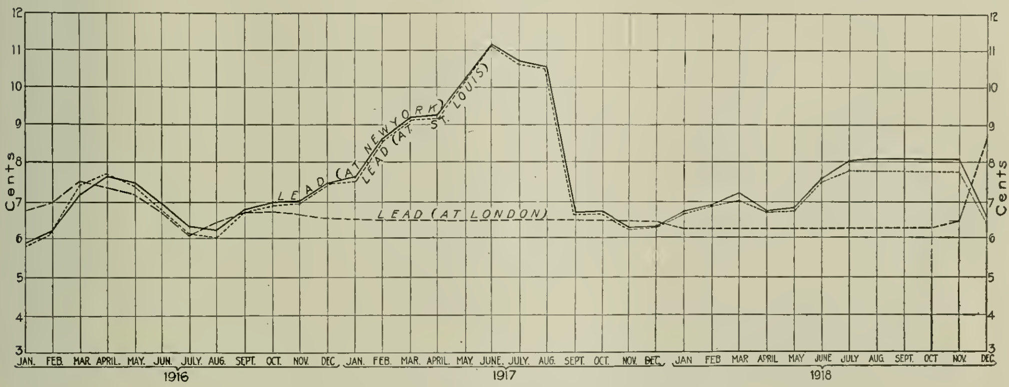
MONTHLY AVERAGE PRICE OF LEAD

Month	New York			St. Louis			London		
	1916	1917	1918	1916	1917	1918	1916	1917	1918
January.....	5.971	7 626	6 782	5 826	7 530	6 684	31 167	30 500	29 00
February...	6 246	8 636	6 973	6 164	8.595	6 899	31 988	30 500	29 00
March.......	7 136	9 199	7.201	7 375	9.120	7.091	34 440	30 500	29 00
April........	7 630	9 288	6 772	7 655	9.158	6 701	34 368	30 500	29 00
May........	7 463	10 207	6 818	7 332	10 202	6 704	32 967	30 500	29 00
June......	6 936	11 171	7 611	6 749	11 123	7 511	31 011	30 500	29 00
July	6 352	10 710	8 033	6 185	10.644	7 750	28 137	30 500	29 00
August	6 244	10 594	8 050	6.088	10 518	7 750	29 734	30 500	29 00
September...	6 810	8 680	8 050	6 699	8 611	7 750	30 786	30 500	29 00
October.	7 000	6 710	8 050	6 898	6 650	7 750	30 716	30 500	29 00
November..	7 042	6 249	8 050	6 945	6 187	7 750	30 500	30 500	31 20
December..	7 513	6 375	6 564	7 405	6 312	6 324	30 500	30 500	40 00
Year.... ..	6 858	8 787	7 413	6 777	8 721	7 222	31 359	30 500	30.10

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

price for lead was raised to 8.05c., New York, compensating for the increase in freight rate. That price prevailed until Dec. 20.

The only way of handling the business in the second half of 1918 was to put consumers practically on a ration basis and curtail non-essential consumption so far as possible. The producers put their output into the hands of the committee, which received the orders from consumers and attended to the distribution, which was prorated among the producers. Earlier in the year there had been a strong demand for lead from foreign quarters. Exportation was now practically forbidden, except with respect to that which was refined from Mexican bullion. The bulk of the latter was taken by the British government in private contract with the two principal producers, and in the latter part of 1918 the whole of it was so taken. The British did very well on these contracts, having made the larger one when lead was at a very low price, while they did not pay higher than 8.05c., New York, for anything.



MONTHLY AVERAGE PRICES OF LEAD—1916, 1917, 1918.

With the signing of the armistice on Nov. 11, the lead producers found themselves in a better position than the copper producers, for they had proportionally more orders on their books, and also had a good many of their old average-price contracts. However, the cancellation of orders caused lead to back up on the hands of manufacturers, and the producers themselves received more or less cancellations. Furthermore, the stock of lead in the hands of the Government was promptly seen to be a menace.

At the request of the War Industries Board, the Committee of Lead Producers continued in service and for a few weeks maintained its price at 8.05c., after which the price was reduced to 7.05c. Small business was received at those prices from random quarters where supplies happened to be inadequate, but the total of this business was only a few hundred tons per week. Most of the lead producers curtailed their production immediately after the armistice, but one of them failed to do so. This produced technical reasons that compelled a dissolution of the committee on Dec. 20, and on the following day lead was offered in tonnage at 6c. and then 5¾, 5½, and 5¼c., without developing any large business. The largest producers reduced their asking price to 6c., but did not follow the market all the way down. At the close of 1918 there were signs that the market might rally to about 5¾c., our closing quotation being 5¼@5¾ cents.

In Great Britain the price for lead was fixed officially at £29 on Jan. 2, 1918, and continued at that figure until Nov. 26, when it was raised to £40. The British government bought lead from Australia, Spain, and Mexico. the cost of which was more than £29 in England, but the government pocketed the loss in distribution at that price. The advance to £40 was evidently to correct that condition in so far as the liquidation of the large governmental stock was concerned. American producers would immediately have broken that price with offerings of their lead, but they could not obtain transportation for it.

The close of 1918 sees very large stocks of pig lead all over the world. There is about 50,000 tons in the hands of the producers and the contractors for the United States, 55,000 tons in the possession of the Ministry of Munitions in Great Britain, 8000 tons at Trail, B. C., a further large quantity in the hands of the Canadian government and supposedly a large supply in Australia. Probably there is 250,000 tons of pig lead in the hands of producers and governments throughout the world.

Silver-Lead Smelting Works of North America

The accompanying list, which has been corrected to Dec. 1, 1918, gives the several silver-lead smelting works of the United States, Mexico, and Canada, together with the number of their furnaces (in all cases, blast furnaces) and their estimated annual capacity in tons of charge. By "tons of charge" is meant ore and flux, but not coke. The ton of charge is manifestly the correct unit. In the case of a self-fluxing ore, the ton of ore smelted and the ton of charge smelted is the same thing. In other cases fuel and labor have to be used in smelting the flux as well as in smelting the ore, and the economy of smelting depends largely upon the percentage of ore in the charge. The management of this question is about the highest exercise of the metallurgist's skill.

The figures in the accompanying table are in most cases from official communications of the respective companies. Estimated capacity is always a matter of more or less uncertainty, and for this reason the figures given should be accepted only as approximations.

The total capacity of the Mexican works at the end of 1918 is a little over 2,300,000 tons per year; of the American works, about 5,521,000 tons. With respect to the American works, such capacity has never been in use at one time. More or less of it represents capacity idle because of changes in the conditions of ore supply.

AMERICAN SILVER-LEAD SMELTING WORKS

Company	Place	Furnaces	Annual Capacity(a)
American Smelters Securities Co. (Selby Works)	Selby, Calif.	3	210,000
American Smelting and Refining Co.	Denver	7	510,000
American Smelting and Refining Co	Pueblo	7	380,000
American Smelting and Refining Co.	Durango	4	210,000
American Smelting and Refining Co	Leadville	10	510,000
American Smelting and Refining Co	Murray	8	657,000
American Smelting and Refining Co.	East Helena	4	306,000
American Smelting and Refining Co.	Omaha (*b*)	2	82,000
American Smelting and Refining Co.	Perth Amboy (*b*)	4	170,000
Con. Kansas City Sm. and Ref. Co	El Paso	6	380,000
Bunker Hill & Sullivan Min. and Concentrating Co	Kellogg, Ida	3	600,000
Ohio & Colorado Smelting Co	Salida, Colo.	3	200,000
United States Smelting, Refining and Mining Co	Midvale, Utah.	7	530,000
Northport Smelting and Refining Co.	Northport, Wash.	2	216,000
Pennsylvania Smelting Co.	Carnegie, Penn.	2	60,000
International Smelting Co	Tooele, Utah	5	500,000
Totals, United States		77	5,521,000
American Smelting and Refining Co.	Monterrey	7	410,000
American Smelting and Refining Co.	Aguascalientes	1	40,000
American Smelting and Refining Co.	Chihuahua	7	400,000
American Smelters Securities Co.	Velardeña	3	150,000
Compañia de Minerales y Metales	Cerralvo	2	35,000
Compañia de Minerales y Metales	Guadalupe, N. L.	1	70,000
Compañia Fundidora y Afinadora de Monterrey	Monterrey	4	210,000
Compañia Metalurgica Mexicana	San Luis Potosi	10	250,000
Compañia Metalurgica de Torreon	Torreon	9	350,000
Compañia Minera de Peñoles	Mapimi	6	350,000
Mazapil Copper Co.	Saltillo, Coah.	1	36,000
Totals, Mexico		51	2,301,000
Consolidated Mining and Smelting Co.	Trail, B. C.	4	98,680

(*a*) Tons of charge. (*b*) Smelt chiefly refinery between-products.

White Lead and Oxides in 1918

The decline in the price of pig lead during the last three months of 1917 was so clearly not justified by actual trade conditions that manufacturers made no reduction on dry pigments after Oct. 19 of that year, and the prices then established continued in force until May 28, 1918.

Dry white lead opened at 9c. per lb. in a large way, but, following the upward course of pig lead, advanced ¼c. on May 28, and there were further advances of ¼c. on June 21 and ½c on July 24, making the price 10c., which continued in force until the close of 1918.

For many years the margin allowed large dealers in white lead in oil had been ¼c. per lb., and though this was accepted as reasonable on a staple of this class when the list price ranged at 7c. or under, it became unprofitably small when the price reached 12c. or more, and corroders, therefore, adopted a system of pricing which gave to all classes of dealers a more liberal profit, based on percentages instead of upon a specified rate per pound. The schedule adopted Apr. 26 established a base price of 12¼c. per lb. for 100 lb. packages, with a discount of 10% on quantities of 500 to 2000 lb.; 10 and 2½% on 2000 to 10,000 lb.; 10 and 5% on 10,000 to 30,000 lb., and 10 and 6% on 30,000 lb. or over. This made the minimum price to largest buyers 10.36c. against 10¾c. as the opening price under the old system. There were subsequent advances in May, June, and July, which brought the base price to 14c. on July 28, giving a net price of 11.84c. to largest buyers, or practically 1c. above the opening price of the year, although pig lead had meantime advanced 1.80c. It is expected that future fluctuations will apply only to the base price, leaving the scale of discounts unchanged.

Sales of dry white lead to paint manufacturers, and of lead in oil to painters, were considerably below any previous year for a long period, owing chiefly to the effect which war conditions had in restricting building operations everywhere. There was little new work except Government construction, and the difficulty in obtaining labor, as well as its high cost, added to that of lead and linseed oil, caused a neglect of old work which would have been repainted under normal conditions.

The demand for oxides has been large. The Government required the use of enormous quantities of red lead on ships and other structures, and the industries using red lead and litharge have all been large consumers, so that sales of these products have been fully equal to the average of previous years going back to prewar dates. Price fluctuations have synchronized with those on white lead, and at the close of 1918 the minimum quotations for casks to largest buyers are 11¼c. per lb. for red lead and 10¾c. per lb. for litharge.

Linseed-oil prices in 1918 established an entirely new record for a period of at least 60 years. Starting at about $1.30 per gal. in jobbing quantities, the price advanced steadily until $1.90 was reached in August. During the last three months of 1918 the price receded somewhat as new-crop flaxseed became available, but, at the close, $1.58 was quoted, and the average for the year will be about that figure. This has added so much to the cost of paint that property owners have deferred painting, wherever it could be postponed.

Lead Products Other Than White Lead

By J. R. Wettstein*

Reviewing the industry of lead products other than white lead in 1918, it is significant to note the wide dissimilarity between the normal demand of these products and the demand created by the war. A lead shortage, threatened through the greater part of the year, made it necessary for the authorities in Washington to adopt measures confining the use of lead to the actual needs of the Government for the successful prosecution of the war. As was to be expected under such conditions, it soon developed that, with few exceptions, most of the products of lead were highly essential to the Government's requirements, both direct and indirect. Therefore the record of business for the year will represent a war demand with which comparison in peace times reveals nothing, except, perhaps, emphasizing the fact that war demands for lead products greatly overshadow the normal demands of peace.

Mixed Metals—These comprise babbitts, solders, and casting metals, and alloys of lead, tin, and antimony, used for the most part industrially. The demand for these products was particularly strong throughout 1918, reflecting the continued demand upon industry and transportation speeded to the utmost by governmental requirements. Although the preceding year was a record breaker in point of tonnage, mixed-metal products in the year just closed will undoubtedly show quite as large if not a larger business than the year before. Since the armistice, the tonnage has shown signs of diminishing, and 1919 will probably exhibit a considerable shrinkage, depending altogether upon how easily the industries of the country return to their pre-war condition. At one time famine conditions existed in tin, which might have led to the enforced curtailment of the demand for bearing metals were it not for the fact that other metals and alloys were in a large degree substituted for tin.

---

*President, United Lead Co., 111 Broadway, New York.

Oxides of Lead—These products, used principally in the form of red lead and litharge in the glass and rubber manufacturing business, and for painting material, record a continuance of the heavy demand of 1917. The business done was probably larger than that of 1917, even though exports were embargoed for some time, owing to the extreme scarcity of lead for a large part of the year. In adjusting themselves to peace conditions these materials will undoubtedly also show a shrinkage in volume.

Shot—Because of the high price of loaded shotgun shells, in the making of which practically all the shot manufactured in the country is used, the tonnage of shot will probably be found to be smaller for 1918 than for any previous year of which there is a record. For a time the industry was threatened with a complete cessation because of the great scarcity of lead and its vital need for purposes more directly connected with the war. The industry was looked upon as non-essential, though a moderate tonnage was taken by the Government in the form of shot-shells for practice work among the recruited troops. The product will probably adapt itself to a normal demand much more rapidly than most of the other products of lead, as a desire to excel in marksmanship has undoubtedly been greatly stimulated by the war.

Lead Pipe—By reason of the Government restriction on building trades, the confining of new construction to the necessary building of plants and the housing of employees, and the discouragement of ordinary public works under municipal guidance, the normal demand for pipe shrank to figures not seen for many years. Its use in manufacturing enterprises, chemical plants and shipbuilding increased rapidly during 1918, so that the total tonnage for the year was not far below normal in point of output. Not much recovery in the normal demand can be expected until a normal condition in the building trades has been completely restored.

Sheet Lead—This product in 1918 came under the Government demand for shipbuilding, acid and powder plants, and industrial purposes generally, which demand was also keenly in evidence during 1917. Indications point to a somewhat larger tonnage for 1918, although the makers of the commodity were probably driven to greater capacity, owing to the fact that a component part of a high-explosive shell—a lead disk—was manufactured at the mills. The over-expansion in the erection of acid and powder plants occurring in the last two or three years will undoubtedly make itself felt by a much lessened demand during the next few years.

Munitions—A large tonnage of an alloy composed of 87½% lead and 12½% antimony found its way into shrapnel balls in 1918. Though complete figures are not yet available, the consumption of lead for this purpose was probably twice as large as during the year before. It is not far off the mark to say that fully 75,000 tons of lead was consumed in the country for this purpose during the last four years. The close of 1918 finds practically all orders for shrapnel balls completed, and such as are in large part unfinished have probably been canceled by the Government, so that the demand for this product is satisfied, and, let it be hoped, for all time.

The Coeur d'Alene District in 1918

By Stanly A. Easton*

The beginning of the year 1918 was marked by unprecedented floods, which cut off for a period of nearly two weeks all railroad communication serving the western part of the district, and did great damage to the new and partly constructed Pine Creek branch of the Oregon-Washington R. & N. Co., which has since remained unfinished and in a damaged condition, and also washed out the recently constructed branch up Beaver Creek on the North fork of the Cœur d'Alene River, serving a portion of the Sunset Peak country, so that no railroad service was possible for months. These troubles, together with the scarcity of skilled labor and the shortage and expense of mining material, practically stopped production and development operations in the Pine Creek and other outlying parts of the district.

Later in the year, the operation of the selective draft, volunteering for the service in considerable numbers, and the lure of other war industries, took many workmen, both single men and men with families, from the district. Still later in the year the Spanish influenza epidemic caused further serious labor shortages. In addition, the difficulty and expense of securing all kinds of supplies added to the burdens of production. In spite of these difficulties, the mines of the Cœur d'Alenes produced with regularity throughout 1918, and though the output of lead, silver, and zinc, which cannot at this time be even reasonably estimated, will doubtless be lower than in 1917, it surely will not fall below the average maintained for the last five years.

The Bunker Hill smeltery and refinery at Kellogg ran continuously throughout 1918. A notable production of refined desilverized lead, refined silver, and gold and copper sulphate was made from the ores of the Bunker Hill and affiliated mines and from the ores of the Hecla Mining Co. The copper-sulphate product is utilized in the flotation plants of the district.

An additional bonus of 50c. per shift so long as New York lead is 8c. per lb. or higher was granted on July 10 by the various companies to all employees of the district. The total bonus thus amounted to $1.75 per shift.

Some copper production is made from the National and Caledonia mines, but there is no immediate promise of a greater copper output. Since the early 80's, when the placers of the North side, on Prichard Creek, at Murray, flourished, Shoshone County had made no considerable gold yield until 1918. During 1918 the dredge of the Yukon Gold Co. handled 4000 cu.yd. per day of Prichard Creek gravels, and gave a gold yield the amount of which is not available, but which is known to be substantial.

The war record of the Cœur d'Alene district, expressed in its financial responses to the needs of the Government and the Army, may well find a place in an account of its activities. The allotment and actual subscriptions to the Government loans and to Red Cross and like campaigns follow:

---

*Manager, Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho.

WAR DRIVES IN THE COEUR D'ALENE DISTRICT

Allotment	Subscription	Allotment	Subscription
First Liberty Loan		First Red Cross Drive	
(No record available)		$50,000	$53,000
Second Liberty Loan		Second Red Cross Drive	
$810,000	$1,667,000	32,000	52,000
Third Liberty Loan		United War Work Drive	
850,000	1,227,000		
Fourth Liberty Loan			
850,000	1,405,000	40,000	48,000

Miscellaneous subscriptions follow: Y. M. C. A., $14,000; Knights of Columbus $4000; Salvation Army, $3500; Y. W. C. A., $4000; War Savings Stamps (to date), $270,000.

It is thus apparent that the citizens as well as the mines have stood the test of war times. There was no break in production or shortage of products from the Cœur d'Alene mines throughout the entire period of the Great War.

British Imports and Exports

The following figures of British metal imports and exports (except exports for use of British forces on active service) have been reported by the Board of Trade, and published in the *Ironmonger*, of Dec. 14, 1918:

BRITISH IMPORTS, FIRST 11 MONTHS

(In Long Tons)

Metals	1917	1918
Pig iron, basic	31,848	53,823
Pig iron, forge, foundry	72,629	27,113
Pig iron, hematite	15,353	9,832
Pig iron, other grades	12,585	23,288
Steel blooms, etc	58,227	20,014
Iron bars, angles, rods	60,087	23,714
Copper regulus	24,294	20,081
Copper, unwrought and part wrought	123,511	191,737
Lead, pig and sheet	133,609	194,081
Tin, blocks, ingots, etc	25,624	11,770
Zinc, crude	68,051	58,315
Zinc, manufactured	4,023	2,495

BRITISH EXPORTS, FIRST 11 MONTHS

(In Long Tons)

Metals and Ores	1917	1918
Pig iron	704,047	455,285
Basic	10,751	12,319
Forge and foundry	314,085	222,235
Hematite	288,021	157,696
Other grades	91,190	63,035
Iron ore	667	160
Copper	9,911	6,933
Ingots, etc	4,980	4,031
Yellow and mixed	482	199
Manufactures of	3,348	2,267
Lead, pigs, etc	9,006	4,168
Tin, unwrought	17,790	14,529
Zinc and spelter	7,771	1,330

Quicksilver in California

By Murray Innes*

The quicksilver output of California in 1918 is estimated at 23,000 flasks, as against 24,251 flasks in 1917 and 21,045 flasks in 1916. The decline in production was due partly to the closing down of some of the smaller mines, and was accentuated by the sudden drop in production of the New Idria mine in the last quarter of the year. That mine made a record production during the summer of 1918, attributable in part to the treatment of a large tonnage of old dumps and surface material, which was handled mainly by concentration. Toward the end of the year these old mining dumps were partly exhausted, resulting in a notable drop in the New Idria output.

As in recent years, the New Idria mine accounted for about half of the California output, the rest being divided between about 15 smaller producers, which struggled with steadily increasing operating expenses, owing to labor scarcity and inefficiency and the high cost of supplies common to all Western mining ventures during the year. In general, the actual cost of producing quicksilver in California exceeded $80 per flask in 1918, without taking into consideration depreciation or depletion, which items most quicksilver mines have in the past been too likely to overlook.

The average cost of producing the metal having at least doubled in the last four years, the immediate outlook for the California quicksilver producer is anything but encouraging. The supply of low-grade ore is ample and it is extremely probable that active development work, such as has been carried on recently, would develop ores of better grade. Both the metallurgical and the mining practices are now entirely up to date in the principal quicksilver mines of the state, and, had they a fair chance in the matter of labor and other costs, some of them might now hold their own in competition with the European producers, but with costs ranging at anything like present figures this seems impossible.

The dumping of the surplus output of Europe put an end to the profitable production of quicksilver in California prior to 1914, and the producers have now every reason to fear a renewal of the dumping process. Their costs, as stated, having doubled in the last four years, they are now much more vulnerable to foreign competition, and though a few of the mines might continue to operate for a time even at a loss, the outlook is for a considerably reduced production of quicksilver in 1919.

Several of the smaller mines recently shut down, including the Sulphur Bank, in Lake County; the Aetna mine, in Napa County, and also the Abbott, La Joya, Big Injun, and the Socrates properties, and I am informed that some of the larger producers are seriously considering doing likewise.

As stated, the narrow policy of the United States Government in the matter of tariff ruined this once-important industry before the war, but the quicksilver producers have now some slight hopes that such essential metals will receive consideration. It would seem that the country should have learned the wisdom of having available all the essentials of national defense, particularly the raw materials and metals, and that it would be most unwise to destroy this industry again when a protective tariff would insure a supply sufficient for home consumption. A thorough investigation by the United States Tariff Commission and by the War Trade Board has demonstrated that only by a high tariff can the California producers now hope to compete with the foreign product.

Alaska Mines Produced Gold to the value of about $10,000,000 in 1918, compared with $14,650,000 in 1917, according to the U. S. Geological Survey. The total value of gold mined in the territory is now about $302,000,000, of which $213,500,000 has been won from placers. In 1918, about 69,400,000 lb. of copper was produced in Alaska. The production in 1917 was 88,793,000 lb. The total copper produced to date is 490,000,000 lb. The value of Alaska's lesser mineral products in 1918 was as follows: Silver, $870,000; coal, $435,000; tin, $90,000; lead, $85,000; miscellaneous metallic products, including chrome ore, tungsten, palladium, platinum, and antimony, $117,000; and miscellaneous non-metallic products, $120,000.

---

*Mining engineer, 217 Kohl Bldg., San Francisco, California

Zinc

THE accompanying statistical tables show clearly the record of production in the United States. During the first quarter curtailment of production was the order of the day. The full effects of this were seen in the second quarter. Thereafter, production was fairly steady, and although much less than in 1917 was large in comparison with the maximum pre-war year. In the latter part of 1918 the predominant feature was the pressure of the electrolytic producers, who made a steadily increasing output. The spelter producers had an unsold stock throughout 1918, and although it diminished in the second half there was considerable doubt whether metal was not simply passing from visible into invisible supply. The stock of spelter in hands of producers on Dec. 31 was 40,325 tons, compared with 60,415 tons at the beginning of the year.

SPELTER PRODUCTION, 1913–1918, BY QUARTERS

(In Tons of 2000 Lb.)

Reports of Ore Smelters Only

District	I	II	III	IV
	1913			
Illinois	27,924	28,523	26,118	28,986
Kansas-Missouri	22,006	23,820	19,204	20,127
Oklahoma	21,430	21,840	18,502	21,458
Others (a)	20,722	20,153	19,238	18,211
Totals	92,082	94,336	83,062	88,782
	1914			
Illinois	31,005	32,482	32,512	34,588
Kansas-Missouri	13,939	14,659	13,193	11,633
Oklahoma	22,563	22,960	22,945	23,999
Others (a)	22,717	22,715	24,106	24,296
Totals	90,224	92,816	92,756	94,516
	1915			
Illinois	35,786	39,511	41,791	44,577
Kansas-Missouri	14,090	24,554	32,152	40,256
Oklahoma	24,713	26,984	28,613	31,095
Others (a)	26,255	30,575	31,360	34,830
Totals	100,844	121,624	133,916	150,758
	1916			
Illinois	45,344	45,547	41,953	48,651
Arkansas	....	....	2,977	4,660
Kansas-Missouri	38,513	42,488	39,447	33,948
Oklahoma	34,994	38,786	42,604	52,680
Others (a)	37,853	39,873	41,514	48,186
Totals	156,704	166,694	168,495	188,125
	1917			
Illinois	48,756	47,237	40,379	39,699
Arkansas	5,597	6,847	7,596	5,661
Kansas-Missouri	26,350	25,621	19,443	15,091
Oklahoma	53,280	57,227	48,478	45,602
Electrolytic	7,950	8,362	5,096	5,837
Others (a)	42,013	41,700	39,736	38,853
Totals	183,946	186,994	160,728	150,743
	1918			
Illinois	35,297	34,829	36,448	34,787
Arkansas	6,157	5,603	7,629	7,317
Kansas-Missouri	10,284	5,015	7,198	9,526
Oklahoma	38,171	34,999	35,192	34,752
Electrolytic	8,088	9,405	11,037	10,568
Others (a)	36,881	36,265	35,445	34,229
Totals	134,878	126,116	132,949	131,179

(a) With the exception of one plant in Colorado, these are all Eastern works. In the fourth quarter of 1915 and in 1916 is included Anaconda and other electrolytic production.

The fundamentals in the zinc business of the United States are not encouraging. At the middle of 1918, after the weaker smelters had discontinued business, probably forever, there remained among the strong and active concerns capacity for producing 800,000 tons of spelter per annum, of which capacity they were able to use only about five-eighths. The capitalization of the idle capacity was estimated at $10,000,000. A similar situation existed with respect to mining and milling plants, of which the unused part was also estimated at $10,000,000. The direct cost of smelting in a large part of the plants had increased by something like 1¾ to 2 times, while the percentage of zinc extraction had diminished from an average of about 86% to something like 82%. The lot of the smelter was not therefore a happy one. The cost of mining had similarly increased in the Joplin district, but it was offset more or less by the mining of relatively rich ore in Oklahoma. The price of ore therefore declined relatively more than the price for spelter. Dissatisfaction over this condition led to a pooling arrangement being formed in October, but it was so uneconomic in its idea that it was bound to blow up, which, in fact, it did speedily. At the end of 1918 there was a large surplus of ore, which was salable only with difficulty, but the declining tendency in the spelter market indicated the approach of the day of curtailment both in mining and smelting, which would be the natural corrective.

American spelter producers have been looking for a revival of the export trade, but the prospect does not seem immediate. There was indeed a certain demand in November, which was met by the producers of high-grade metal. At about that time the British Munitions Ministry reported holding 18,769 long tons of common spelter and 6544 tons of high grade. France professed to have ample supplies. Indeed, the attitude of both the British and French governments was toward disposing of their holdings before letting any more foreign spelter in.

PRODUCTION OF SPELTER

(In Tons of 2000 Lb.)

By Ore Smelters Only

States	1914	1915	1916	1917	1918
Arkansas	....	....	7,637	25,701	26,706
Colorado	8,152	8,984	8,908	7,735	3,890
Illinois	130,587	161,665	181,495	176,071	141,361
Missouri-Kansas	53,424	111,052	154,396	86,505	32,023
Oklahoma	92,467	111,405	169,064	204,587	143,114
Electrolytic	....	....	10,963	27,245	39,098
East and others (a)	85,682	114,036	147,555	154,567	138,930
Totals	370,312	507,142	680,018	682,411	525,122

(a) Includes Anaconda and other electrolytic production in 1915.

EXPORTS DURING FIRST TEN MONTHS

	1916	1917	1918
Zinc ore, long tons	70	924	55
Zinc dross, lb	56,525	20,475,301	26,367,994
Pigs, plates, slabs, etc.:			
From domestic ore, lb	237,256,165	228,573,972	106,945,345
From foreign ore, lb	72,021,299	112,500,809	33,876,062
Sheets, strips, boiler plates, etc., lb	19,734,045	27,907,238	21,593,074

IMPORTS DURING FIRST TEN MONTHS

	1916	1917	1918
Zinc ore and calamine, gross weight, long tons	297,311	175,284	56,168
Zinc contents, lb	252,951,201	135,668,774	44,480,267
Blocks or pigs and old, lb	1,192,657	387,447	70,246
Zinc dust, lb	1,686,665	732,647	23,046

Australia made an increased production of spelter in 1918, and Spain a decreased, but the output of those countries is small. During the first eight months Japan exported only about half the spelter it did in the corresponding period of the previous year. Whether this indicates diminished production, accumulation of stock, or both, we do not know. The production of British smelters in 1918 will be about 55,000 long tons. The great new smeltery at Avonmouth was not finished, nor were extensions to other plants, but these should be completed in 1919, and it is estimated that Great Britain's capacity for producing spelter at the end of 1919 will be 130,000 tons.

The electrolytic plant at Risdon, in Tasmania, is to be greatly increased in capacity, and new plants of considerable size are to be built in France (Pyrenees) and in Italy, but there is no expectation that any of these will be producers in 1919. Nor will be the new distillery of 25,000 tons' annual ore capacity of the Burma Mines, Ltd., at Sackchi, in India.

Recent reports to us from Belgium were that the smelting works of that country were not materially damaged, but it will be an indeterminate time before some of those along the Meuse can resume operations. However, some of the Belgian plants, including Overpelt and Lommel, in the Campine, were operated during the occupation.

The Dutch and French plants, except those in the coal fields of Northern France, are probably in a position to make their usual production as soon as they can be supplied with adequate ore and fuel. The smelteries of Rheinland and Westphalia are mainly within the zone of occupation. The zinc-mining and smelting district of Upper Silesia, near the Polish frontier, is now the scene of Polish advance, with consequential disorder.

The Zinc Market in 1918

At the beginning of 1918 common spelter was quoted at 7⅝c. St. Louis. There was an overproduction and stocks were accumulating. The statistical conditions caused a decline in the market to 6.60c. That relatively low price, which was estimated to be equivalent to about 3¾c. before the war, caused a general closing of inefficient smelteries. Many of these were abandoned, and not a few were dismantled.

MONTHLY AVERAGE PRICE OF SPELTER

	New York			St. Louis			London		
Month	1916	1917	1918	1916	1917	1918	1916	1917	1918
Jan.....	16 915	9 619	7 836	16.745	9 449	7.661	89 810	48.329	54 000
Feb.....	18 420	10 045	7.814	18 260	9 875	7.639	97 762	47 000	54.000
Mar....	16 846	10 300	7 461	16 676	10 130	7 286	95.048	47 000	54.000
Apr....	16 695	9 459	6 890	16 525	9.289	6.715	99 056	54.632	54.000
May....	14 276	9 362	7.314	14.106	9.192	7.114	94 217	54.000	54 000
June....	11 752	9.371	8.021	11.582	9.201	7.791	68.591	54 000	54 000
July....	8 925	8.643	8.688	8.755	8.473	8.338	50.750	54.000	54.000
Aug....	8 730	8.360	8 985	8.560	8.190	8.635	51.587	54.000	54 000
Sept....	8.990	8.136	9.442	8.820	7.966	9.092	52.095	54.000	54.000
Oct.....	9 829	7 983	8.801	9.659	7.813	8.451	54 159	54.000	54 000
Nov....	11 592	7 847	8.491	11.422	7.672	8.141	56.023	54.000	54.100
Dec.....	10.665	7.685	8.163	10.495	7.510	7.813	55.842	54.000	56.050
Year..	12 804	8.901	8.159	12.634	8 730	7.890	72.071	52.413	54.180

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

The curtailment of production was overdone, in view of the continued large requirement of spelter for brass making, and the market price rallied to about 8½c. at the beginning of July. After a minor setback, further improvement in the statistical position advanced the price to 9⅜c. in September, but with this advance the margin between common and high-grade spelters contracted, and eventually it ceased to be profitable to refine by redistillation. The supply of common spelter for sale being thus increased, the market started on a slow but steady decline. The advent of the armistice did not produce in zinc just the same conditions as in copper and lead, for zinc had never been under control. However, the weakness of the market became a little more pronounced, and 1918 closed with the quotation of 7.45 cents.

AVERAGE PRICE OF ZINC SHEETS

(In Cents per Pound)

	1916	1917	1918		1916	1917	1918		1916	1917	1918
Jan..	23 40	21 00	19 00	May	24 00	19 00	15 00	Sept..	15 00	19.00	15.00
Feb..	24 50	21 00	18 00	June	19 50	19 00	15 00	Oct	15 20	19 00	15 00
Mar	25 00	21 00	15 00	July	15 60	19 00	15 00	Nov..	18 25	19 00	15 00
April	25 20	20 44	15 00	Aug.	15 00	19 00	15 00	Dec.	21 00	19 00	15 ..

Average for the year 1916—20 14 cents, 1917—19.62 cents, 1918—15.58 cents.

Note. These are base prices for ordinary size sheets, in carload lots, f. o. b. La Salle-Peru, Ill., less 8% discount

At the beginning of 1918 high-grade spelter was quoted in the neighborhood of 12½c. During the spring the War Industries Board fixed 12c. as a maximum price. A little later, an alteration in the Army specifications increased the supply of high-grade metal. The market becoming more competitive, the price declined below 12c. Toward the close of 1918 high-grade metal was sold at 9c., and at the very end of the year it is doubtful if it were properly quotable above 8½ cents.

The prices of sheet zinc and rolled plate were fixed at 15 and 14c., respectively, and those prices were maintained until the end of 1918, the supply being steadily short, because of insufficient manufacturing capacity. Owing to the large profit that those prices permitted, the producers of special grades of ore in the Joplin district claimed a participation in it and obtained a fixed price of $75 per ton, the requirements of the sheet zinc producers being prorated among those ore producers.

ZINC-SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation		1917		1918
American Spelter Co. (a)	Pittsburg, Kan.		896	(d)	896
American Steel & Wire Co.	Donora, Penn.		9,120		9,120
American Zinc and Chem. Co. (a)	Langeloth, Penn.		7,296		7,296
American Zinc Co. of Ill.	Hillsboro, Ill.		4,864		4,864
American Zinc, Lead and Smg. Co. (a)	Dearing, Kan.		4,480	(c)	...
American Zinc, Lead and Smg. Co. (a)	Caney, Kan.		6,080	(f)	6,080
American Zinc, Lead and Smg. Co. (a)	Neodesha, Kan.		3,760	(c)	...
American Zinc, Lead and Smg. Co.	E. St. Louis, Ill.		5,620		5,620
Arkansas Zinc and Smelting Corpn.	Van Buren, Ark.		3,200		3,200
Athletic Min. and Smelting Co.	Fort Smith, Ark.		1,664		2,496
Bartlesville Zinc Co.	Bartlesville, Okla.		5,184		7,488
Bartlesville Zinc Co.	Blackwell, Okla.		9,600		9,600
Bartlesville Zinc Co.	Collinsville, Okla.		13,400	(i)	13,400
Bartlesville Zinc Co., Lanyon-Starr	Bartlesville, Okla.		3,456		3,456
Collinsville Zinc Co. (a)	Collinsville, Ill.		1,984	(d)	1,984
Eagle-Picher Lead Co.	Henryetta, Okla.		3,000		4,000
Edgar Zinc Co.	Carondelet, Mo.		1,982	(c)	.
Edgar Zinc Co.	Cherryvale, Kan.		5,040		5,040
Fort Smith Spelter Co.	Fort Smith, Ark.		2,560		2,560
Grasselli Chemical Co.	Clarksburg, W. Va.		5,760		5,760
Grasselli Chemical Co.	Meadowbrook, W. Va.		8,520		8,520
Grasselli Chemical Co.	Terre Haute, Ind.		3,360		4,200
Hegeler Zinc Co.	Danville, Ill.		5,400		5,400
Henryetta Spelter Co.	Henryetta, Okla.	(a)	3,000	(b)	3,000
Illinois Zinc Co.	Peru, Ill.	(b)	4,640		5,440
J. B. Kirk Gas and Acid Co. (a)	Iola, Kan.		3,440	(b)	3,440
Kusa Spelter Co.	Kusa, Okla.		7,520		5,360
Lanyon Smelting Co	Pittsburg, Kan.	(d)	448	(d)	448
Robert Lanyon Zinc and Acid Co.	Hillsboro, Ill.		3,200		3,200
Matthiessen & Hegeler Zinc Co.	La Salle, Ill.		6,168		6,168
Mineral Point Zinc Co.	Depue, Ill.		9,068		9,068
National Zinc Co.	Bartlesville, Okla.		4,256		4,160
National Zinc Co.	Springfield, Ill.		4,480		4,480
New Jersey Zinc Co. of Penn	Palmerton, Penn.		7,200		7,200
Oklahoma Spelter Co.	Kusa, Okla.	(d)	1,600	(d)	1,600
Owen Spelter Co	Caney, Kan.		1,920	(d)	1,920
Pittsburg Zinc Co.	Pittsburg, Kan.	(d)	910	(d)	910
Prime Western Spelter Co.	Gas and Iola, Kan.		4,866	(g)	1,972
Quinton Spelter Co	Quinton, Okla.		2,016		2,016
Sandoval Zinc Co	Sandoval, Ill.		672		672
Tulsa Fuel and Manufacturing Co.	Collinsville, Okla.		6,232		6,232
United States Smelting Co. (a)	Altoona, Kan.		4,640	(c)	
United States Smelting Co.	Checotah, Okla.		5,120	(i)	5,120
United States Zinc Co	Henryetta, Okla.		2,400		3,448
United States Zinc Co	Sand Springs, Okla.		8,000		7,560
United States Zinc Co	Pueblo, Colo.		2,200		2,208
United Zinc Smelting Corpn.	Moundsville, W. Va.		1,728		1,728
United Zinc Smelting Corpn.	Clarksburg, W. Va.		3,648	(i)	3,648
Weir Smelting Co. (h)	Weir, Kan.	(a)	448	(d)	448
Totals			216,046		202,426

(a) Closed during latter part of 1917. (b) No report received; entered the same as previous year. (c) Dismantled (d) Idle all year. (f) Part (4 blocks) leased to Weir Smelting Co. (g) The plant at Gas City was wrecked by cyclone, March, 1918. (h) Weir Smelting Co. is operating 4,384 retorts of the Caney plant of American Zinc, Lead and Smelting Co. (i) Idle latter part of 1918

Lead and Zinc in the Joplin District

By Jesse A. Zook*

At the close of 1918 about 30 mills were operating in Jasper County, Mo., not counting those of the Waco camp, and not all of these steadily. All others have been removed, some into Kansas, opposite Waco; some into Kansas, opposite Picher, Okla.; and many into the northern part of Ottawa County, Oklahoma.

Shipments of blende from Jasper County attained the zenith in March, 1918, with 14,605 tons, and dropped to 4932 tons in November. Calamine shipments, only 424 tons in March and 644 tons in June, rose to 680 tons in November. Lead shipments fell from 2335 tons in March to 1526 tons in June and 1076 tons in November. Some revival is noted around Duenweg, where a small mill has been erected, and at Alba one mill has resumed under new management. The three properties of the Athletic Mining and Smelting Co.—the Athletic, at Duenweg; the Bertha A, at Webb City; and the Mutual, at Oronogo—with the Circle mine, of the Connecticut Zinc Corporation, at Oronogo, produce the bulk of the blende obtained at these three points. All other southwest Missouri counties fell far behind their 1917 record, with the one exception of Barry County, which made a small shipment each of blende and calamine.

TABLE I. ORE PRICES IN THE JOPLIN DISTRICT FOR 11 YEARS

(Per Ton of 2000 Lb.)

	Zinc Ores		Lead Ores	
	High	Average	High	Average
1908	$47.00	$43.20	$66.00	$54.66
1909	55.00	41.08	60.50	54.56
1910	52.00	40.42	58.00	51.98
1911	51.00	39.90	64.00	56.76
1912	67.00	53.33	68.00	56.60
1913	59.00	42.26	58.00	52.52
1914	54.00	40.46	54.50	46.55
1915	138.90	79.30	80.00	55.08
1916	131.70	84.72	104.84	84.07
1917	101.95	67.70	135.50	98.00
1918	78.70	51.33	106.00	88.98

The increase in zinc production for Cherokee County, Kan., came from new sources, as the galena production decreased. The greater increase came from the Blue Mound section, near Treece, with a fair increase opposite Waco. Prospecting during 1917 and developments in 1918 offer promise of greater gains in 1919 from each of these areas. Prospecting between Blue Mound and Baxter Springs suggests the possibility of developments that will return a notable production.

TABLE II. MONTHLY AVERAGE PRICES OF BLENDE, CALAMINE, AND LEAD IN 1918, IN THE JOPLIN DISTRICT

(Per Ton of 2000 Lb.)

	Blende	Calamine	All Zinc Ores	Lead
January	$56.01	$35.97	$55.14	$74.37
February	55.84	37.46	54.99	78.75
March	54.40	38.08	53.72	85.04
April	47.56	32.82	46.96	83.50
May	44.59	31.89	44.16	81.81
June	49.61	34.53	48.78	87.99
July	52.52	35.66	51.89	97.16
August	55.75	36.66	54.83	98.17
September	53.26	37.91	52.73	101.36
October	53.80	37.91	52.95	99.47
November	53.29	39.62	51.97	100.13
December	44.16	36.00	44.00	83.00
Year	$52.00	$37.14	$51.33	$88.98

In northern Ottawa County, Okla., it is estimated that if the zenith has not been attained it will be passed by mid-year of 1919. The blende shipments of 1918 increased over 100%, and those of lead showed nearly 100% increase. A visible stock of approximately 20,000 tons of blende is stored in bins in this area, with 50% to 60% of it sold. In eastern Ottawa County, a prospecting campaign has resulted in some developments in the vicinity of Peoria, close to the Missouri line.

Flotation practices made marked strides, in the field under review, during 1918, accomplishing astonishing results for those installing it as an experiment, and establishing it as a fixed and approved method for the concentration of fines. Installations were made in some instances to handle the fines passed over sludge tables, and the later installations have exclusive flotation treatment of fines.

Volunteering, the engineering corps, the draft, and Government employment at higher wages than paid in the mines, called many of the efficient workmen from this field. These causes, with the influenza epidemic, and inefficiency, aided in preventing the accumulation of a disastrous surplus ore stock in the district.

Zinc blende prices at the beginning of 1918 were on a basis of $70@50, falling to $65@50 at the end of February, to $60@40 the end of March, and to $55@37.50 at the end of April. The first of May brought a fixed basis for premium grades at $75, which was carried through the rest of the year. An allocating committee adjusted a division of the shipment among producers. By the end of June, a second rating of ore for Class B spelter was arranged by which a part of the production received practically a fixed price until the end of November of $60@55 basis. A third rating of ore entering into the production of Prime Western spelter lasted for three weeks in November, an agreed schedule being paid by several purchasing agencies. December closed with an open market for all grades of blende, with the price on a basis of $46@42.50. Calamine prices began on $38@31 basis, falling to $33@30 the middle of February, after which a $40@35 basis prevailed to the end of March. April opened with $35@30, closing at $30@25, which quotation extended to the third week of July, when a basis of $35@25 generally ruled. The next week it advanced to $37.50@30, ending August at $40@35, a price that continued, with a few exceptions, to the end of November, when it dropped to $38@30. Lead advanced from a basis of $83@80 to $88@86 the second week of March, then fell to $80 at the end of April, advancing steadily to $100 basis the third week of July. Occasional sales at a premium gave a basis equivalent of $103 at various times until the end of November, when the market dropped to an $80 basis.

TABLE III. SHIPMENTS OF BLENDE, CALAMINE, AND LEAD IN THE JOPLIN DISTRICT, WITH VALUES

Missouri	Blende, Lb.	Calamine, Lb.	Lead, Lb.	Values
Jasper County	174,580,220	9,755,710	36,396,960	$6,547,370
Newton County	22,435,510	27,023,930	535,520	1,108,130
Lawrence County	3,060,860	4,517,970	187,220	162,880
Greene County	524,010	83,300	....	14,160
Christian County	231,040	165,510	....	6,110
Howell County	....	171,310	....	1,800
Dade County	....	115,880	....	1,630
Barry County	34,270	59,390	....	1,230
Totals	200,865,910	41,893,000	37,119,700	$7,843,310
Oklahoma				
Ottawa County	643,227,720	....	101,025,910	21,467,400
Kansas				
Cherokee County	99,932,840	....	10,899,150	3,187,000
Arkansas (a)	200,980	3,779,510	81,730	81,290
1918 District Total	944,227,450	45,672,510	149,126,490	$32,579,000
1917 District Total	884,326,450	75,564,480	144,392,770	41,126,610
Increase	79,901,000	....	4,733,720	....
Decrease	....	29,891,970	....	8,547,610

(a) Ores settled for by Joplin purchasing agencies. An estimate of Mr. Dunlap, of the U. S. Geological Survey, places the total Arkansas production at 5000 tons blende and calamine, and 200 tons of lead.

---

*Statistician, Joplin, Missouri.

Iron and Steel

THE year 1918 will always remain a memorable one in the steel industry. The distinguishing feature was the contrast between the beginning and the end of the year, and the complete coöperation that prevailed in the face of increasing demands for steel is greatly to the credit of the various governmental boards and the heads of the industry. In May, the Director of Steel Supply announced that the entire United States steel production must be placed at the disposal of the country, and in June the industry voluntarily accepted Government supervision. This resulted in a system of priorities in production and delivery that was maintained in full until the signing of the armistice. After that date there were cancellations, and prices dropped, but the efforts of the industry to bring about a readjustment, a continuation of satisfactory labor conditions, and a stable basis throughout were untiring.

TABLE I. LAKE SUPERIOR IRON-ORE SHIPMENTS

(In Long Tons)

	1916	1917	1918
Escanaba	7,457,444	7,156,854	6,774,969
Marquette	3,858,092	3,207,145	3,457,054
Ashland	8,057,814	7,597,841	7,565,608
Two Harbors	10,735,853	9,990,901	8,723,472
Superior	12,787,046	13,978,741	14,068,341
Duluth	21,837,949	20,567,419	20,567,288
Totals by lake	64,734,198	62,498,901	61,156,732
Totals all rail (est.)	1,924,268	1,938,102	2,000,000
Total shipments	66,658,466	64,437,003	63,156,732

TABLE II. MONTHLY PRODUCTION OF COKE AND ANTHRACITE PIG IRON IN THE UNITED STATES, BEGINNING JAN. 1, 1914

(In Long Tons)

	1914	1915	1916	1917	1918
January	1,885,054	1,601,421	3,185,121	3,150,938	2,411,768
February	1,888,670	1,674,771	3,087,212	2,645,247	2,319,299
March	2,347,867	2,063,834	3,337,691	3,251,352	3,213,091
April	2,269,655	2,116,494	3,227,768	3,334,960	3,288,211
May	2,092,686	2,263,470	3,361,073	3,417,340	3,446,412
June	1,917,783	2,380,827	3,211,588	3,270,055	3,323,791
July	1,957,645	2,563,420	3,224,513	3,342,438	3,420,988
August	1,995,261	2,779,647	3,203,713	3,247,947	3,389,585
September	1,882,577	2,852,561	3,202,366	3,133,954	3,418,270
October	1,778,186	3,125,491	3,508,849	3,303,038	3,486,941
November	1,518,316	3,037,308	3,311,811	3,205,794	3,354,074
December	1,515,752	3,203,322	3,178,651	2,882,918	3,433,617
Totals (a)	23,049,752	29,662,566	39,039,356	38,185,981	38,506,047

(a) Totals do not include charcoal pig iron. Figures secured from *Iron Age*.

Lake shipments of iron ore from the Lake Superior districts for 1918 were 61,156,732 tons, a decrease of 1,342,169 tons from 1917, when 62,498,901 tons was shipped. Cuyuna Range shipments totaled 2,432,838 tons, an increase of 9954 tons over those of 1917. It is estimated that approximately 700,000 tons of manganiferous iron ore was shipped in 1918 from the Cuyuna. Rail shipments during 1918 increased over those of 1917 and probably exceeded 2,000,000 tons. The Lake shipping season was practically completed the latter part of November. Through the excellent coöperation of the various committees directing the Lake trade, transportation and distribution of ore were adequately arranged and ample supplies furnished to the furnaces.

The increase of 37c. per ton in freights, and the three voluntary wage increases, which originated in Eastern steel mills and were continued to the iron mines, were forceful arguments for the increases in iron-ore prices. At the beginning of the season these remained on the same basis as in 1917. On July 21, 1918, a 45c. increase was granted, and, effective Oct. 1, a further increase of 25c. per ton was allowed. Final prices were: Old Range bessemer, $6.65; Mesabi Range bessemer, $6.40; Old Range non-bessemer, $5.90, and Mesabi Range non-bessemer, $5.75 per ton.

TABLE III. PIG-IRON PRODUCTION (a) FOR 15 YEARS

(In Long Tons)

1904	16,497,003	1909	25,795,471	1914	23,332,244
1905	22,992,380	1910	27,303,567	1915	29,916,213
1906	25,307,391	1911	23,649,547	1916	39,434,797
1907	25,781,381	1912	29,726,937	1917	38,621,216
1908	15,936,918	1913	30,966,152	1918 (b)	38,820,000

(a) American Iron and Steel Institute.
(b) Estimated.

TABLE IV. PIG-IRON PRODUCTION BY GRADES

	1917		1918 (a)	
Grades	Long Tons	Per Cent.	Long Tons	Per Cent.
Basic	17,671,662	45.8	18,361,860	47.3
Bessemer	13,714,732	35.5	12,810,600	33.0
Foundry	5,328,258	13.8	5,357,160	13.8
Malleable	1,015,579	2.6	1,281,060	3.3
Forge	345,707	0.9	427,020	1.1
Spiegeleisen	171,685	0.5	194,100	0.5
Ferromanganese	281,425	0.7	310,560	0.8
All other	92,168	0.2	77,640	0.2
Totals	38,621,216	100.0	38,820,000	100.0

(a) Estimated.

Pig-iron production in 1918 was about 38,820,000 tons of all grades, as compared with 38,621,216 tons in 1917. In the early part of the year, production of pig iron fell below that of previous years, but reacted strongly with advancing demands. Production of steel ingots in 1918 showed a decrease from that of 1917, when it was 43,700,000 tons. Shell steel was the largest in demand, and approximately 5,000,000 tons was produced.

Pittsburgh Iron and Steel Markets

BY B. E. V. LUTY*

AS THE Great War lasted through more than 10 months of 1918, the course of the iron and steel industry in the year must be viewed chiefly from a war standpoint. Except for the unfortunate curtailment in output in the first two months of the year, caused by traffic conditions, the tonnage output was fairly satisfactory. It was not by any means equal to capacity, but there were various barriers to full production, and on the whole the showing was a gratifying one. Owing to the lessened pressure for material after the signing of the armistice, there was a slight falling off in production. Altogether, the 1918 output of steel ingots was about 42,000,000 gross tons, comparing with about 43,700,000 tons in 1917 and 41,400,000 tons in 1916.

There was more or less labor shortage in the iron and steel industry throughout the war, but the curtailment in output on this account was not great in itself. The labor shortage fell largely upon construction work, which the mills had to forego. As to performance, common labor was more or less indifferent, and hardly rendered as good service for the high wages paid as it had rendered in former times for wage rates half as high. Skilled and partly skilled labor, however, performed their work very well.

---

*971 Union Arcade, Pittsburgh, Pennsylvania.

One obstacle to the fullest production of steel ingots was the shortage of scrap of good quality, which was simply a result of the character of the industrial operations being carried on. As the railroads were short of cars, locomotives, and new rails, as well as of labor to lay rails, there was little scrapping of material, and thus the railroads did not furnish their usual quota of old material. There was hardly any new construction except for war purposes; hence little wrecking of bridges and buildings. Again, much steel was shipped out of the country in unfinished form, and the scrap resulting from converting such steel into manufactured goods was produced abroad.

At times there was a shortage of steel-making pig iron, and this was notably the case in January and February, when the inability of the railroads to move coal and coke resulted in light operations at blast furnaces. Thus it is not surprising that only about 42,000,000 tons of ingots was produced in 1918, although the capacity, under normal working conditions, is undoubtedly more than 47,000,000 tons. Production of ingots in 1913 was 30,300,000 tons, and capacity at the close of that year, or at the beginning of the war, was about 34,000,000 tons, so that there has been an increase of about 40%. This, however, is not particularly excessive, considering the previous growth of the steel industry. The history of that industry, however, shows that it is to the domestic market, rather than to foreign markets, that the steel makers must turn for demand to engage this capacity.

Government price regulation of the iron and steel industry worked fairly smoothly. Arguments were made from time to time that higher prices should be allowed, but much of the talk indulged in was doubtless for the purpose of forestalling reductions which the authorities might have had in mind. The great majority of producers made large profits, subject to heavy taxes, though a few small producers had only a scant margin, and were less subject to taxation.

The important finished steel products were unchanged as to price during the period of Government control, though two changes were made in pig iron in 1918, one being a reduction and the other an advance table.

The year opened with pig iron at a basing price of $33, f.o.b. furnace, bessemer being 10% higher, or $36.30. Foundry iron at base price was such as contained 1.75 to 2.25% silicon, and the No. 2X made by Eastern furnaces, running 2.25 to 2.75%, was 50c. in advance, or $33.50. On Apr. 1, basic iron was reduced $1, to $32, bessemer being still 10% above basic, or $35.20. On Oct. 1, the basic price of pig iron was increased $1, but this did not apply to bessemer. The advance on foundry iron with silicon 2.25 to 2.75% was increased from 50c. to $1.25. Eastern Pennsylvania furnaces were given a Pittsburgh basing, and Virginia and Tennessee a Birmingham basing, whereby the furnaces mentioned experienced a separate and additional advance. Government prices continued to the end of the year 1918, with no definite prospect of a decline.

The last quarterly meeting between the War Industries Board and the general committee of the American Iron and Steel Institute was scheduled for Dec. 11. The committee attended the meeting prepared to submit a schedule of price reductions to rule for the first quarter of the new year, but, not much to the surprise of the committee, the War Industries Board refused to have the statement even read into the minutes, explaining that it was through price fixing. The statement was thereupon given to the press. The steel producers immediately began quoting the suggested reduced prices, but the pig-iron producers did not recognize the $3 reduction suggested for pig iron. The accompanying table shows average prices in 1917, Government prices and the reduced prices effective after the meeting of Dec. 11 for 1918. Billets are per gross ton. Beams, plates, bars, and black sheets are per 100 lb. Pipe is represented by a basing discount from list, and nails are per keg, base.

PRICES OF STEEL PRODUCTS

		1918	
	1917	Government	Reduced
Billets, per gross ton............	$71.16	$47.50	$43.50
Beams, per 100 lb...............	3.66	3.00	2.80
Plates, per 100 lb...............	5.21	3.25	3.00
Bars, per 100 lb...............	3.49	2.90	2.70
Black sheets, 28 gage, per 100 lb.	6.29	5.00	4.70
Pipe, discount from list..........	52⅛%	51%	54%
Wire nails, per keg............	$3.56	$3.50	$3.50

During Government control ferromanganese stood at $250, delivered, for 70%, as the result of an informal understanding. At the close of 1918 a new market price had not been definitely established.

At the beginning of 1918, the War Industries Board was exercising only a limited amount of control over the distribution of iron and steel, its regulations pertaining chiefly to prices. By reason of growing needs for steel, and the reduced rate at which steel was made early in the year, it became necessary that the steel industry should recognize more fully the war-time requirements, and the Director of Steel Supply had to make the industry fully acquainted with the fact. At a meeting held on Apr. 26, the iron and steel producers took a "100% efficiency pledge," promising their entire efforts would be directed toward helping to win the war.

In June the scheme of distribution, which had previously covered only a certain number of priorities, was greatly extended, and in July "automatic priority" was provided for many cases in which previously it had been necessary for the War Industries Board to issue individual priorities. The sequence of importance was as follows: Class AA priorities, Class A priorities, Class B priorities, Class C, or preference steel, and Class B, or permit steel. No steel could be manufactured or shipped against a given class of orders until provision had been made that all steel of a higher order would be made and shipped within the time required by the buyer. The preference list was a "list of purposes entitled to preference treatment." After priorities and preference wants were fully met, producers could make and ship Class D steel, upon written permission, for purposes not recognized as essential.

An important thing that this distribution system showed was that steel is the backbone of industry, for when nearly all industries were summoned to help win the war they required more steel than could be made.

There was a shortage, yet there were few industries that were denied steel.

Larger wage advances occurred in 1918 than in either of the two preceding years. From the general wage advance of Feb. 1, 1913, to the beginning of 1916 there was no general change in wage rates in the iron and steel industry. Wage advances during the war period occurred as follows: 1916, Feb. 1, May 1, Dec. 15; 1917, May 1, Oct. 1; 1918, Apr. 15, Aug. 1, Oct. 1. All these advances averaged about 10% each, except that the advance of Apr. 15, 1918, was about 15%, and the advance of Oct. 1, 1918, was chiefly the establishment of the basic eight-hour day system of payment, providing 14 hours' pay for 12 hours' work and 11 hours' pay for 10 hours' work, with some advances to eight-hour men to equalize. The standard hourly rate in 1915 was about 19c. for common labor, this increasing to about 42c., Aug. 1, 1918, though after the establishment of the eight-hour basic day 12-hour men received an actual average of 49c. per hour, or two and one-half times the rate in 1915.

Though such wages appeared excessive, no way to effect a reduction presented itself at the close of the war. The iron and steel industry sought to secure more efficient performance as one means of reducing its extremely high wage cost per ton. As to its business prospects, the industry recognized that the cost of putting steel into employment was extremely high, through high wage rates and indifferent performance of labor in the building and other trades consuming steel, and that this would have a great influence upon investors in permanent construction work.

Iron Mining in the United States

THE extraordinary demand for iron ore in 1918 was met by a sustained and successful effort on the part of the mine operators to keep pace with the requirements. Though the total shipments from the Lake Superior districts were less than in 1917, they were sufficient to provide the furnaces with the necessary stocks to carry them over until next season. At practically all of the iron-producing districts, operations were impeded by insufficiency or inefficiency of labor; the draft called a number of the men, the influenza epidemic had a further serious effect on the situation, and in some districts there was a tendency for some of the men to seek other work. Toward the close of the shipping season, and the accompanying slowing down of outside operations, the labor situation became easier.

There were no strikes or labor troubles during the year in the iron-mining industry. In the Lake Superior districts, wages were increased three times, all of the operators following the lead set by the United States Steel Corporation. In spite of the fact that the price of iron ore was raised twice during 1918, the independent ore producers operated under a real hardship, as the increase in ore prices was only sufficient to cover the raise in freight rates, and operative costs continued to rise. Common surface labor received $4.84 per day, and average contract miners were paid 83c. per hour, so that it was little wonder that even large underground operations piled up costs of $4.40 to $4.60 per ton of ore, placed in cars at the mine. In Tennessee, wages have increased 150% in the last three years; in the New York iron mines they were practically doubled during 1918.

The more extensive utilization of labor-saving devices was not so marked in 1918 as had been expected. However, the various types of improved machinery and apparatus which were adopted in 1917 on the Mesabi Range were used extensively in 1918. On the Gogebic Range, the Halby, Hoar, and Middlemiss shoveling machines were installed in several of the mines, and in the New York magnetic mines electric shovels were used underground to compensate for the shortage in men required for mucking operations.

In the Lake Superior districts, with the larger companies, the high taxes on profits resulted in unusual activity in exploring and the taking of bigger chances. New development and new equipment appealed to few, as the depreciation allowed by present tax laws meant that one would not be allowed to charge off the real shrinkage in the value of the plant before paying the larger part of the income in taxes. The changes in railroad transportation were burdensome to the mine operator, and the ruling which requires the industry to pay for all railroad spurs and tracks and for all service other than actual hauling of the ore was a great drawback to new development. Though it compelled those industries that could do so to establish themselves close to the railroads, the mines are "where they are," and even the old rates (before the present double rates) for shipping ore to the head of the lakes were excused on the ground of the extra service given in the way of building spurs and sidings, switches at stockpiles, and storage in cars and at the docks. During 1918 all of these were charged for, in addition to the doubling of the haulage rates, and these increases constituted a permanent expense on the cost sheet.

New Shafts Sunk on Mesabi Range

On the Mesabi Range of Minnesota, both open-pit and underground properties were active, although there were few new shippers. Among new shafts sunk were the Majorca, at Calumet; the South Agnew, at Hibbing; the Johnson, at Virginia; the Wistar, at McKinley; and the Pilot mine, at Mountain Iron. At Kewatin, on the western Mesabi, Butler Bros. completed stripping the Bennett mine, and ore was loaded from the pit on contract by the Guthrie company. The mine is operated by Pickands, Mather & Co., which company conducted underground operations. The Mississippi was a new shipper in 1918, having been taken over by the Interstate Iron Co. The International Harvester Co. sunk a shaft at the Sargeant mine and completed buildings. The property is to be operated as an underground and open-pit mine, and stripping is being done by the Winston-Dear Co. A number of workmen's houses were built at various points by the Oliver, Cleveland

Cliffs, Pickands Mather, and Shenango companies. Building of washing plants on the western Mesabi was brisk, but no new treatment methods were brought out in 1918. The first shipment of low-phosphorus sinter produced from eastern Mesabi magnetic ores was made. The Wade mine, at Kinney, formerly the Helmer, was acquired by the Cleveland Cliffs Iron Co. Changes in ownership during 1918 were mostly in the cleaning up and leasing of the Great Northern ore lands, and lands that were associated with the Great Western Mining Co. Few ore lands are now obtainable on the Mesabi Range.

Manganiferous Iron-Ore Mines of Cuyuna Developed for War Market

During 1918 an active season prevailed at the mines on the Cuyuna Range, although the close of the year shows an unsettled condition among operators of the small manganiferous iron-ore properties. These mines were developed for a strictly war market, and the releasing of tonnage for the unrestricted importation of foreign manganese ore and ferromanganese leaves them in a precarious position. Shaft sinking was carried on at the Northland, Ida Mae, Preston, Merritt, Adbar, Clark, Joan No. 3, Hopkins, Cuyuna-Mille Lacs, Cuyuna-Duluth, Martin, Huntington, Arko, and Bonney Belle mines. The Cuyuna-Duluth, Croft, Thompson, Preston, and Gloria mines, all underground properties, closed early in December. The Oneida Mines Co. built and operated the only manganiferous iron ore washing plant on the Cuyuna Range, at the Cuyuna-Sultana mine. The Omaha Iron Co. erected a drying plant at the Wilcox mine, which was completed in July. There was considerable new construction in surface plants and buildings, most of which was carried on at the new properties.

Two New Mines Opened on Marquette Range

On the Marquette Range, in Michigan, several diamond drills were operated throughout 1918 by the Cleveland Cliffs Iron Co. in prospecting for other orebodies to take the place of those which are being exhausted. Some exploration was done by the Florence Iron Co. at the Kloman mine, at Republic. New mines opened were the Maitland, at Palmer, and the Barnes-Hecker, at Ishpeming. The Maitland and the Francis and Mackinaw mines, in the Gwinn district, were new producers in 1918. The Princeton mine, at Princeton, was reopened. Producers in 1918 were: American, Angeline, Athens, Breitung-Hematite, Cambria, Cliffs Shaft, Empire, Francis, Gwinn, Holmes, Isabella, Lake, Maas, Mackinaw-Gardner, Maitland, Mary Charlotte, Morris-Lloyd, Negaunee, Princeton, Republic, Salisbury, Section 16, and South Jackson mines.

New Orebodies Opened on Gogebic Range

Considerable drilling was done during 1918 on the Gogebic Range by the Jones & Laughlin Ore Co., and the Republic Iron and Steel Co. The latter has taken over the old Plummer mine, near Iron Belt, Wis., and is unwatering the shaft. The Newport Mining Co. is exploring the old Atlantic mine, at Iron Belt. The Morgan mine, near Wakefield, is being opened by the Thomas Furnace Co., which is sinking a shaft. The Townsite Mining Co., incorporated by A. B. Coates, G. P. Tweed, and L. C. Brewer, of Duluth, and G. H. Rupp, of Ironwood, took over the old Norrie property, which was surrendered by the Oliver Iron Mining Co. in 1916. The property produced about 85,000 tons of bessemer ore in 1918. The Plymouth mine, near Wakefield, was sold by Coates and Tweed to Pickands-Mather & Co., and the Midvale Steel Company. The East Norrie, Montreal, Townsite, Castile, and the Ironton mines have opened up new orebodies, of which the East Norrie body is showing considerable extent. These orebodies are generally in the hanging, and north of the foot-wall side of the iron formation, which was formerly considered to be the only productive ore area. Producers in 1918 were the Montreal, Ottawa, Eureka, Asteroid, Castile, Cary, Windsor, Brotherton, Sunday Lake, Plymouth, Ashland, Townsite, Yale, Newport, Anvil, Palms, Norrie-Aurora, Pabst, Vaughan, Davis, Puritan, Tilden, Ironton, Colby, and Wakefield mines.

First Vertical Shaft Being Sunk in Alabama Iron District

In the Birmingham, Ala., district, sinking was begun during 1918 on the first vertical shaft for mining iron ore, and this work is being continued on Red Mountain. In August, a decision, made applicable to the entire district, was reached by the War Labor Board whereby wage increases were granted and other adjustments made. The award establishes a wage schedule by which no mine worker shall receive less than $3.99 for a 10-hour day. The Tennessee Coal, Iron and Railway Co., Republic Iron and Steel Co., Sloss-Sheffield Steel and Iron Co., Woodward Iron Co., and the Alabama Iron and Fuel Co. were active in 1918.

In the New York magnetite district, no exploratory work was done, as all available labor was engaged in increasing the output from developed workings. The Chateaugay Ore and Iron Co., at Lyon Mountain, has partly completed the company's new magnetic concentrating mill, which is to have a capacity of 100 tons per hour. During 1918 producers were Witherbee, Sherman & Co., at Mineville; Chateaugay Ore and Iron Co., at Lyon Mountain; Cheever Iron Ore Co., and Port Henry Iron Ore Co., at Port Henry, New York.

Operations in Tennessee

In Tennessee, the Standard Iron Co., of Nashville, acquired the Aetna property at Aetna during 1918 and has been operating by open cut, using steam shovels. Log washers and jigs are employed in concentrating the ore. The Lafollette Coal and Iron Co., Lafollette, is electrifying its mine, and the power plant is using waste gas from the blast furnace. The Bon Air Coal and Iron Corporation, of Allens Creek, is preparing to open a mine at Nunelly. J. J. Grey, Jr., of Rockdale, has been developing a mine near Iron City which is expected to operate early in 1919.

Overhand Stoping in New Jersey Iron District

Of a large number of old mines in the New Jersey iron district only two operated during 1918, the Mount Hope mine, of the Empire Steel and Iron Co., and the Richard mine, of the Thomas Iron Co., both situated near Dover. At the Richard mine, a three-compartment shaft has been sunk to a depth of 1100 ft. and a new steel headframe, hoisting plant, and a magnetic cobbing mill, with jaw and disk crushers, have been installed. New mine development which took place during 1918 consisted of dewatering and opening up of the old Hibernia mine by the Wharton Steel Co., of which J. Leonard Replogle is the head and principal owner. This company also opened up the Scrub Oak mine and developed a large tonnage of bessemer ore during the year. The property has been equipped with a 2500-ton magnetic concentration mill, which is in operation. Mining methods in this district consist of overhand stoping, with haulage levels placed from 100 ft. to 250 ft. apart. Electric haulage is used, and stope chutes are placed at about 40-ft. centers. The orebodies dip at about 60°, and no trouble is experienced in drawing stopes, even when the stope height is 250 ft. along the dip of the vein. The average breaking per drill shift, using one-man stoping drills, is about 25 tons. The only new property prospected during 1918 is the old Dickerson mine, which has been dewatered by the Black Rock Iron Mining Co., of Dover. Producers in 1918 were the Mount Hope, Richard and Scrub Oak mines.

WESTERN IRON-ORE MINING

The lease on the Snowflake, Jim, Fair, and Cupola mines, at Fiero, N. M., which was held by the Colorado Fuel and Iron Co., expired Sept. 1, 1917, at which time the management of the properties was assumed by the Hanover Bessemer Iron and Copper Co., Fiero, N. M. This company shipped the entire output of these properties during 1918 to the Colorado Fuel and Iron Co.'s steel works at Pueblo, Colorado.

The Noble Electric Steel Co. operated a mine in the Pitt River district, California, in 1918. A prospecting tunnel which cuts the orebody 160 ft. below the present working level was completed. No crosscutting or stoping was done on this level, but work preparatory to mining by the gloryhole method was carried on.

Antimony in 1918

BY K. C. LI*

ANTIMONY in 1918 presented a spectacle of less interest than in any year since the beginning of the world war. During the early days of the war there was a phenomenal advance in prices, which culminated at 45c. per lb. in the winter of 1915-16. This was followed by the sensational decline of 1916; but, despite the fact that consumption of the metal continued on a large scale for munitions of war, at no time in 1918 was there anything resembling a flutter of excitement in the market. Several causes contributed to this constant appearance of dullness, the chief being the abundance of supply, and the keen competition among holders to secure a share of the business. It is fairly safe to say that little profits have been netted, either by producers or middlemen.

AVERAGE MONTHLY PRICES OF ANTIMONY (a)

(In Cents per Pound)

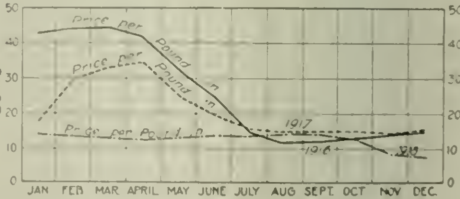
	1915 Ordinaries	1916 Ordinaries	1917 Ordinaries	1918 Ordinaries
January	15 85	42 45	17 29	14 281
February	18 21	44 31	29 80	13 823
March	22 13	44 75	32 89	13 091
April	24 88	42 06	34 04	12 536
May	35 30	31 60	25 20	12 846
June	37 69	20 05	19 51	13 055
July	38 13	14 70	15 83	13 197
August	33 00	11 53	15 06	14 000
September	28 63	11 81	14 94	14 145
October	31 45	12 70	14 75	13 319
November	38.88	13 84	13 91	8 771
December	39 25	14 59	15.06	7.915
Year	30 28	25 37	20 69	12.581

(a) *Engineering and Mining Journal* quotations.

As far as an outsider can estimate, the United States Government consumption of antimony was at the rate of at least 500 long tons per month throughout the entire year, but the requisitioning was carried out in such a judicious manner, and importers coöperated with so much willingness, that the prices were disturbed but little. In fact, competition to obtain Government business was so great, that, despite the steady demand, the tendency of prices was downward rather than upward. Furthermore, since the scare of 1916, speculation in antimony metal has been conducted in a cautious way, and jobbers have been wary of getting a large stock on hand.

CANADIAN AND RUSSIAN DEMAND

The Canadian government was also a heavy purchaser during the year, although not to such a large extent as formerly. It is known that during 1916 and 1917, from 2500 to 3000 tons of antimony was used each year for the manufacture of munitions for England and Russia. A large proportion of the metal, although bought through concerns in the United States, was imported direct from the Orient to Canada. With Russia out of the war, the quantity required during 1918 was naturally less, and it is probable that the amount did not exceed 1500 tons.



ANTIMONY PRICES 1916, 1917, 1918

ANTIMONY IMPORTATIONS

The apparently abundant supply of metal throughout the year seems to indicate that importations from China and Japan continued on almost the same scale as formerly, in spite of the fact that prices were seldom above 14c. per lb. The importations for the nine months ended Sept. 30 bear out the statement. According to Custom House figures these were as follows:

---

*Mining engineer and metallurgist, 4901 Woolworth Building, New York, representative of the Wah Chang Mining and Smelting Co. Ltd. of Changsha, China

Antimony in ore, 2,479,673 lb., valued at $155,307; antimony matte and regulus, 20,788,681 lb., valued at $2,018,638.

It would appear that producers, especially those in the Far East, have kept up their output, always in the hope that prices would again advance to something near the extraordinary level of the winter of 1915-16. There can be no other explanation of the plentiful supply, because the margin of profit during 1918 was certainly not such as to warrant overproduction. After the fabulous prices obtained at the beginning of the war, there is nothing surprising in the persistence of this hope in the Oriental mind. The high rate of exchange which existed in China throughout 1918, coupled with increased cost of materials used in smelting, raised the expense of production more than 100%, and it is questionable whether the present cost is likely to decrease for some time. In addition to this, the cost of transportation and warehousing and other charges have greatly increased, and it would therefore appear that, when the disturbances caused by the ending of the war have subsided, the tendency of prices would be upward from the present level.

Position of China Maintained

It is interesting to note that from available reports regarding exports of antimony to the Unied States, either direct or via Japan, China has maintained her predominant position as a producer. Antimony was one of the metals discussed by the United States Tariff Commission with a view to ascertaining whether it would be wise to increase the rate of duty. It is not known what the ultimate policy in respect to antimony will be, but, with all due deference to the opinions of domestic producers, it seems to me that, with the passing of the war demand, there is little to be gained by increasing the present rate of duty on the metal. The domestic uses of antimony have not been developed to any great extent, and the prosperity of any industry cannot safely depend upon a state of war. An abundant supply can now be obtained at relatively low cost, and the need of the moment is for research to discover new uses and applications for this hitherto comparatively unimportant metal.

Antimony Prices

As already indicated, prices throughout 1918, until the signing of the armistice, ruled very steady. Such fluctuations as took place did not amount to more than one or two cents per pound. At the beginning of the year the price was a little over 14c. per lb., with a steady but slow decline as the year advanced. During May, a price just over 12c. per lb. was reached, and then began a slow advance, until, in September, 14c. was again realized. From that time on, prices declined steadily, and, with the signing of the armistice, there was a drop to about 8c. It may be that the price now obtaining will continue for some time, because it is probable that the ending of the war, which, after all, came rather suddenly, found importers and jobbers with considerable stocks. This, of course, is mere surmise on my part, and I have explained in another part of this article that there are other causes tending to force the price upward.

In any case, the future of the world and civilization is something immeasureably greater than the future of any particular metal or industry, and we are all happy that the new year will see the resumption of business on the safe and sane basis of a world peace.

The Tin Market in 1918

By J. H. Lang*

A review of tin after the usual fashion is not possible for 1918, owing to the lack of reliable statistics. No information as to shipments has been given out, and no estimate of the visible supply is possible. The Metal Exchange publishes deliveries here and in London, and imports for 1918, together with comparisons for 1917. According to the Government, imports during 1917 were 64,428 gross tons, instead of 54,867 tons, as reported by the exchange. Official figures for 1918 are available only to the end of October, to which date they show 56,064 tons, against 51,603 tons according to the Metal Exchange.

Prices for Straits tin in London and parity of same in U. S. Currency were as given in the accompanying table:

LONDON MARKET FOR SPOT STRAITS TIN

	London—Pounds Sterling per Long Ton	U. S. Currency Equivalent in Cents per Lb.
Open January 2	270 0 0	57.50
High August 2	399 0 0	84.75
Low December 19	236 0 0	50.15
Close December 31	236 0 0	50.15

For the greater part of 1918 there was no recorded American market. Straits in New York opened at 75c. per lb., and within a week went to 85c. Thereafter published quotations were suspended. During the month of January spot sales were reported as high as $1 per lb. In the early spring both Straits and Banca practically disappeared from the market. This was due more to numerous restrictions and to fear of shortage rather than to actual dearth of supplies. Later the situation was aggravated by an embargo on exports of Banca tin from Batavia. Transactions represented chiefly small lots, and price was a matter of private negotiation. Chinese tin was sold at $1 per lb.; Straits was quoted as high as $1.25, with authenticated sales at $1.10. All the time there was furious bidding by American buyers in the Straits, forcing the price there to over £400, or more than 90c. per lb. c.i.f. U. S. ports, a condition which the authorities seemed powerless to remedy, or to prevent the serious overbuying which occurred. The turning point came about the middle of 1918, and an easier tendency was noted from then on. Efforts were made to stabilize Straits prices, and to those who could procure export licenses from the British authorities Straits tin became available at much lower prices than Banca or Chinese.

Settlement of the shipping question with Holland, rumors of price fixing and large arrivals unsettled the market, and prices fell away rapidly on small business. Banca and Chinese sold early in August at 92@93c., and by the end of August at 86@84c., respectively. The announcement of the Inter-Allied control was made in September. According to this plan, buying in primary markets was confined to official agencies, and no tin could come to this country except that consigned to the U. S. Steel Products Co. Importers were eliminated. Thereafter the only tin in the open market was scattered spot lots and parcels already afloat or contracted for, and these could be sold only to buyers holding purchase licenses from the War Industries Board.

---

*Specialist in tin, L. Vogelstein & Co., 42 Broadway, New York.

Allocations to the United States out of the Inter-Allied purchases are stated to be about 10,000 tons. The approximate cost is given at 72½c. f.o.b. Eastern points, and 71¼c. f.o.b. Pacific Coast, at which price consumers will be compelled to take the metal.

It is understood that purchases for Inter-Allied account have ceased, and that no further allocations will be made. Also that no purchases by the U. S. Steel Products Co., or any other importer or consumer, with the exception of ore purchases by domestic smelters, will be allowed until further notice. These regulations place the smelters in an advantageous position to the extent that they are able to buy in open markets and sell on the closed American market, thus benefiting by the difference, which at the moment is about 20c. per lb. Markets of all other countries are now free and open except for restrictions necessary to maintain control here. Domestic production in 1918 was about 10,000 tons.

The length of time that it will take to absorb the U. S. Steel Products Co's. stock will be affected by a variety of considerations; by the state of business prevailing; by the amount of stocks in consumers' hands; by the quantity of tin turned out by domestic smelters, and by other conditions of a less specific nature. There are not lacking those who claim that in the disorganization of the country's industries attending transition from war to peace, consumption will be seriously curtailed, and possibly will not exceed 3500 tons per month. Against this will be first applied the unusually large stocks in consumers' hands, which it is estimated can be drawn on to the extent of 1500 tons per month for six months before return to normal. Then, the output of local smelters, which in 1919 should average 1500 tons per month, will have to be taken care of. Apparently it will be the second half of 1919 before the 10,000 tons in the hands of the U. S. Steel Products Co. is disposed of.

Information as to when and how America will again be allowed to deal in the world's markets will be announced later. Meanwhile, what these markets will do in the absence of the buyer who formerly took 60% of the total production is an interesting speculation. The English, Dutch, and Chinese are all heavily long of tin. Low prices are likely to prevail abroad, to the great detriment of American export trade in all articles containing tin. In fact, efforts are already being made to import such articles.

Bad as the situation now is, it will inevitably grow worse, and the trade is nonplussed as to why it should be thus handicapped and why the consumers of its products should be thus singled out and specially taxed. Opponents of the Government plan contend that the Inter-Allied stock was bought as a war measure and should be liquidated and the loss absorbed by the Government as a legitimate war expense. Eventually this will probably have to be done; otherwise criticism, now universal, if latent, is likely to flare out into open revolt.

NEW YORK METAL EXCHANGE TIN STATISTICS

	Arrivals U. S. Long Tons		Deliveries U. S Long Tons		Deliveries London Long Tons	
	1917	1918	1917	1918	1917	1918
January..	6,288	4,912	7,127	4,642	1,215	1,579
February..	4,335	2,828	3,930	3,398	1,117	1,595
March ..	5,139	5,088	4,804	5,151	1,424	1,782
April....	2,725	4,975	4,380	5,045	1,634	1,022
May.....	8,444	4,355	5,249	4,056	1,801	1,138
June....	4,328	6,514	6,398	6,782	1,350	1,034
July.. ..	4,196	7,339	4,806	7,169	1,118	1,440
August....	3,675	6,403	3,305	5,953	932	735
September..	5,707	5,014	5,402	5,454	1,584	917
October...	3,929	4,175	4,669	4,260	1,523	1,239
November...	2,513	2,369	2,578	2,379	1,750	994
December..	3,588	4,055	4,683	4,050	1,696	(a) 1,225
Totals ...	54,862	58,027	57,881	58,339	17,144	14,700

(a) Average estimated.

Are American consumers going to be made to pay more for tin than the Germans? Both the wisdom and the necessity of the Government's action are matters of grave doubt, especially as, at the time it was taken, heavy stocks, large arrivals, and constantly falling prices all indicated that the crisis was passed. No other country has found it necessary to put into effect such drastic regulations, with such lasting and disastrous consequences, and the sooner they are abolished the better.

Labor and Mining in 1918

BY F. F. SHARPLESS

IN TAKING a retrospective view of the mining industry during 1918, one is impressed more with what has been accomplished through man-power than through the accomplishments of horse-power. Called upon to produce greater quantities of the base-metal ores than ever before, the mines not only fulfilled all requirements, but in several instances exceeded them. This was brought about, not through any revolutionary methods in mining or milling, but through the personal efforts of prospectors, operators, and miners, using to the best advantage their skill and such appliances as were available, which in many instances were woefully inadequate or almost non-procurable at any price.

This extraordinary effort and increased production, accomplished in spite of decrease in the number of skilled miners available, was induced partly through high prices offered for the product, and partly through patriotism, which secured accomplishments regardless of cost or extent of effort. Whether it is one of the results of the war or is due to the gradual awakening of intelligence, there has come a realization of the fact that man-power is, in many instances, the most important element in production, and that through the proper education, development, and treatment of man his power factor may be raised.

J. Parke Channing presented a very thoughtful paper on man-power at the March meeting of the American Institute of Mining Engineers in Boston, wherein he dwelt upon the necessity of making our man-power more efficient. He directed attention to recent conditions in

England, where the laboring class, growing in ability to demand recognition, has acquired decidedly socialistic tendencies, suggesting that the same program is in store for the United States unless the employer realizes the justice of some of labor's demands and forestalls its ultra-socialistic ideas by improving working conditions. He recommends that our engineering colleges devote some time to human engineering, that their graduates, the future managers, may be better prepared to establish proper social and living conditions, at the same time improving efficiency; that these colleges and present managers study the subject of trades unions, not in order to destroy them but so that it may be possible to use them to the best advantage for the employer and employee. And not the least task is that of Americanizing the heterogeneous mass of humanity that goes to make up the personnel of a mining plant.

Throughout the mining districts of the West, more particularly at some of the larger plants, the work of studying and improving the man-power made notable progress during 1918, and constitutes perhaps the chief advance in the art of mining during the period under review.

Education of Workers

The education of mature men is not an easy task, and little can be accomplished in the lecture room or with textbooks. Education of the men referred to will be accomplished through the gradual improvement of conditions surrounding their place of employment, and the gradual realization on their part that these conditions render them more happy and contented than they were formerly. They will, under improved conditions, physical and other, have less desire to move; they will become a part of the mine and the community; they will become more interested in their work, and will give more thought to breaking an extra foot of ground than to quitting on the hour. One of the most difficult tasks that has been undertaken and is being solved is that of the Americanization of the large foreign population of the mining camps. Until foreigners have some conception of the American point of view, the manager's efforts may yield small return or be entirely unavailing.

When the manager has to deal only with Americans, the task is much simplified. The improvement of living conditions, or, if the mine has promise of long life, the improvement of housing conditions and the development of community interests, are immediately appreciated. If it is made easy for a miner to own his own home, and if that home has modern conveniences—if good schools are available and some suitable recreation is close at hand—a feeling of contentment is rapidly developed that is soon reflected in the turnover and in the tons mined per man.

The work of the Bunker Hill & Sullivan Company is typical of what is being done at several long-life mining properties. The acquisition of land for house and garden is made easy; liberal advances are made by the Bunker Hill & Sullivan company for building purposes, and every encouragement is given for men to own their homes. The schools are excellent, and the company has subscribed liberally toward furnishing intelligent recreation.

Charles Mitke, in the *Journal* of Jan. 26, 1918, explains in detail how the Phelps Dodge Corporation is endeavoring to solve the efficiency problem. The methods of education suggested by Mr. Mitke have been of such decided advantage to both employer and employee that they may well be taken as a model upon which to plan similar work at other mining plants. Lectures and discussions as to methods of mining and means of improving operations were first held for the benefit of foremen, bosses, and heads of departments. Attendance was not compulsory, but there were few absentees after the first or second discussion. Methods of putting in rounds, raising, timbering and other details were talked over, and, after trials, many of the suggestions have developed into standard practice. So successful were these conferences that they were widened to include miners, with the result that here, also, a better spirit of coöperation exists, and there is little complaint in a change of method after the miner has been carefully shown the advantage of a new method and what it is hoped to accomplish by its practice.

In an attempt to reduce the labor turnover and its accompanying inefficiency, the Phelps Dodge Corporation, the Calumet & Arizona Mining Co., and the Shattuck Arizona Copper Co., operating in the Warren district of Arizona, announced in January, 1918, that every man who has been in their service continuously underground for a year would receive a $100 bonus, with $50 for six months' service. Surface workers were given $60 and $30, respectively. The bonus was not given as a reward for staying with the company for one year, but rather as a recognition of the skill that might be acquired in that length of time. At this time the Copper Queen plant of the Phelps Dodge Corporation paid to its employees for the preceding year a bonus of $181,120, in which two-thirds of its men participated. It is not claimed that this represents the ideal method of payment for increased effiicency, which should be based on individual effort and attainment, but would contain so many complex facts that it would be impracticable for a large organization of slightly skilled laborers.

To facilitate coöperation and increase efficiency, the Oliver Iron Mining Co., in the Lake Superior district, has adopted a "mutuality plan." To carry out the purposes of this plan, committees have been appointed by the employees of each mine and each open pit, who first hear and decide upon the merits of any complaint or grievance that may be offered by any employee respecting underground or living conditions, hospital, or any affair in which the company may be interested. If the matter is considered unfavorably by the committee, it is dropped and goes no further. If, on the other hand, it is considered to be of a serious nature, the committee makes recommendations and refers it to higher authority. Arrangements are made for rapidly disposing of any subject or passing it up to the proper authority for disposition in a manner that is expected to meet with general approval both of employer and employee. Arrangements are also included for the reception and consideration of suggestions relative to operating methods, as well as to living and working conditions.

Other aids to tenure of service may be noted in the establishment of real coöperative stores, as at the New Cornelia, where the miner soon learns that his dollar is buying the most possible and that the local tradesman is not living and growing fat on him; in the establishment of the building and loan association, through which it is made easy for the miner to become a property owner; and in the pension system adopted by the Copper Queen for long-time service.

Last but not least in the attainment of efficiency is to be noted the continued improvement in the prevention of accidents and in sanitation. We note nothing revolutionary in this, but a continued endeavor all along the line to educate laborers to care for themselves and their fellow men while engaged in their various tasks underground and on the surface.

On the whole, it may be said that the most notable advances in mining of the year 1918 have been, first, a marked realization on the part of employers that efficiency may be materially promoted through coöperation; second, the endeavor of employers, through various means, to stimulate this coöperation on the part of workmen; and, third, a tendency on the part of the employee to become more efficient through the better understanding that has resulted.

State Geological and Mining Officials

The following lists of the directors of state geological surveys and of the chiefs of state mine inspection bureaus constitute a convenient reference. The lists were compiled in December, 1918, from the latest information available at that time.

It will be seen that of the 48 states of the Union, 36 have organized geological surveys.

STATE GEOLOGISTS

Alabama	Eugene A. Smith, University.
Arkansas	N. F. Drake, Fayetteville.
Colorado	R. D. George, Director, Boulder.
Connecticut	Herbert E. Gregory, Superintendent State Geological and Natural History Survey, New Haven.
Florida	E. H. Sellards, Tallahassee.
Georgia	S. W. McCallie, Atlanta.
Illinois	F. W. DeWolf, Director State Geological Survey, Urbana.
Indiana	Edward Barrett, Indianapolis.
Iowa	George F. Kay, Iowa City.
Kansas	Raymond Moore, Lawrence.
Kentucky	J. E. Barton, Commissioner of Geology and Forestry.
Maryland	Edward B. Mathews, Baltimore.
Michigan	R. C. Allen, Lansing.
Minnesota	W. H. Emmons, Minneapolis.
Mississippi	E. N. Lowe, Director, State Geological Survey, Jackson.
Missouri	H. A. Buehler, Director, Bureau of Geology and Mines, Rolla.
Nebraska	E. H. Barbour, Lincoln.
New Jersey	H. B. Kümmel, Trenton.
New Mexico	R. W. Ellis, Albuquerque.
New York	John M. Clarke, Albany.
North Carolina	Joseph Hyde Pratt, Chapel Hill.
North Dakota	A. G. Leonard, Grand Forks.
Ohio	J. A. Bownocker, Columbus.
Oklahoma	C. W. Shannon, Norman.
Pennsylvania	R. R. Hice, Beaver.
Rhode Island	Charles W. Brown, Supt., Natural Resources Survey, Providence.
South Carolina	Stephen Taber, Columbia.
South Dakota	Freeman Ward, Vermillion.
Tennessee	Wilbur A. Nelson, Nashville.
Texas	J. A. Udden, Director, Bureau of Economic Geology, Austin.
Vermont	G. H. Perkins, Burlington.
Virginia	Thomas L. Watson, Charlottesville.
Washington	Henry Landes, Seattle.
West Virginia	I. C. White, Morgantown.
Wisconsin	W. O. Hotchkiss, Madison.
Wyoming	L. W. Trumbull, Cheyenne.

STATE MINE INSPECTORS, COMMISSIONERS, ETC.

Alabama	C. H. Nesbitt, Chief Mine Inspector, Birmingham.
Alaska	Sumner S. Smith, U. S. Mine Inspector, Eska Creek Coal Mine, via Anchorage, care of Alaskan Eng. Commission.
Arizona	G. H. Bolin, Chief Mine Inspector, Phœnix; G. Montague Butler, Director, State Bureau of Mines, Tucson.
Arkansas	John H. Page, Commissioner, Bureau of Mines, Manufactures and Agriculture, Little Rock; John T. Fuller, State Mineralogist; Claud Speegle, State Mine Inspector, Fort Smith.
California	H. M. Wolflin, Chief Mine Inspector, San Francisco; F. McN. Hamilton, State Mineralogist, San Francisco.
Colorado	Fred Carroll, Commissioner, Bureau of Mines, Denver; James Dalrymple, Chief Inspector of Coal Mines, Denver.
Idaho	R. N. Bell, State Mine Inspector, Boise.
Illinois	John C. Thompson, Director, Department of Mines and Minerals, Springfield.
Indiana	John Ogilvie, Chief Mine Inspector, Indianapolis.
Iowa	L. E. Stamm, Secretary, State Mining Board, Des Moines.
Kansas	Fred Green, State Mine Inspector, Pittsburg.
Kentucky	C. J. Norwood, Chief Inspector of Mines, Lexington.
Maryland	Lawrence Dunn, State Mine Inspector, Midland.
Michigan	Richard H. Fletcher, Commissioner, Department of Labor, Lansing.
Minnesota	F. A. Wildes, Chief Inspector of Mines, Hibbing.
Missouri	George Hill, Chief Mine Inspector, Bevier.
Montana	W. B. Orem, State Metal Mine Inspector, Helena.
Nevada	A. J. Stinson, State Mine Inspector, Carson City.
New Mexico	W. W. Risdon, State Mine Inspector, Albuquerque.
New York	W. W. Jones, State Mine Inspector, Albany.
North Dakota	J. W. Bliss, State Engineer, Bismarck.
Ohio	Jerome Watson, Chief Deputy of Mines, Industrial Commission of Ohio, Columbus.
Oklahoma	Ed. Boyle, Chief Mine Inspector, McAlester.
Oregon	H. M. Parks, Director, Bureau of Mines and Geology, Portland.
Pennsylvania	Seward E. Button, Chief, Department of Mines, Harrisburg.
South Dakota	Otto Ellerman, State Mine Inspector, Lead.
Tennessee	R. A. Shiflett, Chief Mine Inspector, Nashville.
Texas	B. S. Gentry, State Mine Inspector, Rockdale.
Utah	John A. Crawford, State Coal Mine Inspector, Salt Lake City.
Virginia	A. G. Lucas, State Coal Inspector of Mines, Richmond.
Washington	James Bagley, State Inspector of Coal Mines, Seattle.
West Virginia	W. J. Heatherman, Chief, Department of Mines, Charleston.

Chronology of Mining for 1918

JANUARY

Jan. 7—Offices and laboratory at the Omaha plant of the American Smelting and Refining Co. destroyed by fire.

Jan. 9—A premature explosion of 3000 lb. of blasting powder on Sacramento Hill, Bisbee, Ariz., killed two, fatally injured two, and seriously hurt eight men.

Jan. 10—Resolution passed by the New York Metal Exchange placing on the purchaser of tin the burden of all risks attendant on railroad and shipping delays or losses.—Mark L. Requa made head of oil division of Fuel Administration.

Jan. 14—Disastrous fire at the plant of the Chemical Products Co., at Denver, causing a loss of from $50,000 to $75,000.—Temporary injunction granted by U. S. District court at Portland, Me., upon request of the American Smelting and Refining Co., against the smelting of certain Bunker Hill & Sullivan ores in the latter's new smeltery at Kellogg, Idaho.—Resumption of operations of the High Ore and Lawrence mines, in the Butte district, after a prolonged shut-down for repairs.

Jan. 22—Copper price of 23½c. extended to June 1, 1918, following conferences of producers and War Industries Board.—Important joint meeting of the Colorado Metal Mining Association and the American Mining Congress at Denver.

Jan. 24—Price of 12c. per lb. for high-grade spelter agreed upon by producers and the War Industries Board for U. S. Government, Allied and domestic requirements until June 1, 1918.

FEBRUARY

Feb. 2—First potash land permit issued under the new law by the Secretary of the Interior, covering 2560 acres of alkaline marsh land in Inyo County, California.

Feb. 13—Seneca shaft started at Mohawk, Michigan.

Feb. 14—Accident causing four deaths occurred just below the 1100 level of the Williams shaft of Iron Cap Copper Co., at Miami, Arizona.

Feb. 16—The entire foreign commerce of the United States, including all exports and imports without exception, was made subject to control by license by President Wilson.

Feb. 18—Opening day of the 116th meeting of the American Institute of Mining Engineers in New York.

Feb. 19—Decision rendered by the U. S. Circuit Court of Appeals in San Francisco upholding previous decision rendered by Judge G. M. Bourquin, of Montana, in the case of Clark-Montana Realty and the Elm Orlu mining companies against the Butte & Superior Mining Company.

Feb. 23—Eleven men trapped in a mine cave at Amasa Porter mine, Amasa, Mich. Three were rescued.

Feb. 26—Gas-Iola plant of the Prime Western Spelter Co. partly destroyed by cyclone and fire.

MARCH

Mar. 1—Government took control of production, refining, distribution and use of crude and refined platinum for the period of the war.

Mar. 4—Price of aluminum fixed by the Government at 32c. per pound.

Mar. 5—Plant of Little Martha property, in Joplin, Mo., destroyed by fire.

Mar. 8—The trial on appeal of the Minerals Separation North American Corporation vs. the Butte & Superior Mining Co. opened at U. S. Court of Appeals at San Francisco.

Mar. 23—Decision rendered in the case of Federal Mining and Smelting Co. vs. Star Mining Co. in favor of Federal company by Judge F. S. Deitrich of the U. S. Court for the District of Idaho.

Mar. 23—List No. 1 of restricted imports issued by War Trade Board. Articles named include asbestos, graphite, pyrites, zinc, cryolite, and nickel.

Mar. 31—American Smelting and Refining Co. reopened its smelting works near Chihuahua.

APRIL

Apr. 1—Prices on iron ore, coke, steel and steel products, recommended previously by the price-fixing committee of the War Industries Board, subject to revision on Apr. 1, ordered by President Wilson to be continued in effect until July 1.

Apr. 9—Conference of wire-rope manufacturers with Mark L. Requa, head of the oil division of the U. S. Fuel Administration, decided to speed up production of the domestic wire-rope industry.

Apr. 11—Gas-Iola plant of Prime Western Spelter Co., damaged by cyclone and fire Feb. 26, resumed production of spelter.

Apr. 14—Charles M. Schwab was appointed Director General of the Emergency Fleet Corporation.

Apr. 20—Glendale plant of the Edgar Zinc Co., at St. Louis, Mo., permanently closed.

Apr. 22—Strike at smeltery of St. Joseph Lead Co. settled on terms offered originally by company.

Apr. 23—Pittman silver bill, authorizing the use of $350,000,000 in silver in the U. S. Treasury for cancellation of foreign obligations, and replacing this amount by the purchase of silver bullion at $1 per oz., signed by the President.

Apr. 25—Appointment of John D. Ryan, president of the Anaconda Copper Mining Co., to the directorship of aircraft production for the Army.

Apr. 26—British Minister of Munitions issued order taking entire control of trading in tin.

MAY

May 1—Resumption of full advances in the 90% basis on the apparent value of lead ore shipped to Consolidated Mining and Smelting Co.'s smeltery at Trail, British Columbia.

May 3—Announcement of export tax schedule in metals shipped out of Mexico effective after April 1.

May 8—Decision rendered at Tonopah, Nev. against Manhattan Morning Glory Mining Co. which was prevented from sinking shaft on White Cap Mining Co. property in an effort to follow an apex claimed by the defendant company.

May 10—First unit of Ohio Copper Co.'s new flotation plant placed in operation.

May 13—Decision of U. S. Court of Appeals rendered in the case of Minerals Separation North American Corporation vs. Butte and Superior Mining Co., the court ruling that in the use of more than 0.5% oil there is no infringement of patent.

May 15—Indictment by Federal Government of 21 citizens of the United States, residents of Bisbee, Ariz., for deportation on July 12, 1917, of 1186 I. W. W. agitators and other German propagandists.

May 18—Announcement by War Industries Board of commandeering of platinum, palladium, and iridium and the fixing of prices at $105, $135, and $175 per oz., respectively.

May 20—Overman bill, giving the President complete power for coördination of the executive work of the Government, signed by the President.

May 23—Recommended that price of copper, as fixed by Government at 23½c. per lb., be continued for 75 days beginning June 1.

May 27—Official announcement that the Mother Lode Copper Mines Co. had been taken over by interests indentified with the Kennecott Copper Corporation.

May 29—Price of aluminum fixed at a maximum base of 33c. per lb., effective to Sept. 1—Announcement of increase of 25% in freight rates and 20% increase in passenger rates of all Government-operated railroads as a result of increase in wages, amounting to $325,000,000 per annum—American Institute decided to drop all enemy aliens from membership.

May 31—Maximum base prices of Grade A zinc, sheet and plate zinc, as previously established, to be continued in effect to September 1.

JUNE

June 1—Official announcement of the schedule of prices for the manganese ores produced in the United States issued by the War Industries Board—Announcement of plans for the distribution of coal within the various states formulated by the U. S. Fuel Administration—Strike of smelters at Bartlesville, Okla.; men returned to work on June 4.

June 3—Oil producers warned by the oil division of the U. S. Fuel Administration that the Government will not at this time permit any further advance in the price of crude oil.

June 6—American Zinc Institute was formed at Joplin, Missouri.

June 7—Announced that entire production of pig iron and steel is to be distributed by the War Industries Board—Chemical Alliance pledged itself to coöperation with the chemical division of the War Industries Board in allocating and distributing sulphur-bearing materials during the war.

June 9—Rod and wire plant of the Anaconda company began operations.

June 12—Decision rendered by U. S. Supreme Court which sustained the Nevada courts in a case covering a new phase of the law of the apex, and upheld the right of the West End Consolidated to operate in both directions from the crest of a roll in its vein which formed the outcrop. Jim Butler Tonopah Mining Co. had brought suit to recover the value of ore extracted from beneath the surface of its claims.

June 13—Supreme Court of the United States denied the application for the writ of certiorari by the Butte & Superior company in its litigation with the Clark-Montana Realty Co., commonly known as the Elm Orlu-Black Rock case—Case of Louis Ross against Albert C. Burrage, vice-president of the Chile Copper Co., which involved a commission on the flotation of the Chuquicamata property, was decided in favor of Ross by the U. S. Supreme Court.

June 16—Imports of copper ore, except from Cuba or that on rail from Canada or Mexico, forbidden by War Trade Board.

June 17—U. S. Tariff Commission opened a conference with tungsten producers at Denver, Colorado.

June 20—Restrictions on the importation of Mexican labor to be used in certain specified occupations removed by an order of the Secretary of Labor—Fire destroyed the Darling 500-ton mill of Commonwealth Lead and Zinc Co., near Picher, Oklahoma.

June 21—The War Industries Board added 45c. per ton to base price of Lake Superior iron ore.

June 25—James Douglas died—Meeting of antimony producers with U. S. Tariff Commission in San Francisco—Increased freight rates became effective.

June 26—Meeting of quicksilver producers with U. S. Tariff Commission at San Francisco—Explosion of dynamite blast prematurely by lightning caused caving of a bank at Silver open-pit mine at Virginia, Minn., burying and killing 19 men.

June 27—War Industries Board announced maximum prices for sulphuric acid—U. S. Tariff Commission, sitting at San Francisco, heard arguments of chrome-ore producers.

June 28—Meeting of tungsten producers before U. S. Tariff Commission in San Francisco.

June 29—Federal Trade Commission issued a report on war profits which discussed policies and profits of mines producing copper, zinc, nickel, and sulphur

JULY

July 2—Price of copper advanced to 26 cents.

July 3—International Nickel Co. began production at its Port Colborne, Ont., works.

July 4—Meeting of chief gold producers of British Empire at London to discuss value received for their product.

July 6—Department of Labor refuses to permit importation of Mexican labor to work in New Mexico coal mines.

July 8—International Mining Convention held at Revelstoke, British Columbia.

July 9—Control of sulphur production taken over by War Industries Board—Chemicals division and explosives division created by War Industries Board

July 15—Meeting of petroleum producers held in San Francisco, California.

July 18—A. Mitchell Palmer, Alien Property Custodian, announced taking over of the Becker Steel Co. by the Government—First unit of United Verde Extension 500-ton smeltery blown in.

July 19—Gold mining listed as an essential industry by War Industries Board.

July 20—Importations of manganese ore from Asia and Australasia prohibited.

July 22—Meeting of stockholders of Mother Lode Copper Mines Co., of Alaska, at Seattle, Wash., ratified sale of all assets of the company to the Mother Lode Coalition Mines Co.—Seizure of certain metal firms, among them being L. Vogelstein & Co. and Beer, Sondheimer & Co., was announced by Alien Property Custodian.

July 29—First meeting of American Zinc Institute held at St Louis, Missouri.

AUGUST

Aug. 1—U S Steel Corporation makes 10% wage increase effective—Committee acting under War Industries Board assumes control of sulphur-bearing materials

Aug. 6—Meeting of "high-cost" copper producers with War Industries Board at Washington—Plant of Union Sulphur Co. at Sulphur, La. damaged by hurricane

Aug. 8—Meeting of Colorado chapter of American Mining Congress and Colorado Metal Mining Association at Denver to discuss the gold-mining situation

Aug. 9—President approved continuance of the 26c. price of copper.

Aug. 10—Missouri-Kansas-Oklahoma Zinc Institute formed at Joplin, Missouri.

Aug. 12—Meeting of American Mining Congress at Reno, Nev., to discuss gold production—Mexican oil decree modified so that Government is now to receive one-sixteenth of the product of every foreign-controlled well—First 500-ton unit of 1500-ton mill of Ray Hercules Copper Co., Arizona, placed in operation.

Aug. 15—Price of silver fixed at $1.01½ per fine ounce by the Government.

Aug. 20—Lead Producers' Committee issued notice to manufacturers and dealers requesting that efforts be made to eliminate non-essential uses of lead.

Aug. 21—Agreement between sheet-zinc producers and War Industries Board to maintain existing prices—British Treasury fixed price for silver at 49½ pence.

Aug. 27—War-Minerals Bill, introduced by Senator Henderson, proposing Government production of metals and minerals needed for the war.

Aug. 30—Suit of minority stockholders of Hull Copper Co. against Charles W. Clark settled out of court.

SEPTEMBER

Sept. 1—Opening day of American Institute of Mining Engineers' meeting at Denver, Colo.—Mining and industrial machinery exempted from import duty in Mexico.

Sept. 2—War-Minerals Bill reported to the Senate.

Sept. 3—John D. Ryan resigned as president and director of Anaconda Copper Mining Co., for the period of the war, to become Director of Air Service—Benedict C. Crowell, First Assistant Secretary of War, appointed Director of Munitions.

Sept. 5—International Gold Conference at Spokane, Washington.

Sept. 7—Fire destroyed part of the ore-roasting plant of the Trail smeltery of the Consolidated Mining and Smelting Co. of Canada.

Sept. 9—New list of preferred industries issued—Sale of gold, excepting to those holding priority orders, forbidden by the Director of the Mint.

Sept. 10—Breaking of hoisting rope at Protection Island shaft of Canadian Western Fuel Co., Nanaimo, B. C., resulting in the death of 16 miners.

Sept. 11—War-Minerals Bill passed by Senate.

Sept. 12—Registration day for selective draft—Orenstein-Arthur Koppel Co. plant sold to Pressed Steel Car Company.

Sept. 15—Works of Compañía Fundidora y Afinadora y Monterrey taken over by American Metal Company.

Sept. 16—Opening day of seventh annual meeting of National Safety Council at St. Louis, Missouri.

Sept. 17—First furnace of Anaconda's ferromanganese plant put in operation.

Sept. 18—Conference on iron and steel prices between general steel committee and War Industries Board at Washington—War Trade Board and Danish mission agree on certain exports to Denmark which include quantities of metal, minerals, and related commodities.

Sept. 23—Opening day of Fourth National Exposition of Chemical Industries at Grand Central Palace, New York.

Sept. 24—Eight-hour day adopted by U. S. Steel Corporation, effective October 1

Sept. 30—Regulations for licensing platinum issued.

OCTOBER

Oct. 1—Increase of 25c. in the base prices of Lake Superior iron ores effective—Eight-hour basic day effective for U. S. Steel Corporation employees—Regulations for licensing platinum became effective.

Oct. 2—Henry R. Merton & Co. announced voluntary liquidation, owing to the fact that they were refused a license under the Non-Ferrous Metal Industry Act.

Oct. 5—War-Minerals Bill signed by the President—Explosion of a Government shell-loading plant at South Amboy, N. J.

Oct. 9—Utah Apex Mining Co. filed suit to restrain Utah Consolidated Mining Co. from mining ore on contested ground—American Metal Co. surrenders holdings in Consolidated Interstate-Callahan Mining Co. and cancels smelting contract with that company—Important A. I. M. E. meeting at Milwaukee, at which tin conservation was discussed by members, representatives of the Government and of many large firms

Oct. 12—Northern Minnesota devastated by forest fires, resulting in heavy loss of lives and property and retarding iron-ore output

Oct. 14—British Treasury fixed maximum price of 48 13/16d. per oz. for silver.

Oct. 15—Anaconda Copper Mining Co. began operation of ferromanganese plant at Great Falls, Montana.

Oct. 20—Outstanding licenses for importation of tin revoked by War Industries Board.

Oct. 25—Loss of Canadian-Pacific steamer "Princess Sophia," which foundered in the Lynn Canal, west of Juneau, Alaska, with all on board, including many mining men.

NOVEMBER

Nov. 5—Taxation of mines amendment to Utah State Constitution passed.

Nov. 6—Tin Importers' Association protested to War Industries Board against the fact that U. S. Steel Products Co. should have sole direction of the import of tin—Shipment of silver bullion to the value of $3,000,000 made from the Government Assay Office at New York to India.

Nov. 11—Armistice signed by Germany—Licenses for importation of chrome ore, except those covering shipments from Cuba, Canada, and Brazil, revoked by the War Trade Board.

Nov. 13—Monetary system of Mexico placed on a gold basis.

Nov. 15—Agreement reached between copper producers and War Industries Board that provides for maintenance of present production, prices, and wages, and regulation of prices and allocations until Jan. 1, 1919.

Nov. 16—Restrictions on domestic uses of gold and silver for industrial purposes removed by the War Industries Board—Zinc producers notified to suspend production on the filling of Government contracts.

Nov. 19—Dr. Charles R. Van Hise died.

Nov. 20—Meeting of quicksilver producers with the War Industries Board at Washington to consider prices.

Nov. 22—William G. McAdoo resigned as Secretary of the Treasury—John D. Ryan resigned as Second Assistant Secretary of War and Director of Air Service.

Nov. 25—New Cornelia Copper Co. paid initial dividend of 25c. per share.

Nov. 27—Meeting held by producers of war minerals with War Trade Board at Washington—Tin, with its alloys and compounds, removed from the Export Conservation List.

Nov. 29—Zinc-ore producers of Oklahoma, Kansas, and Missouri instituted plan of allocation, so that ore purchases may be distributed through participating mine owners.

Nov. 30—Allocation of steel stopped by the War Industries Board.

DECEMBER

Dec. 1—Capt. Joseph R. De Lamar died.

Dec. 4—Opening day of Reconstruction Conference at Atlantic City.

Dec. 5—U. S. Fuel Administration announced that its requisitions for the shipment of bituminous coal to industrial plants have been canceled.

Dec. 6—Ferromanganese plant of the Anaconda Copper Mining Co. at Great Falls, Mont., closed down—War Trade Board announced the removal of certain metals from the Export Conservation list.

Dec. 7—War Trade Board announced modification of the restriction placed on importation of ocean shipments of iron ore to permit importation of calcined spathic iron ore.

Dec. 8—Fuel oil and gas priorities abolished by U. S. Fuel Administration.

Dec. 10—Utah Consolidated Mining Co. filed suit against Utah Apex Mining Co. asking temporary restraining order and accounting and judgment for ores taken from its property.

Dec. 11—Inter-Allied Tin Executive dissolved—Meeting between American Iron and Steel Institute and the War Industries Board at Washington to discuss iron and steel prices.

Dec. 13—Suit filed against Utah State Treasurer by 20 Utah mining companies to test validity of so-called occupation tax on mines.

Dec. 14—Last brick laid on 585-ft. stack of Anaconda Copper Mining Co. at Washoe smeltery, Anaconda, Montana.

Dec. 17—Copper Export Association, Inc., formed.

Dec. 20—Lead Producers' Committee met in New York and decided to dissolve and let a free market be instituted—War Industries Board announced price regulations of copper industry would cease Jan. 1.

Dec. 22—One miner killed in cave-in of drift at the Negaunee mine, Negaunee, Mich. Three miners were rescued after 63 hours' entombment.

Dec. 23—War Trade Board announced the removal of restrictions on tin and tin plate.

Dec. 24—Anaconda reduced its quarterly dividend from $2 to $1.50 per share.

Dec. 31—R. W. Raymond died.

New Mining and Metallurgical Construction In 1918

National Steel Products Co., Bessemer, Jefferson County, Ala., began 25-ton steel castings plant.

Sloss-Sheffield Steel and Iron Co., Birmingham, Jefferson County, Ala., erecting 120 Semet-Solvay byproduct coke ovens at North Birmingham at an approximate cost of $5,000,000.

Tennessee Coal, Iron, and R.R. Co., Birmingham, Jefferson County, Ala., completed repairs on Little Belle furnace at Bessemer and completed 110-in. plate mill at Fairfield.

Shelby Chemical Co., Shelby, Shelby County, Ala., completed byproduct plant at a cost of $600,000.

Central Alabama Coal and Iron Co., Jenifer, Talladega County, Ala., rehabilitated iron furnace plant, erected hot-blast stove and installed electrical equipment and built additional brown-ore washery.

Fairbanks Gold Mining Co., Fairbanks, Alaska, placed dredge, built by the Union Construction Co., in operation.

Alaska Juneau Gold Mining Co., Juneau, Alaska, making alterations and enlargements to mill to increase daily capacity to 8000 tons.

Saltchuck Mine, Ketchican, Alaska, installed 100-ton concentration and flotation mill.

North Midas Copper Co., Strelna, Alaska, built cyanide plant for treatment of gold and silver ores. Estimated cost of plant, $80,000.

Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Cochise County, Ariz., cleared site for 5000-ton concentrator and is stripping ore overburden.

Shattuck-Arizona Copper Co., Bisbee, Cochise County, Ariz., completed a 400-ton mill at a cost of $240,000.

American Smelting and Refining Co., Hayden, Gila County, Ariz., completed installation of coal-crushing plant and new fumes stack.

Miami Copper Co., Miami, Gila County, Ariz., completed new four-compartment concrete working shaft No. 5 to 875 ft.; concreted No. 3 shaft, for fire protection, to 420 ft.; installed 200,000-cu.ft. fan; remodeled five of six mill units to enlarge capacity to 6000 tons daily; constructed 100-ton experimental plant for working out plan of treatment of oxidized ores and installed two 600-hp. boilers and two 4000-kw. turbo-generators for additional mill power required.

Lavelle Gold Mining Co., Winkleman, Gila County, Ariz., began construction of 50-ton mill to cost $60,000. First unit expected to be completed in January, 1919.

Arizona Copper Co., Ltd., Clifton, Greenlee County, Ariz., installed 16 Deister tables at No. 4 concentrator, and erected 15-ton experimental leaching plant. At its No. 6 concentrator, Morenci, the company installed 12 Allen cones, 12 Dorr classifiers and 3 Dorr tanks. Also built and equipped an experimental 400-ton mill for the treatment of low-grade ores. Completed 500-locker change house.

Detroit Copper Mining Co., Morenci, Greenlee County, Ariz., replaced gas engine at concentrator with two Deisel engines of large capacity.

Emerald Isle Copper Co., Chloride, Mohave County, Ariz., completed additional precipitation unit to increase product by 2000 lb. daily.

Gold Road Mines Co., Goldroad, Mohave County, Ariz., built 300-ton crushing plant.

Hackberry Silver Mining Co., Hackberry, Mohave County, Ariz., completed 200-ton concentrator and power plant at an estimated cost of $200,000.

Arizona Ore Reduction Co., Kingman, Mohave County, Ariz., completed 250-ton concentrator, roaster and separation unit; also a million-gallon reservoir.

Standard Minerals Co., Kingman, Mohave County, Ariz., completed 50-ton test mill for flotation of molybdenite ores.

McCracken Silver-Lead Mines Co., Yucca, Mohave County, Ariz., built 100-ton dry concentrating mill.

Yucca Tungsten Mining Co., Yucca, Mohave County, Ariz., completed 60-ton mill.

New Cornelia Copper Co., Ajo, Pima County, Ariz., erecting 500-ton experimental plant for flotation of sulphide ores.

Red Chief Mining and Milling Co., Casa Grande, Pinal County, Ariz., completed 50-ton mill, which uses Elsol type of dry concentrators.

United States Vanadium Development Co., Kelvin, Pinal County, Ariz., completed Bryan dry classifier and 50-ton concentrator. Plant cost about $50,000. Construction began October, 1917, and was finished Mar. 5, 1918.

Ray Consolidated Copper Co., Ray, Pinal County, Ariz., erected new brick office and shaft buildings; installed new compressor system for underground haulage, now nearly complete, and concreted main haulage tunnel.

Ray Hercules Copper Co., Ray, Pinal County, Ariz., completed 1500-ton concentrator and Diesel power plant at Hercules, seven miles from mine, also power line to mine, large skip hoist, crushing plant, concrete ore bins, sampler, and machine shop, at main shaft head and several miles of railroad and a steel bridge across Mineral Creek.

Silver King of Arizona Mining Co., Superior, Pinal County, Ariz., installed small crushing plant.

Flux Mine, Patagonia, Santa Cruz County, Ariz., installed 300-ton mill.

World's Fair Mine, Patagonia, Santa Cruz County, Ariz., installed 100-ton tube mill and 225-ton concentrator.

Octave Mines Co., Congress Junction, Yavapai County, Ariz., began construction of a 250-ton gold reduction plant.

Verde Inspiration Co., Dewey, Yavapai County, Ariz., made additions to stamp mill and built flotation and cyanidation plant.

Consolidated Arizona Smelting Co., Humboldt, Yavapai County, Ariz., completed new roaster plant at cost of $300,000, including four Wedge furnaces, with Cottrell treaters and electric precipitation installation. Also completed converter stack, 190 ft. high, costing $20,000.

United Verde Copper Co., Jerome, Yavapai County, Ariz., completing extensive house-building program at Jerome and Clarkdale; completed loading station, with electrical equipment, at 1000 level of main shaft, and is completing new switchback railroad up to former smeltery site above Jerome, where ore croppings are being handled by steam shovels.

United Verde Extension Copper Co., Jerome, Yavapai County, Ariz., completing smeltery at Verde. Blast furnace in operation; two reverberatories under construction. Completing 12,000-ft. haulage tunnel and ore pockets at shaft. Working on large housing plans at Jerome and Verde.

Pocahontas Copper Queen Mining Co., Mayer, Yavapai County, Ariz., began construction on a 50-ton unit of flotation plant to cost $25,000.

Swansea Consolidated Gold and Copper Mines Co., Swansea, Yuma County, Ariz., completed 250-ton plant for flotation of sulphide copper ores.

Washing Plants built in the Batesville, Ark., manganese field during 1918 were: 500-ton plant at the Cutter mine; 200-ton plant at the Polk-Southard mine, operated by the Independence Mining Co., and a smaller one on the company's property on Lafferty Creek; 300-ton plant at the Adler mine; 300-ton plant at the U. S. Canadian and a 300-ton plant at the Oklahoma-Kansas mine, all of these near Cushman, Ark. Near Batesville the Waco Mining Co. erected a 250-ton plant at the Patterson mine and a 250-ton plant at the Bilharz mine. The Leader Mining Co. completed a 250-ton plant at the Allen mine, and a small plant was built by Shepherd and Wilson at their Ball mine. Plants under construction are two 200-ton mills on the Napoleon Hill land, at Cushman, under operation by Beatty and associates; a 300-ton plant at the Pugh Hollow mine operated by the Everton Mining and Development Co. at Cushman, and a 300-ton plant at the mine of the Liberty Manganese Co. At Batesville, a 250-ton plant is under construction at the Ball mine.

Western Magnesite Co., Livermore, Alameda County, Calif., installed 150-ton mill.

California National Gold Mining Co., Oroville, Butte County, Calif., installed 1500-ton concentrator.

Western Ore Co., Oroville, Butte County, Calif., constructed 50-ton concentration plant at Lime Saddle; also 1400-ft. tramway. Equipment used in treatment of low-grade chrome ores.

Napoleon Copper Co., Copperopolis, Calaveras County, Calif., completed 90-ton plant consisting of ball mills, flotation unit, and concentrators.

Consolidated Wilshire Mining Co., Bishop, Inyo County, Calif., installed 80-ton flotation plant. Test run made Dec. 7, 1918.

Pine Creek Tungsten Mining Co., Bishop, Inyo County, Calif., installed 225-ton mill.

Tungsten Mines Co., Bishop, Inyo County, Calif., installed 150-ton flotation plant for treatment of tungsten ores.

Saline Valley Salt Co., Keeler, Inyo County, Calif., completed aërial tramway from mill to railroad.

Round Valley Tungsten Co., Pine Creek, Inyo County, Calif., built 150-ton mill.

Gold State Mine, Caliente, Kern County, Calif., installed 30-ton mill.

Mount Gaines Gold Mining Co., Hornitos, Mariposa County, Calif., completed installation of 100-hp. electric hoist, and made improvements in mill.

Empire Mines and Investment Co., Grass Valley, Nevada County, Calif., bdilt two retaining reservoirs for mill tailings.

Grass Valley Consolidated Gold Mines Co., Grass Valley, Nevada County, Calif., completed construction of mill and cyanide plant of 29,000 tons' annual capacity at a cost of $225,000.

North Star Mines, Grass Valley, Nevada County, Calif., installed 1225-ft. aërial cable operating clam-shell bucket for handling tailings.

Sierra Asbestos Co., Washington, Nevada County, Calif., built tramway between mine and mill, remodeled mill and constructed three-span bridge over Yuba River.

Parker Chrome Co., Auburn, Placer County, Calif., completed mill for crushing ore.

Placer County Chrome Co., Auburn, Placer County, Calif., enlarged concentration plant and installed machinery.

Engels Copper Co., Keddie, Plumas County, Calif., installed 750-ton flotation plant.

Geisendorfer and Farmer, Folsom, Sacramento County, Calif., installed 50-ton mill for treatment of chrome ores.

Noble Electric Steel Co., Folsom, Sacramento County, Calif., installed mill for crushing and concentrating low-grade chrome ores.

Pacific Electric Metals Co., Stockton, San Joaquin County, Calif., installed 40-ton electric furnace for making ferromanganese at Bay Point.

Santa Margarita Chrome Co., Santa Margarita, San Luis Obispo County, Calif., completed installation of 75-ton concentrator at a cost of $20,000.

Afterthought Copper Co., Ingot, Shasta County, Calif., completed construction of cottages for employees, made improvements in 400-ton flotation plant, and completed electrolytic zinc plant and reverberatory furnace.

Mountain Copper Co., Keswick, Shasta County, Calif., increased flotation plant at Minnesota station by 300-ton unit.

American Gold Dredging Co., Redding, Shasta County, Calif., constructed 132-ft. dredge with 6-cu.ft. buckets.

Bully Hill Copper Mining and Smelting Co., Winthrop, Shasta County, Calif., converted old smeltery into 150-ton flotation plant.

Brandy City Mining Co., Brandy City, Sierra County, Calif., completed 300-ft. dam on north fork of the Yuba River.

Index Gold Mining Co., Quimby Creek, Trinity County, Calif., completed 50-ton gold mill.

Kleinsorge Chrome Mine, Lowrey, Tehama County, Calif., installed ten 850-lb. stamps and two concentrating tables.

Elder Creek Chrome Co., Red Bluff, Tehama County, Calif., installed crushing and concentration plant.

Pacific Coast Gold Mines Corporation, Quartz, Tuolumne County, Calif., building stamp and fine-grinding mill of 180,000 tons' annual capacity. To be completed by January, 1919.

Tonopah Belmont Development Co., Shawmut, Tuolumne County, Calif., completed stamp, flotation, and cyanide mill of 144,000 tons' annual capacity.

Confidence Gold Mines Corporation, Sonora, Tuolumne County, Calif., installed ball mill, tube mill, 10-tank cyanide plant, and other equipment.

Federal Gold Mining Co., Sonora, Tuolumne County, Calif., installed 50-ton Huntington mill.

Golden Age Mining and Reduction Co., Jamestown, Boulder County, Colo., installed 120-ton flotation plant.

Wano Mining and Milling Co., Jamestown, Boulder County, Colo., added three tables to mill treating fluorspar.

K. K. Mining and Milling Co., Alice, Clear Creek County, Colo., completed 50-ton amalgamating and concentrating mill at a cost of $10,000.

Colorado Central Mining Co., Georgetown, Clear Creek County, Colo., completed construction of 150-ton flotation plant to treat dumps.

Sceptre Mines and Mills Co., Georgetown, Clear Creek County, Colo., completed 7000-ft. aërial tram from mine to loading station on Colorado and Southern Ry.; also new ore bins, boarding house, and bunk house for 50 men at the mine.

Idaho Mining, Reduction, and Transportation Co., Idaho Springs, Clear Creek County, Colo., added new 100-ton flotation unit to mill.

Little Giant Mining and Milling Co., Lawson, Clear Creek County, Colo., completed mill.

Primos Chemical Co., Urad, Clear Creek County, Colo., completed new boarding house, bunk house, 200-ton mill, and 2400-ft. tramway.

Buffalo Hunter Mining and Milling Co., Silver Cliff, Custer County, Colo., completed 100-ton mill.

General Reduction Co., De Beque, Garfield County, Colo., installed 50-ton unit of Scott process to treat oil shale.

Mount Blaine Oil Shale Products Co., De Beque. Garfield County, Colo., built 100-ton oil-distillation plant.

Fanny Rawlings Mining Co., Leadville, Lake County, Colo., rebuilt surface plant and installed electric hoist.

Radium Ore Sampling Co., Montrose, Montrose County, Colo., completed rare-ore custom sampler at a cost of $12,000.

Ouray Custom Milling Co., Ironton, Ouray County, Colo., installed table and flotation machinery.

Calliope Consolidated Mining Co., Ouray, Ouray County, Colo., installed power plant and compressor.

Mountain Top Mining Co., Ouray, Ouray County, Colo., completed 3000-ft. tramway from mine to Governor Basin.

Yellow Jacket Mines Co., Ouray, Ouray County, Colo., completed mill.

Norcross Chemical Co., Pueblo, Pueblo County, Colo., installed chemical plant for sulphuric-acid manufacture.

Sunnyside Mining and Milling Co., Eureka, San Juan County, Colo., completed 500-ton flotation mill, 16,000 ft. of tramway, mining plant, and power line.

Lackawanna Mining and Reduction Co., Silverton, San Juan County, Colo., completed new tramway, installed new mining machinery, and remodeled mill.

Lewis Mine Co., Telluride, San Miguel County, Colo., made alterations to mill and installed flotation plant for treatment of lead-zinc-copper ore.

Belmont Wagner Mining Co., Telluride, San Miguel County, Colo., completed 300-ton mill.

Liberty Bell Gold Mining Co., Telluride, San Miguel County, Colo., remodeled mill to treat concentrates.

Liberty Leasing Co., Breckenridge, Summit County, Colo., remodeled mill and installed flotation unit at Monte Cristo mine.

Power River Dredging Co., Breckenridge, Summit County, Colo., installed new transformers and new dredge built by the Yuba Construction Company.

Molybdenum Products Co., Buffehrs, Summit County, Colo., completed 250-ton mill.

Climax Molybdenum Co., Climax, Summit County, Colo., completed 400-ton mill; 500 ft. two-bucket tramway; 5000 ft. aërial tramway, and crushing plant.

Minerals Products Co., Frawley, Summit County, Colo., completed 200-ton milling plant to treat molybdenum ores.

Big Toad Mining and Milling Co., Cripple Creek, Teller County, Colo., remodeled Reid mill.

Mary McKinney Mining Co., Cripple Creek, Teller County, Colo., installed steam hoist and drag-line excavator at the Howard shaft.

Vindicator Consolidated Gold Mining Co., Cripple Creek, Teller County, Colo., is installing additional equipment to double capacity of ferro-alloy plant purchased from the Ferro-Alloy Co. of Denver.

Excelsior Mining, Milling and Electric Co., Victor, Teller County, Colo., erected new ore house at shaft of Longfellow mine.

Akron Mines, Whitepine, Whitepine County, Colo., installed electric power line and rebuilt mill.

Chestatee Pyrites and Chemical Co., Chestatee, Hall County, Ga., completed 600-ton sorting and concentration plant and enlarged hydroelectric power plant.

Falls Creek Mining Co., Sandpoint, Bonner County, Idaho, began installation of a concentrator having a capacity of 20,000 tons per year and to cost $40,000.

Armstead Mines Corporation, Talache, Bonner County, Idaho, completed 100-ton mill.

Empire Copper Co., Mackay, Custer County, Idaho, completed three-mile tramway from mine to railroad.

Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Shoshone County, Idaho, at its smeltery, completed Cottrell precipitation plant, added three Dwight & Lloyd sintering machines, made additions to blower house, added 1100-cu.ft. compressor, and completed coal pulverizing plant; also made extensions to lead refinery. Remodeled old Sweeny mill at Bradley, to treat 600 tons daily of coarse tailings from the Last Chance mine.

Cœur d'Alene Antimony Mining Co., Kellogg, Shoshone County, Idaho, completed K. & K. flotation plant.

Throndson Metal Saving Co., Kellogg, Shoshone County, Idaho, completed 200-ton concentrating and flotation mill.

Spokane Metals Recovery Co., Mullan, Shoshone County, Idaho, completed 200-ton mill, which was destroyed by fire in September.

Blewett Mining Co., Galena, Jo Daviess County, Ill., began construction of 600-ton zinc concentrating mill at an estimated cost of $52,000 in August. To be completed January, 1919.

American Zinc Products Co., Greencastle, Putnam County, Ind., completed modern zinc-rolling mill of 1000 to 1500 tons' daily capacity.

Zimmerman Steel Co., Bettendorf, Scott County, Iowa, installed a five-ton three-phase electric furnace.

Calumet & Hecla Mining Co., Calumet, Mich., increased capacity of Lake Linden leaching plant by substituting Hardinge mills for Chilean mills; installed 250 forty-ton cars; completed 10,000-kw. power house and office building at Lake Linden; installed electric furnace for making stamp shoes; began construction of 2000-ton flotation plant.

Seneca Mining Co., Calumet, Mich., completed surface buildings, shafthouse and power plant.

Quincy Mining Co., Hancock, Mich., completed dwelling houses and began making additions to stamp mill at Mason.

Lake Milling, Smelting and Refining Co., Point Mills, Mich., built two additional stamp heads.

White Pine Extension Copper Co., Pinex, Mich., installed Minerals Separation machines.

Charcoal Iron Co., Bessemer, Mich., began erection of complete new surface plant at the Yale mine.

Oliver Iron Mining Co., Ironwood, Mich., completed electric plant at Pabst mine, which is to be used as a central power station for the company mines on the Gogebic Range.

Cleveland Cliffs Iron Co., Ishpeming, Mich., built surface plant at Barnes-Hecker mine; at Marquette rebuilt refining house at Pioneer Iron Co. furnace, destroyed by fire; installing hydroelectric power plant at Forestville to generate 5000 kw., to be completed February, 1919.

Cuyuna-Minneapolis Iron Co., Crosby, Minn., completed shaft, built engine house, dry-house and dwellings at Ida Mae mine.

Northern Minnesota Ore Co., Cuyuna, Minn., began sinking of 10 x 16 ft. three-compartment shaft, and built office, dry-house, shops, and dwellings at Northland mine.

Breitung & Co., Ironton, Minn., completed sinking of shaft and erection of buildings at Hopkins' mine in July.

American Manganese Manufacturing Co., Ironton, Minn., completed three-compartment shaft, began in 1917, in August; also erected steel headframe, built surface plant and machinery at Cuyuna-Mille Lacs mine. Sunk shaft deeper and installed new compressor at the Cuyuna-Duluth mine.

Arko Mining Co., Ironton, Minn., completed in September, two-compartment shaft at the Arko mine. Also erected headframe and mine buildings.

Bessemer Iron Co., Ironton, Minn., sunk shaft and installed machinery, but closed down in April. Machinery and supplies sold and buildings dismantled.

Cuyuna-Sultana-Oneida Mines Co., Ironton, Minn., completed 2000-ton manganiferous iron-ore washing plant in August.

Inland Steel Co., Ironton, Minn., completed new office building in November.

Liberty Mining Co., Ironton, Minn., sunk shaft, erected headframe and surface buildings at the Bonnie Belle mine.

Whitemarsh Mining Co., Ironton, Minn., completed sinking of shaft, built shops, headframe, and dwellings, and installed machinery at the Martin mine. Completed shaft and hoist equipment at Huntington mine.

Coates & Tweed, Manganese, Minn., began sinking shaft at Preston mine, but closed down same Dec. 1, pending labor and ore-price developments. Built dry-house, shops and engine and boiler house and installed machinery.

Adbar Development Co., Trommald, Minn., began sinking shaft in August. Temporary surface plant, but no permanent improvements.

Gloria Mining Co., Trommald, Minn., installed hoist, compressor, and pumps at Gloria mine, formerly known as McKenzie mine. Closed down December 2.

Joan Mining Co., Trommald, Minn., began sinking drop shaft at Joan No. 3 mine in June. Temporary buildings erected.

Merritt Development Co., Trommald, Minn., completed three new shafts at Merritt mine. Erected headframes, built railroad spurs, and installed machinery, completing construction in October.

Onahman Iron Co., Trommald, Minn., at its Algoma mine, changed from steam to electrical equipment and installed 200-hp. oil engine auxiliary and new pumping equipment.

Oneida Mines Co., Trommald, Minn., began sinking of drop shaft at Clark mine, and erected boiler and engine house, dry-house, and surface buildings.

Omaha Iron Co., Woodrow, Minn., erected drying plant at the Wilcox mine. Construction began March, 1918, and was completed in July.

Interstate Iron Co., Calumet, Minn., began construction of two-unit washing plant at the Hill Annex mine; capacity, 1000 tons daily.

Picklands, Mather & Co., Calumet, Minn., constructed office, camps, and blacksmith shop at the Majorca mine; completed concentrating plant at Riley Lake on May 1.

Duluth, Missabe & Northern Ry., Duluth, Minn., completed No. 6 ore dock at a cost of $2,500,000. New approaches were built to No. 3 and No. 4 docks.

M. A. Hanna & Co., Hibbing, Minn., built new office building.

Draper Mine, Marble, Minn., completed concentrating plant.

Oliver Iron Mining Co., Virginia, Minn., completed 470-ft. coal dock at Missabe Mountain mine; added seventy 20-cu.yd. air-dump cars to stripping equipment; Hibbing, Minn., completed small gravity screening plant at Hull Rust mine to separate waste and ore. Eveleth, Minn., began concentration and crushing plant at the Leonidas mine.

Bannack Mining and Milling Co., Bannack, Beaverhead County, Mont., completed milling plant of 9000 tons' annual capacity.

Boston & Montana Development Co., Elkhorn, Beaverhead County, Mont., built 500-ton mill.

Anaconda Copper Mining Co., Great Falls, Cascade County, Mont., completed copper rod and wire plant; completed electrolytic ferromanganese plant, consisting of five furnaces, at a cost exceeding $500,000. Plant closed down on Dec. 6. Completed 585-ft. stack at Washoe smeltery, Anaconda.

Cascade Mine, Neihart, Cascade County, Mont., completed 500-ton mill for the treatment of lead-silver sulphide ores.

Philipsburg Mining Co., Philipsburg, Granite County, Mont., completed 400-ton mill for the treatment of low-grade manganese ores by magnetic separation.

Alta Mining Co., Corbin, Jefferson County, Mont., completed new electric power plant to replace Bertha plant destroyed by lightning.

Economy Gold Mines Co., East Helena, Lewis and Clark County, Mont., completed 100-ton concentrator.

New York-Montana Testing and Engineering Co., Helena, Lewis and Clark County, Mont., increased plant for treating manganese to 100 tons' capacity.

Porphyry Dike Gold Mining Co., Rimini, Lewis and Clark County, Mont., completed 300-ton mill for treatment of free gold ores.

Liberty Mining Co., Silver Camp, Lewis and Clark County, Mont., repaired 100-ton mill to treat lead-zinc ores.

Tarbox Mining Co., Saltese, Mineral County, Mont., completed 300-ton mill for the treatment of zinc-lead ores.

Crystals Goldsmith Co., Butte, Silver Bow County, Mont., installed 75-hp. electric hoist and 1000-cu.ft. compressor at the Tong shaft; also surface plant buildings.

United States Manganese Corporation, which took over the Ophir mill of the Butte-Detroit Copper and Zinc Mining Co., Butte, Silver Bow County, Mont., added further equipment to mill for treatment of silver-zinc and manganese ores. Mill and mine closed down.

Hoosier Del Monte Mining Co., Goodsprings, Clark County, Nev., completed 50-ton concentrator for treatment of low-grade lead-silver ore.

Sultan Mine, Goodsprings, Clark County, Nev., enlarged dry concentrating plant.

Rochester Combined Mines Co., Rochester, Humboldt County, Nev., completed installation of leaching vats and part of grinding plant of 500-ton cyanide leaching installation.

Nevada-Humboldt Tungsten Co., Tungsten, Humboldt County, Nev., completed 100-ton tungsten mill, consisting of crushers, rolls, jigs, Deister-Overstrom tables, driers, and magnetic separators.

Pacific Tungsten Co., Tungsten, Humboldt County, Nev., completed 125-ton mill, which began operation in November.

Bluestone Mining and Smelting Co., Yerington, Lyon County, Nev., completed 400-ton flotation plant in April at a cost of $300,000.

Silver Dike Tungsten Mine, Mineral County, Nev., completed 30-ton mill for treating high-grade scheelite ore.

Kansas City-Nevada Consolidated Mining Co., Bruner, Nye County, Nev., began installation of 50-ton mill and nine-mile pipe line.

White Caps Mining Co., Manhattan, Nye County, Nev., completed changes to mill.

Nevada-California Power Co., Tonopah, Nye County, Nev., completed electric power line to camp of Divide.

Consolidated Coppermines Co., Kimberly, White Pine County, Nev., completed second 500-ton section of mill.

Thomas Iron Co., Wharton, Morris County, N. J., sunk three-compartment shaft to 1100 level; installed new headframe, hoisting plant, and magnetic cobbing mill at the Richard mine.

Wharton Steel Co., Wharton, Morris County, N. J., completed 2500-ton magnetic concentrating mill at the Scrub Oak mine.

Vera Cruz Leasing Co., Carizozo, Grant County, N. M., installed crusher, ball mill, amalgamators and thickening tanks at a cost of $20,000.

85 Mining Co., Lordsburg, Grant County, N. M., constructed 300-ton mill and new hoist.

Last Chance Mining Co., Lordsburg, Grant County, N. M., completed 50-ton unit of mill.

Calumet Mining Co., Silver City, Grant County, N. M., began construction of lead-zinc concentrating mill, to have an annual capacity of 30,000 tons.

Chateaugay Ore and Iron Co., Lyon Mountain, Clinton County, N. Y., began construction of a new magnetic concentrating mill having a capacity of 100 tons per hour.

St. Nicholas Zinc Co., Summitville, Sullivan County, N. Y., made additions and improvements to mill.

Tri-State Chrome Mining Co., Canyon City, Grant County, Ore., remodeled 80-ton mill of Jupiter Mining Company.

Ranier Mercury Co., Gold Hill, Jackson County, Ore., erected 12-pipe mercury furnace.

Gold Hill Mining Association, Medford, Jackson County, Ore., installed 10-stamp mill.

Alameda Copper Mines, Grants Pass, Josephine County, Ore., built 200-ton concentrator and 150-ton reduction furnace.

Rare Minerals Co., Custer, Custer County, S. D., installed a 50-ton concentrator that will be placed in operation soon after the first of the year to handle tin and tungsten ores.

Spokane Lead Co., Hermosa, Custer County, S. D., completed 100-ton concentrator and placed same in operation in July.

Cutting Mining Co., Deadwood, Lawrence County, S. D., began construction of shafthouse, electric hoist, and compressor.

Deadwood Lead and Zinc Mining Co., Deadwood, Lawrence County, S. D., completed 10-stamp mill and concentrator in August.

Mogul Mining Co., Terry, Lawrence County, S. D., completed aërial tramway from portal of main working tunnel to mill bins, a distance of 1600 feet.

American Tin and Tungsten Co., Hill City, Pennington County, S. D., remodeled tin mill. Plant to be ready for concentration by March 1, 1919, and is to have from 75 to 250 tons' capacity. Installed 60-hp. hoist at Cowboy mine.

Metal Products Association of Texas, Alpine, Brewster County, Tex., began construction of 50-ton copper blast furnace.

Mariposa Mining Co., Terlingua, Brewster County, Tex., installed furnace to treat low-grade quicksilver ores.

Southwestern Graphite Co., Burnet, Burnet County, Tex., built 200-ton electrostatic plant for graphite concentration.

National Potash Corporation, Devils Slide, Morgan County, Utah, made alterations in Union Portland Cement Co. plant to produce potash from Wyoming leucite rock.

Chief Consolidated Mining Co., Eureka, Juab County, Utah, added 2500-cu.ft. Laidlaw-Dun-Gordon compressor and Worthington pumps. Began three-compartment, concrete-lined shaft July 1. To be 2000 ft. deep.

Deer Trail Mining Co., Marysvale, Piute County, Utah, completed 100-ton flotation and cyanide mill for treatment of gold-silver-lead ore.

Florence Mining and Milling Co., Marysvale, Piute County, Utah, completed 100-ton unit of alunite mill and installed roasting furnace and leaching plant.

Mineral Products Co., Marysvale, Piute County, Utah, rebuilt 200-ton mill for treatment of alunite.

Sells Mine, Alta, Salt Lake County, Utah, built and put in operation a 2000-ft., 100-ton tramway.

Ohio Copper Co., Bingham Canyon, Salt Lake County, Utah, completed 3000-ton flotation plant.

Little Cottonwood Transportation Co., Wasatch, Salt Lake County, Utah, completed eight-mile, 36-in. gage railroad from Wasatch to Alta.

Big Indian Copper Co., Lasal, San Juan County, Utah, completed 200-ton mill for copper ores. After short operation, mill was remodeled.

Judge Mining and Smelting Co., Park City, Summit County, Utah, made additions and improvements to zinc plant of 30-ton capacity.

Silver King Consolidated Mining Co., Park City, Summit County, Utah, completed 150-ton mill for silver-lead-zinc ores.

Utah Mine, Fish Springs, Tooele County, Utah, nearly completed 100-ton mill for silver-lead ores.

Western Utah Copper Co., Gold Hill, Tooele County, Utah, began 100-ton mill to treat copper ore.

American Fork Exploration Co., American Fork, Utah County, Utah, completed small mill.

American Mineral Co., Johnson, Lamoille County, Vt., completed installation of hydroelectric mill for treatment of talc.

Crimora Manganese Corporation, Crimora, Augusta County, Va., remodeled mill to treat 50 tons daily of manganese ore.

Roanoke Ore and Iron Co., Roanoke County, Va., constructed 12 miles of railroad and a washing plant for iron ores.

Stange Mine, Narrows, Giles County, Va., completed mill of 75,000 tons' annual capacity to handle manganese ores.

Great Metals Mining and Milling Co., Nespelem, Okanogan County, Wash., completed 100-ton concentrator.

Copper World Extension Mining Co., Nighthawk, Okanogan County, Wash., began two-mile tramway from Copper World and Copper World Extension mines to Palmer Lake.

Ivanhoe Mining Co., Oroville, Okanogan County, Wash., completed 50-ton flotation plant.

Metalene Oriole Mining Co., Metalene, Pend Oreille County, Wash., erected 50-ton mill to treat lead-zinc-silver-gold ores.

Young America Mine, Bossburg, Stevens County, Wash., began construction of a 50-ton concentrator.

Northwest Magnesite Co., Chewelah, Stevens County, Wash., completed five-mile aërial tramway from Finch quarry to Chewelah, grinding and mixing plant, and pulverizing plant.

Electric Point Mining Co., Northport, Stevens County, Wash., completed 2½-mile tramway at a cost of $45,000.

Northport Smelter Co., Northport, Stevens County, Wash., completed drossing plant.

Zinc Hill Mining Co., Cuba, Wis., completed 100-ton zinc concentrating mill at the Little Dick mine. Construction started Aug. 1, and was completed Nov. 15. Estimated cost, $40,000. Also began construction of 300-ton mill at Big Dick mine on Dec. 2.

United States Government started construction of acid plant, capacity 100 tons oleum per 24 hours, at the National Zinc Separating Plant, Cuba, Wis. Construction began July 15, and about 80% of work was completed when it was ordered discontinued by the Government. Began construction of an acid plant of a capacity of 50 tons of oleum per 24 hours at the Skinner roaster of the Wisconsin Zinc Co., New Diggings, Wis. Construction started July 15, but was ordered stopped at the end of the year.

Connecting Link Mining Co., Jenkynsville, Wis., completed 150-ton mill at an estimated cost of $41,000. Work was started November, 1917.

Lucky Six Mining Co., Linden, Wis., completed, in April, 50-ton zinc concentrating mill which was started November, 1917.

Vinegar Hill Zinc Co., Livingston, Wis., completed 350-ton mill at the Dale Rundell mine at an estimated cost of $65,000.

Little Platte Lead and Zinc Co., Platteville, Wis., completed 75-ton zinc concentrating mill in October.

Wisconsin Zinc Co., Shullsburg, Wis., completed Copeland mill having a capacity of 250 tons. Construction was started in November, 1917, and was completed March 1, 1918.

Dolly Varden Mines Co., Alice Arm, B. C., constructed 15 miles of railroad from beach to mine. No estimate of cost available. Installation of 150-ton concentrator and 750-hp. power plant proposed during 1919.

Granby Consolidated Mining, Smelting, and Power Co., Anyox, B. C., began construction in April of 30-oven byproduct coke plant and benzol plant at Graves Point. Completed work at Anyox smeltery, including two new converters, construction of which was started in July, 1917.

Pacific Coast Contractors, Ltd., Cariboo Road, Clinton Mining Division, B. C., installed evaporating plant for the treatment of water at Soda Lake, which carries 6% sodium carbonate. Capacity three tons of crystal soda per day.

Tertiary Gravel Co., Cottonwood Canyon, Fraser river, north of Quesnel, B. C., began remodeling of mill, to treat cemented gold-bearing gravel. Capacity, 50 tons a day.

Drum Lummon Copper Co., Drum Lummon Bay, Douglass Channel, B. C., completed installation of 36-ton experimental Gibson mill and concentrator.

French Complex Ore Reduction Co., Fairview, near Nelson, B. C., completed electrolytical plant for experimental treatment of complex silver-lead-zinc ores of eastern section of province. Government, in 1917, voted $25,000 for improvement of works and to aid in starting operations.

Lanark Mining Co., Illicillewaet, B. C., installed 250-hp. hydroelectric plant to drive mill and furnish power for mine.

Sunloch Mining Co., Ltd., Jordan river, West Coast, Vancouver Island, B. C., started construction of a wagon road and the installation of a compressor plant. Estimated cost, $65,000. Capacity of plant, 30,000 tons per year.

Queen Bess Mines, Inc., near Kamloops, B. C., began installation of concentrating plant.

Cork-Province Mines, Ltd., Kaslo, B. C., installed ball mill and flotation plant at a cost of $15,000.

Outsider Group, Maple Bay, Portland Canal, B. C., installed small compressor plant.

Silver Standard Mining Co., New Hazelton, B. C., completed 50-ton mill. Cost of mill estimated between $30,000 and $35,000. Construction started late in 1917, and was finished June, 1918.

Aetna Iron and Steel Co., Port Moody, B. C., installed six-ton electric pig-iron furnace.

Canada Copper Corporation, Princeton, B. C., continued construction of 300-ton concentrator, 15 miles of railroad, and power line, involving total expenditure of $4,500,000, of which $2,000,000 is being spent by Canadian Pacific interests.

South Easter Group, Skidegate, Graham Island, B. C., installed compressor and hoist.

Efanjay Gold Mining Co., Tulameen River, B. C., built dam and flume for recovery of gold and platinum of gravel from river bed at a cost of $20,000.

Rex Mines, The Pas, Man., installed 30-ton amalgamating mill at the Rex property, Herb Lake. This is the first gold mill in the district.

Dominion Steel Corporation, Sydney, N. S., installed new coke-oven plant comprising 120 byproduct ovens having 1320 tons' daily output.

Miller Independence Mining Co., Boston Creek, Ont., completed 40-ton mill in October.

Patricia Mine, Boston Creek, Ont., completed 50-ton mill.

Casey Cobalt Mining Co., Ltd., Cobalt, Ont., built new mill.

Mining Corporation of Canada, Cobalt, Ont., installed mining plant at Rickard Township; also increased mill capacity at Cobalt and installed pump for slimes.

Peterson Lake Silver Cobalt Mining Co., Cobalt, Ont., completed 100-ton flotation mill for the treatment of slime and jig tailings.

Provincial Mine, Cobalt, Ont., installed 50-ton flotation plant.

Trethewey Silver-Cobalt Mine, Ltd., Cobalt, Ont., completed 150-ton flotation mill for the treatment of tailings.

The Steel Company of Canada, Hamilton, Ont., completed 80 13-ton Wilputte byproduct coke ovens in December. Plant to have 950 tons' daily capacity.

Burnside Mines, Ltd., Kirkland Lake, Ont., started construction of 30-ton mill, which is expected to be in operation early in 1919.

Kirkland Lake Gold Mining Co., Kirkland Lake, Ont., began construction of a 150-ton mill.

Lake Shore Mines Ltd., Kirkland Lake, Ont., completed new 60-ton mill in March.

Wright-Hargraves Mining Co., Kirkland Lake, Ont., began constructing 150-ton cyanide mill.

Hill Gold Mines, Munro Township, Ont., started installation of a 70-ton mill.

Premier Langmuir Mine, Porcupine, Ont., completed 30-ton mill for the treatment of barite.

International Nickel Co., Port Colborne, Ont., completed refinery in June. Total cost over $5,000,000.

Pittsburgh-Lorrain Syndicate, South Lorrain, Ont., installed small oil-flotation plant.

Davidson Gold Mines Co., South Porcupine, Ont., installed five-stamp mill.

Dome Lake Mining Co., South Porcupine, Ont., installed 60-ton cyanide addition to stamp mill.

Hollinger Consolidated Gold Mines, Ltd., Timmins, Ont., completed new addition to old stamp mill.

Indian Peninsula Mining Co., Cobalt, Ont., began installation of 100-ton Groch flotation unit to treat molybdenum ore at Amos, Quebec.

Mutual Chemical Co., Black Lake, Que., installed 100-ton chrome concentrating mill at the St. Cyr mine.

Bennett-Martin Asbestos Co., Coleraine, Que., built new plant.

British-American Nickel Corporation, Ltd., Nickelton, Ont., continued construction of refinery at Deschenes, near Hull, Que. Estimated cost of plant is $3,000,000.

Eastern Milling Co., Sherbrooke, Que., installed 60-ton concentration and flotation mill at the old Huntington mine.

Platinum

Platinum was one of the metals respecting which there was most concern in 1918, for the supply is diminishing, owing to exhaustion of the placers in the Urals, and there is no known substitute for this metal. In 1917 the market price rose to $105 per oz., owing to the decline of production in the Urals, whence authoritative information to us in the early part of 1917 was to the effect that a price of $100 per oz. was necessary to enable production to be maintained from the poorer ground.

A lot of 21,000 oz. of crude platinum, collected by the Russian-English Bank during 1917, was brought to this country personally by F. W. Draper, and was delivered to the United States Government early in 1918. Had it not been for this supply, our Government would have been ratherly badly off. As it was, the Government found it necessary to commandeer all platinum, which was done in the spring, and the price was wisely fixed at the high level that had already been made in the market, viz. $105 per oz. At the same time the price for palladium was fixed at $135 and for iridium at $175, all the metals of the platinum group being taken over at the same time with platinum. After the signing of the armistice on Nov. 11, the ban on platinum was removed, and on Dec. 1 the platinum market was set free. Trading began then at $105@106 per oz., with strong demand and indications that the price might rise, but that tendency was checked by the news that the Government was offering its surplus platinum for sale at $105.

All of the platinum acquired by the Government was refined at the New York Assay Office, which received upward of 60,000 oz., this including crude platinum, scrap, and platinum sponge. The lot delivered by Mr. Draper, consisting of grains and nuggets, weighed 20,922 oz., from which was refined 17,640 oz. of platinum, 64.751 oz. of palladium, 182.113 oz. of iridium, and 48.563 oz. of rhodium.

No information respecting platinum production in Russia is available. Probably the quantity was very small. However, the high price for the metal is stimulating the production in Colombia, where it exists in the coastal region traversed by certain rivers flowing from the western slopes of the Andes, especially in the Choco district. In that district the British Platinum and Gold Corporation, Ltd., of London, and the South American Gold and Platinum Company (Lewisohn) of New York, are hydraulicking and dredging on a considerable scale. The output of platinum in Colombia was estimated at 12,000 oz. in 1911; 15,000 in 1912; 15,000 in 1913; 17,500 in 1914; 18,000 in 1915; 25,000 in 1916; 35,000, in 1917 and 35,000 in 1918. The Colombian crude yields about 82% of platinum and fetches a price of about £2 10s., or, say, $12.50 below that for refined ingot.

AVERAGE PRICES OF PLATINUM

(In Dollars per Ounce Troy)

	1916			1917	1918
		Russia, Crude Metal			
	New York Refined Platinum	83% Petrograd	Platinum Ekaterinburg	New York Refined Platinum	New York Refined Platinum
January	90.05	61.25	61.10	87.83	105.9166
February	90.00	61.14	62.625	103.75	107.6818
March	90.75			103.33	108 (nom.)
April	83.10	63.70	63.70	103.77	108 (nom.)
May	80.50	66.64	65.92	105.00	106.2692 (a)
June	78.13	63.70	63.92	104.75	105
July	63.60	63.21	63.92	103.88	105
August	62.56	67.41	66.45	104.55	105
September	84.25	67.41	66.45	104.13	105
October	89.75	77.42	71.44	104.00	105
November	101.25			104.52	105
December	86.87			104.38	105.5400
Year	83.40			102.82	105.9506

New York average for year 1915, $47.13; 1914, $45.14. 1913, $44.88; 1912, $45.55; 1911, $43.12 (a) Fixed May 14 at 105

At the end of 1918 the quotation for platinum was $105 for refined ingot, while sponge scrap, crude, etc., was bought on the basis of $100 for the fine platinum content. However, a differential of $0.50@1 for sponge and $3 for crude ought to be sufficient.

Alaska's Output of Placer Gold in 1918, according to the U. S. Geological Survey, was about $6,100,000. The Yukon Basin produced $4,325,000; Seward Peninsula, $1,140,000; Copper River, $300,000; Cook Inlet-Susitna region, $215,000; Kuskokwim region, $90,000; and miscellaneous, $30,000. The total production in 1917 was $9,810,000.

Manganese Ore in 1918

A YEAR and a half ago it was generally thought that the manganese situation presented a rather serious aspect. The customary supplies from Brazil and India were, because of the shortage of bottoms, not reaching United States ports, and it was a question as to whether the ever-increasing demands of steel and alloy manufacturers could be supplied from domestic sources. American steel plants had been accustomed to and preferred the use of ferromanganese, and the domestic supplies of ore suitable for making this alloy were believed to be limited. Lack of definite information on this point, and lack of knowledge as to how to use such low-grade ores as were known to exist, were only two of the many factors that combined to make up the great total of America's unpreparedness for entering the war. Committees met and discussed the situation, bills were prepared, studied and reviewed, high prices were promised, and everyone was encouraged to hunt for and mine manganese ore.

What saved the situation, what brought about production, and gave the domestic industry knowledge of domestic manganese resources, was the smelting of lower-grade ores, with competitive bidding and the high prices actually paid.

TABLE I. DOMESTIC PRODUCTION OF MANGANESE ORE
(In Gross Tons)

State	Ore Containing 35% of Manganese or More		Ore Containing 10 to 35% of Manganese	
	Production Jan. 1 to June 30, 1918	U.S.G.S. Estimate of Production for 1918	Production Jan. 1 to June 30, 1918	U.S.G.S. Eatimate of Production for 1918
Alabama	53	600	85	630
Arizona:				
Bisbee district	7,169	13,200		....
Other districts	2,703	5,572	4,609	6,237
Arkansas:				
Batesville district	4,089	11,000	3,534	8,500
California	10,601	22,158	31	100
Colorado:				
Leadville district	.....	...	60,804	125,000
Other districts	67	150		
Georgia	1,963	5,850	5,151	10,520
Michigan	......	......	5,534	22,500
Minnesota:				
Cuyuna district	.....	.....	223,332	625,000
Montana:				
Butte district	28,986	78,500		.....
Phillipsburg district	58,312	133,700		
Other districts	40	500		
Nevada	12,586	26,870	40,327	85,030
New Jersey	......	100	....	......
New Mexico:				
Silver City district	120	250	6,978	21,050
Other districts	312	500	1,609	1,609
North Carolina	244	250	...	.....
Oregon	150	500		
South Carolina	100	250	850	850
South Dakota	31	31	...	50
Tennessee	840	3,600	959	2,350
Texas	207	800	....	......
Utah	3,701	6,305	....	......
Virginia	4,280	13,800	5,206	14,400
Totals	136,554	324,576	314,137	832,866

In the spring of 1918 manganese ore was commanding four to five times the price that it sold for in 1913, and grades were being accepted which could not have been marketed at any price five years earlier. With this incentive, American miners proved equal to the situation, and production of ore, such as it was, increased by leaps and bounds until the middle of October, when information came from Washington that production had reached such a stage that, should importation be entirely suspended, the country could probably fulfil all requirements through domestic supplies. There is reason to believe that there was no intention to create such a situation, as it would certainly have been undesirable. It is now known that the United States has manganese resources assuring the country independence of imports should the necessity arise. At the same time the industry has learned, if the fact was not previously generally known, that there are no manganese deposits in the United States comparable with those of Brazil and India in quality and quantity; that when war demands have ceased, and ample shipping is again available, manganese mining will return to much the same condition as in pre-war days; and that no amount of protection and Government fostering will ever enable American manganese producers to compete with foreign countries as miners of manganese ore.

PRODUCTION AND CONSUMPTION

Production statistics given in Table I are condensed from an estimate made by the U. S. Geological Survey. The compilation shows the production of manganese ore in the United States for the year 1918 to have been over 1,150,000 gross tons, containing 10% or more of manganese.

Importations of manganese ores are given in Table II. During the first half of 1918, the principal countries exporting manganese ores to the United States were Brazil, Cuba, and India. Manganese-ore importations in 1918 were about 100,000 tons less than in 1917, but the domestic production was the highest on record. The supply of ore, although often threatened by restriction of imports, was never low. Prospecting was active, and new sources of low-grade ore and the development of new mines were reported almost without limit.

TABLE II. IMPORTS OF MANGANESE ORES INTO THE UNITED STATES, BY COUNTRIES

Countries	Fiscal Year Ending June 30, 1918 (*a*)		Jan. to June, 1918 (*b*)
	Tons	Value	Tons
England	2,234	$382,515	......
Scotland	5	1,217	......
Canada	832	32,928	......
Costa Rica	6,017	184,575	...
Panama	3,676	129,000	....
Mexico	1,114	32,605	
Cuba	67,780	1,479,314	41,984
Argentina	6,600	40,023	.....
Brazil	427,267	9,090,380	171,895
Chile	2,804	44,838	......
China	20	438	
British India	37,150	442,557	22,150
Japan	2,419	79,645	......
Australia	96	4,300	......
British South Africa	4	180	....
Other countries	..	....	8,827
Totals	558,018	$11,944,515	244,836

(*a*) Prepared by Division of Statistics, Bureau of Foreign and Domestic Commerce, Department of Commerce. (*b*) U. S. Geological Survey.

Perhaps the most notable item in the table of United States production is the position of Montana, which state produced nearly ten times as much high-grade ore as any other state in the Union and more than a third of all produced in the States. Though the Phillipsburg district stands first, as it did in 1917, Butte stands second, and it occupies this position because of the versatility and enterprise of the Anaconda Copper Mining Company.

The presence of the carbonate and silicate of manganese in the Butte silver veins had long been recognized, but the ores had been used only as a flux in furnace operations. Early in 1918 the War Industries Board appealed to Mr. Ryan to stimulate the production of ferromanganese in this country. The outcome of this appeal was that the technical staff developed and put into practice an electro-thermic process that is a commercial success, producing approximately 100 tons of ferromanganese per day, and of a grade so high that it caused the Washington non-metallurgical authorities no little trouble to see that it was disposed of properly. In fact none of this ferromanganese was marketed.

Nevada occupies second place in the production of high-grade ores, notable quantities having been shipped from the Los Vegas field, from Ely, and from near Golconda.

California has been a fair producer, about thirty operations contributing to the output, but this state labors under the disadvantage of small deposits, widely scattered, and often far from transportation. Fortunately, the power situation in California is such as to encourage smelting by electro-thermic processes, and little of the ore left the state until in the form of ferromanganese.

Virginia, once the premier manganese producing state of the Union, now occupies third place, followed closely by Arizona, which has never before been regarded as an important source of this ore. Arkansas, Utah, Georgia, and Tennessee all contributed important tonnages. Indeed, manganese deposits of workable size have been recognized in nearly every state of the Union, and under a continued stimulus of high prices it is possible that several other states than those mentioned would become important sources of the ore.

Among the producers of low-grade ore, Minnesota stands first, with the production from the Cuyuna Range, and Nevada, Colorado, and New Jersey all produce large quantities of ore suitable for the manufacture of spiegeleisen. Other states are producing in the thousands of tons and are capable of producing much more if the demand for spiegel warrants development and exploitation.

There was considerable experimental investigation of methods for the dressing of low-grade ores by the U. S. Bureau of Mines, but a complete report of the results obtained is yet to be published. Much low-grade ore is now being concentrated to remove silica and other impurities, notably at Phillipsburg, Montana.

About mid-year, the War Industries Board approved a scale of prices for manganese ore, viz: $0.86 to $1.30 per unit of metallic Mn, long ton, f.o.b. cars, South Chicago, Ill., for ores from 35 to 54% and over, respectively, with certain restrictions; standard 48%. The high prices had the effect of greatly stimulating domestic production, and about July 30 the offerings so increased in volume that the market became depressed. Low-grade ore could not be sold, although the high-grade found a ready market at the fixed prices.

The close of 1918 was marked by a continued slump in manganese-ore prices. The market was clearly overstocked, and buyers refused to consider offerings at the established prices.

The Tungsten Industry in 1918

BY GEO. J. YOUNG

THE domestic production of tungsten ores for 1917 is given by *The Mineral Industry* as 5313 tons 60% WO_3; imports for 1917 were 4880 tons; total supply, 10,193 tons. The returns for domestic production in 1918 are too incomplete for any statement, although J. H. Mackenzie estimated the production would be between 4000 and 4500 tons 60% WO_3. The imports for the first semester of 1918 totaled 3487 tons, of a value of $3,558,636. They are given in the accompanying table. Estimated domestic production and imports total 11,500 tons. J. H. Mackenzie gave an estimate of the stocks of tungsten ore, ferrotungsten, tungsten steel, and warehouse stocks of 3878 tons as of May 1, 1918. The estimated tungsten consumption for 1918 is given as equivalent to 11,000 tons 60% WO_3. Under war conditions, the estimated consumption of tungsten in 1919 was expected to be 15,000 tons. Thus tungsten production and available stocks, plus imports, considerably exceeded the 1918 requirements.

Under the stimulus of war necessities there was great activity in the industry in the United States, as well as in other countries, in 1918. The signing of the armistice found large accumulations of stocks of both tungsten concentrates and ferrotungsten, on hand, the effect of which circumstance was to produce a chaotic condition among producers of tungsten ores and manufacturers of tungsten products. Prices fell, the market reflecting the uncertainties which attended inevitable readjustment to a peace basis. The maintenance of a lower price by Great Britain caused export ores, wherever permitted by licensing regulations, to seek the high-price market of the United States. The result was a superabundance of tungsten ore imports in the United States, which caused the condition described by Charles Hardy in his report on the tungsten market, elsewhere in this issue. Before the Committee on Mines and Mining of the U. S. Senate, W. R. Ingalls, on May 10, 1918, made the following statement about tungsten:

> The supply of this metal is probably rather superfluous, production having been greatly stimulated in 1915-16, when the price rose as high as $100 per unit, but before the end of 1916 excess of supply had reduced the market to $16. At present the price is about $20. The supply both from domestic and foreign sources increased from about 1300 tons in 1914 to about 10,000 tons in 1916. The behavior of this market has not indicated that there is any need for encouraging production beyond what natural factors will effect.

The market conditions in the latter part of 1918 amply bore out the foregoing statement that natural factors were the only requirements for stimulating production. At present the market is dormant and the industry in a similar condition.

During 1918 there were three important meetings to consider the tungsten situation. The first was held by representatives of the U. S. Tariff Commission on July 17, in Denver. Colorado producers were present. The result of the hearing was to show that the costs of tungsten production in Colorado were high, and the producers advocated a tariff that would raise the price of domestic tungsten ore to $30@40 per unit on the basis of 60% WO_3 concentrate. The second meeting was held in San Francisco on June 28, and was also before representatives of the U. S. Tariff Commission.

Producers of California and Nevada attended, and advocated stabilizing the tungsten market by a tariff at from $25@40 per unit on the basis of 60% WO_3 concentrate. The third meeting was held in New York on Nov. 25, at which producers, importers, and smelters of tungsten ores discussed conditions generally.

The difficulties attendant upon tungsten mining are those that naturally arise from location, the spotted character of the deposits, the uncertainty of persistence to moderate depths, the relatively high cost of installation, the short life of the deposits, and the marketing of the ores. Small producers are under the necessity of marketing small lots of ores, and as a consequence receive lower prices than the larger producers who market carload lots. Lack of a stable market is the universal complaint of the small producer.

During 1918 there were no revolutionary changes in dressing practice. Closer work of the mills, a greater elimination of impurities, and higher grade of concentrates were features.

It is unfortunate that the buying of tungsten ores in accordance with definite grades and specifications has not been standardized. Changing specifications and uncertainty respecting the marketability of tungsten ores and concentrates have made it difficult for some producers to satisfy themselves that they have received a fair price for their product. Prices are made on the basis of per unit of tungstic acid on the short ton. Scheelite and wolframite are recognized as two important types, although there is little distinction in price of either type where the accompanying impurities do not exceed the following amounts: Sulphur, not over 0.1%; copper, not over 0.02%; tin, not over 0.02%; phosphorus, not over 0.02%. Ores of this type are termed pure or high-grade ores, and where they exceed 60 to 65% WO_3 or over they command the highest prices. The scheelite concentrate and ore of the Atolia mine are in a separate class, and also command a high price. All other ores, whether scheelite, wolframite, or otherwise, are classed as impure ores, and are sold at various prices, depending on the amount and kind of impurity as well as upon the facilities of the buyer for the treatment of the different kinds of ore.

That the limits given are not universally recognized is shown by Charles Hardy's classification, which places the maximum percentage of impurity for high-grade ore and concentrate at tin, 0.05%; copper, 0.05%; and phosphorus, 0.04%. All ores and concentrates exceeding these amounts of impurity are called off-grade ores. Other firms have specifications which make no use of the terms high-grade, off-grade, or impure, but merely specify the lower limit of tungstic acid and the upper limit of certain impurities. The highest-grade wolframite marketed contains 70% tungstic acid, traces of tin and copper, and manganese under 1%. Tungstic acid content ranges from 10 to 72%, although there is recognized, to some extent at least, a base grade containing 65% tungstic acid. In some cases a 60% grade is named. There is no recognized deduction or addition in price for a variation in tungstic acid content in either direction from the base grade. Ores with impurities may contain the following range: Sulphur, up to 3 or 4%; tin, up to 10%; copper, up to 3%; phosphorus, up to 0.3%. Certain foreign ores even exceed these percentages, as the tungstic acid content may reach 45%, copper 6%, and tin, 19%. Some buyers handle only scheelite, others wolframite, and still others both types. There is need for a clean-cut classification.

COLORADO

The tungsten production of Colorado in 1918 is estimated at 1500 tons of 60% WO_3 content, as against 2200 tons in 1917. Boulder County produced about 90% of this, the remainder coming from Gilpin County, with small percentages from Lake, Park, San Juan, Eagle, and Chaffee counties. The crude ores, as mined, range from 0.7 to 20% WO_3. Some mills treat only high-grade ores; others ores better than 12% WO_3, but most of the plants are operating on low-grade ores of variable quality.

Some of the active producing companies are the Wolf Tongue Mining Co., at Nederland; the Vasco Mining Co., at Tungsten; the Primos Chemical Co., at Lakewood; the Rare Metals Co., at Rollinsville; the Black Metal Production Co., at Boulder; the Tungsten Products Co., in Boulder Canyon; and the Red Sign Mill, at Ferberite.

Many conditions have operated to retard production, the most important of which was the lack of a stable market and competition with imported ores. The cost of tungsten ore production in Colorado ranges from $15 to $33 per unit. With few exceptions, mills have been running below their capacities. This is thought by some operators to be due to the pinching out of the veins in depth. However, some mines report improvement at depth. Falling off in production is ascribed by others as attributable to hard conditions in leases and settlements imposed by large operators and buyers.

Milling has reached a high state of development. No success has attended the attempts to use flotation. Some new properties were opened in 1918, but the operations have not been profitable. Other discoveries have been made but not opened up. Tungsten mining on new properties is at a standstill.

CALIFORNIA

The tungsten production of California for 1917 was, according to the report of the California State Mining Bureau, 2466 tons 60% WO_3 concentrates, of a total value of $3,079,013. The principal production was from San Bernardino County, which produced 1943 tons; Inyo and Nevada counties, 474 tons, and Kern County, 49 tons. The principal producer is the Atolia Mining Co. There was more or less activity at Bishop, Inyo County, at which place the Tungsten Mines Co. is operating. Though production figures for 1918 are not available, the production for the year will probably exceed that of 1917.

NEVADA

The principal activity centered at Tungsten, near Mill City, and at Toulon, 18 miles west of Lovelocks. In the latter part of 1918 two mills at these points were approaching completion, one of 100 tons and the other of 125 tons' daily capacity. The two companies erecting the mills are the Nevada Tungsten Co. and the Mill City Tungsten Co. In the vicinity of Sodaville there was some activity, and, late in 1918, two additional mills were reported about to be erected. New discoveries were reported in the vicinity of Rebel Creek, Humboldt County. Operators were reluctant to report outputs, and, as a consequence, the production of Nevada for the year cannot be given.

FOREIGN TUNGSTEN PRODUCERS

Reports of foreign tungsten production are unavailable for 1918, but fairly complete statistics are given by *The Mineral Industry* for 1917. According to these, Burma, Portugal, China, Australia and New Zealand, Argentina, Bolivia, Chile, Peru, and Japan each made production in excess of 1000 tons per annum. Mexico, England, Spain, Siam, the Federated Malay States, and Rhodesia made substantial production. The production of tungsten ores in Portugal was described by F. W. Foote and R. S. Ransom, Jr., in the *Journal* of July 13, 1918.

The world production in 1917 was about 20,000 tons, divided into somewhat over 5000 tons for the United States and 15,000 tons for all other countries. It is evident from these figures that there is much potential production, however scattered. The outstanding fact is that tungsten deposits, although relatively superficial and small in quantity, are numerous and occur in many localities. If the discoveries made in the last five years are any indication of the future, there is promise of sufficient number of new discoveries to maintain output. Necessarily, the small size of the deposits and the great distance that separates most of them from the few marketing centers will make toward high costs, and relatively high prices must rule if returns from the mining of tungsten are to be sufficiently attractive to keep up the interest of those engaged in the industry. The actual production being large, and the potential production susceptible of considerable increase, there is need for an increased consumption. Up to the present the greatest use for tungsten has been for the manufacture of high-speed steels. There is a growing tendency to employ tungsten steel in machine parts and miscellaneous small uses. If these uses can be extended and new ones discovered, there is promise of sufficient increased consumption to absorb any probable increase in production.

TUNGSTEN ORE IMPORTS FOR SIX MONTHS ENDED JUNE 30, 1918(a)

Country:	Tons	Value	Country:	Tons	Value
France	26	$3,400	Chile	612	$636,719
Portugal	24	17,760	Ecuador	5	9,797
Canada	11	36,000	Peru	1028	863,947
Costa Rica	16	19,081	China	615	608,633
Panama	21	23,109	Br. East Ind.	17	13,071
Mexico	178	154,514	Hongkong	213	193,422
Argentina	203	309,312	Japan	483	623,706
Bolivia	25	37,500	Siam	10	8,583
Total				3487	$3,558,636

(a) U. S. Department of Commerce.

Total imports for 10 months ended Oct. 31, 1918, were 7001 tons, valued at $7,536,875, as against 4373 tons, valued at $3,594,961, for the corresponding period of 1917.

Tungsten Ore Market

By CHARLES HARDY*

THE tungsten ore market started in 1918 with a considerable accumulation of off-grade ore in New York, and also a fair quantity of high-grade material, urgently needed by the trade, but not salable, because traffic conditions made the transfer of ores from New York to the mills exceedingly difficult. Prices ranged from $24.50 to $25 per unit for scheelite, as well as for wolframite, and they did not fluctuate during the year to any appreciable extent.

The congestion on the railroads operated in favor of the stocks in New York in January and February, and western ore traveled, at times, two and three months before it reached its destination; and buyers, running short of material, preferred to buy spot New York delivery, which, though delayed in delivery, reached the works quicker than material sent from California and Nevada. During February the American Iron and Steel Institute introduced a licensing system which covered the molybdenum, vanadium, manganese, chrome, and ferro alloys from abroad, and hence the importations of these minerals were under strict control. The March market was dull, but, during April, the business became much livelier, and though importations gradually increased, and amounted during the first two months to more than 1000 tons, considerable business was possible, and prices were fully maintained around $24 and $25 for wolframite and scheelite, respectively.

In May, China, which had accumulated a considerable amount of tungsten ore, started to compete actively for orders in this market, as Great Britain allowed exportations from Hong Kong, and the importation of this Chinese ore effected a great change on the American market for the rest of the year. It was not at first realized that the quantities from China might be large. The accumulation of 500 tons, which was spoken of, was assumed to be the accumulation of many months, as during 1917 the total exportation from China to this country amounted to less than 200 tons. The Chinese ore, although high in tungsten content, showed a large percentage of manganese, and, almost invariably, an appreciable percentage of tin. Tin, though it can be utilized abroad, is, to most of our users of tungsten ore, of the greatest detriment; and the importations from China soon reached such a point that the shipments could not be absorbed by the existing tungsten-ore reducers, and stocks began to accumulate.

AVERAGE MONTHLY PRICE OF TUNGSTEN ORE (a)

(In Dollars per Unit, WO_3)

	1917			1917	
	Wolframite	Scheelite		Wolframite	Scheelite
January	17.14	17.50	August	24.66	26.50
February	16.80	17.50	September	23.92	26.00
March	17.17	17.77	October	24.00	26.00
April	17.86	19.04	November	26.00	26.00
May	19.10	20.94	December	25.24	26.56
June	20.80	23.50			
July	23.44	25.68	Year	21.34	22.75

	1918			1918	
	Wolframite	Scheelite		Wolframite	Scheelite
January	24.75	26.00	August	24.50	25.05
February	24.50	26.00	September	24.50	25.35
March	24.00	24.55	October	25.00	26.00
April	24.00	24.50	November	(b)	(b)
May	24.00	24.13	December	(b)	(b)
June	24.00	24.00			
July	24.00	24.00	Year	24.325	24.958

(a) *Engineering and Mining Journal* quotations. (b) No market

---

*Ore broker, 50 Church St., New York.

High-grade tungsten ore continued to sell, right down to the signing of the armistice, at prices of $24 and $24.50 for wolframite, and $25 and $26 for scheelite, and off-grade ore, which could be used in only a few quarters, dropped in price and showed a margin of from $5 to $6 per unit below the price of high-grade ore.

During July and August, the United States Government was of the opinion that the war would last well into 1919. The available supply of tungsten ore in this country would, therefore, not be sufficient to meet the anticipated increased consumption, and the Government actually entered the market as a buyer, to obtain available stocks. In turn it induced the consumers to lay in stocks to cover their requirements for several months ahead. Purchases made at this time were all of high-grade material as a rule, and the stocks of off-grade tungsten became larger and larger. In addition, the Chinese production increased beyond all expectations. Though total shipments to this country, as heretofore stated, amounted to less than 200 tons in 1917, the receipts during the first six months of 1918 increased to about 400 tons monthly; and during the months of July, August, September, and October actually reached the figure of 1200 tons per month.

In view of the fact that the price for tungsten ore in the United States was higher than that quoted by any of the European buyers, the bulk of the Chinese shipments were directed to this country; and if at the moment of writing the tungsten situation is very obscure, it is entirely due to this unexpected influx of Chinese ore into the United States.

This can be better understood when it is considered that the total importations from all countries into the United States during 1917 amounted to only just over 4000 tons, and that the importations from China, a new source altogether, alone exceed this figure. The estimated consumption of tungsten ore during 1918 was 11,000 tons. I believe this figure is nearly correct and that this amount was fully consumed.

For 1919, the estimated consumption under war conditions was 15,000 tons. The Government, therefore, relying upon the usual production here and the normal importation, anticipated a rise of the market, and hence purchased heavily. When the war came suddenly to an end, the market prices were still at $24 to $25 for high-grade wolframite, and $25 to $26 for high-grade scheelite, practically showing the same values as existed at the beginning of the year. The only change that occurred was the difference in off-grade ore, which, instead of selling at $1 per unit under the high-grade price, sold at $6 per unit below. This big margin acted as an incentive to some of the works to buy this low-grade ore and mix it with high-grade ore, or actually to start to build additions to their plants for the treatment of Chinese and off-grade ore by the acid process. A margin of $6 per unit, or $360 per ton, is sufficient to warrant manipulation of ores to a considerable extent.

When the armistice was signed, Nov. 11, the business in tungsten ore came almost to a complete stop. Those who had contracts with the Government and others for ferrotungsten and tungsten steel found that a considerable number of orders were canceled; and, whereas new business for peace purposes was booked, this did not even counterbalance the full quantity canceled. Thus the operators find themselves with a small volume of business, and are exceedingly reluctant to commit themselves for new purchases of ores unless an equivalent amount of finished material is sold at the same time. In consequence of this condition, as well as the receipt of imports, ore stocks have materially increased.

It looks as if the tungsten industry will be hard hit through the readjustment of prices, and at the moment of writing the entire industry—that is, the producers in the West, the importers, the ferrotungsten maker and the steel maker—has combined and is laying its case before the authorities in Washington. What the trade wants is not compensation from the Government, but assistance to allow the war situation in the tungsten market to be liquidated in an orderly rather than in a panicky fashion. This article may be published before the result of the efforts in Washington is known, and, therefore, it is exceedingly difficult to make any forecast as to the prospects of a reopening of the market at an early date, or concerning the price which will govern the first sales.

Chrome Ore in 1918

BY F. F. SHARPLESS

THE condition of the chrome ore business, from the miner's point of view, in 1918, is well paraphrased by the familiar quotation "Off ag'in, on ag'in, gone ag'in," which, in a nutshell, describes what has happened to the producers' market within the last twelve-month period.

The accompanying table from *Mineral Resources*, 1917, read in conjunction with press reports widely circulated during the latter part of 1917 and the early part of 1918, partly accounts for the marked increase in the domestic production during 1918.

With a normal consumption during the pre-war years of 66,500 tons metallurgical, coincident with increased production of munitions, the United States began calling for additional supplies of ferrochrome alloys, which demanded, in their turn, additional supplies of high-grade chrome ore. There was no misrepresentation in the fact that a very large amount was needed for arms and armament, and for military supplies outside of these two items. For these purposes there was no substitute immediately available, and it was a fact, as shown by the table, that importations were growing less, owing to lack of transportation. Under these conditions it is not

AVAILABLE SUPPLIES OF CHROMITE, 1913-1917

Year	Domestic Production, Long Tons	Imports, Long Tons	Quantity Available, Long Tons
1913	255	65,180	65,435
1914	591	74,686	75.277
1915	3,281	76,455	79.736
1916	47,035	115,945	162.980
1917	43,725	72,063	115.788
1918	......	88,531(a)	......

(a) Imports for 10 months ended Oct. 31, 1918, by U. S. Department of Commerce.

surprising that users of the metal gave wide publicity to their requirements, and were supported by the Government in urging a maximum production at home by every one who knew where the ore existed. This production was urged both through appeals to patriotism and through rapidly rising prices.

The price of 40% chromite at the beginning of 1917 was about 37½c. per unit. By the end of the year it had advanced to 70c., and on June 1, 1918, it was quoted at $1.20 per unit. No limit was placed on the probable consumption, and the general impression was permitted to go forth that all possible production could be taken at this or better prices during 1918 and for such time as the war might continue.

The Pacific Coast responded quickly to these high prices, and by July 1 gave promise of supplying a large portion of the deficiency. With the cessation of hostilities the market for ore practically disappeared, and no reliable data are available as to the quantity and quality of ore that has been mined or could have been put upon the market had demand continued. One thing is certain: at the time demand ceased production had not attained its maximum.

War Resulted in Abnormal Markets

The mining of chrome ore in the United States must be regarded largely as a war measure and one that must sensibly diminish or return to the previous condition with the resumption of normal trade. No large bodies of ore, capable of being mined cheaply, have been discovered in the United States as a result of recent activity. On the other hand, reports from Brazil indicate the recent development in that country of several large bodies of high-grade ore, and a like condition also exists in Rhodesia, which was shipping 50,000 tons per annum before the war. Domestic producers of chrome ore cannot compete with these and other foreign sources without a tariff so high that it would simply mean that American steel manufacturers could not pay the requisite prices.

There were perhaps 350 producers or operators preparing to put chrome ore on the Pacific Coast market when the armistice was signed. Many of them have lost much or all that they have put into development, and are now asking the Government to let them get out without loss. Many of these operators deserve sympathy, but, under existing conditions, can scarcely expect special legislation.

Though the authorities in Washington admit that every effort was made to stimulate production to the maximum, and in this acknowledge, to a certain extent, moral responsibility toward the prospector and small producer, the operators must realize that Albert Burch and Samuel H. Dolbear, who gave special attention to this subject on behalf of the Government, fully warned them that the high prices would only continue during the war. And, further, what may be more to the point, these two officials gave some excellent advice upon the financial side of the development and equipment of chrome prospects, which, if it had been followed, would have resulted in so small a loss, regardless of the cessation of hostilities, that the losers could have readily charged this amount to their share in the cost of winning the war.

Molybdenum Ores in 1918

Previous to 1914, little was known of the properties of molybdenum alloys, and they had been used to only slight extent. With the coming of the war, and the increased use of tungsten, the price of that metal rose to a point that made the search for a substitute attractive. Molybdenum was known to possess some similar properties to tungsten, and search for deposits of its chief ore, molybdenite, was extended all over the world.

Molybdenite may be called a common mineral, as it is found in many places, but in few where it is sufficiently concentrated to form an ore of commercial importance. The development of molybdenite deposits has been retarded through the fact that manufacturers, unable to assure themselves of a constant supply at a reasonable cost, have hesitated to conduct costly experiments for the purpose of studying its properties and placing its alloys on the market, and, not knowing its properties and the extent to which it might be used, they have been unwilling to contract for any appreciable tonnage. On the other hand, miners with molybdenum prospects, being unable to get any bids for their product, have been slow to develop and prepare their properties for production; hence the dormant condition of the industry.

In the autumn of 1915 the British government fixed a price of $1.09 per lb. of MoS_2 contained in 85% concentrates, at Ottawa, the price varying up and down with the percentage of MoS_2. At the same time there was a small nominal market in the States for the sulphide, at about double this price. The assurance of a market for all that could be produced in Canada stimulated search for the metal, even at the lower price, and resulted in the opening of a large number of small deposits in Quebec and Ontario. In 1917, with definite information that the metal was being used by the ordnance departments of the French and British governments, and with a small demand at $2 per unit in the States, prospecting and development became more active on this side of the line, culminating in the opening of large deposits at Climax, Summit County, Colorado.

At Climax the molybdenite is rather uniformly disseminated through a silicified zone of alaskite-granite, variously estimated to contain an average of 0.6% to 1% MoS_2. After the expenditure of nearly $600,000 in development and the construction of a mining and milling plant, the American Metal Co., owner of the largest developed deposit at Climax, is now milling about 250 tons per day, with the recovery of about 11 lb. of MoS_2 per ton of ore treated. The concentrates contain 65% or more of molybdenite. The Molybdenum Products Co., working at the same place, has not made public information respecting its operations. It is reported that this property is now more or less under the control of the American Metal Company.

With the cessation of hostilities it is probable that those who have been studying the properties of the metal and its alloys, particularly in the manufacture of ordnance supplies, will make public information which they have felt should be kept as secret as possible. We know that it has been used in the manufacture of guns, gun carriages, motors, and automobiles. It is used in the place of tungsten for certain heavy cutting tools. Molybdenum is also used in the form of an alloy with chromium, cobalt, and tungsten in the manufacture of high-grade small tools for surgery and dental purposes. This alloy retains an edge equal to the best steel, does not rust, and is not attacked by acid or alkaline antiseptic solutions.

The future of molybdenite mining is extremely uncertain, depending almost entirely upon the development of uses for the metal in the manufacture of alloys. If it is found that it can be used to considerable extent with advantage, the metal can be produced. The outlook for the small deposits of high-grade ore, workable when the sulphide sold for $1 to $2 per lb., is not promising. From the large deposits of Colorado the sulphide can probably be produced at a cost of less than 50c. per lb., and the available tonnage of this locality exceeds any probable demand for some years to come.

The concentration of molybdenite has been one of the most difficult problems in ore dressing, mainly because of the peculiarities of MoS_2, and subordinately because of the high-grade concentrates demanded by the ferromolybdenum makers. Considerable progress, nevertheless, has been made in milling practice. The mill of the Climax Molybdenum Co. at Climax, Colo., is designed to have a maximum capacity of 400 tons per 24 hours. It contains two ball mills, Callow and Janney flotation machines, Goldfield agitating tanks, a drum filter and a steam driver. The crusher plant is situated near the mine outlet.

Molybdenum Ore Market

By Charles Hardy[*]

To those interested in the production of molybdenite, 1918 was a most unsatisfactory year. The market started strong during the early days of January, with a price quoted at $2.25 to $2.30 per lb. for the 90% molybdenite concentrate.

During the months of January and February a fairly large business was done, and the quantities that were available in warehouses at the beginning of the year were fully absorbed by the end of February. A considerable amount of the ferromolybdenum sold in this country was for account of European buyers, and a large amount of ferromolybdenum found its way to Russia. With the collapse of Russia as a belligerent, and therefore as a buyer of war material, the orders placed either by Russia directly or through English and French sources were stopped or canceled, and the molybdenum which was thus released absolutely swamped the market. A little molybdenum went into the motor industry, but not enough to absorb the molybdenite which was offered, and though molybdenite was placed on the restricted list, and all further imports were forbidden, the quantities available in this country, either at the mine or in warehouses in New York or Pittsburgh, remained unsalable. Most of the mines producing molybdenite shut down, and only the largest producers have kept in operation.

During the latter part of 1918, I understand that molybdenite was more favored by some of the steel plants and a little business was done, which kept the larger producers going, but left the stocks of molybdenite in Pittsburgh and New York, and the accumulated material at the mines, untouched. Only at the end of 1918 was the bulk of molybdenite in Pittsburgh and New York taken up by buyers, but to ship this material it was necessary to reduce the price to 85c., or practically to 40% of the price which ruled at the beginning of the year.

AVERAGE MONTHLY PRICES OF MOLYBDENITE (*a*)

(In Dollars per Pound in Concentrates Assaying 90%)

	1917		1917
January	1.81	July	2.16
February	1.80	August	2.14
March	1.90	September	2.18
April	2.10	October	2.20
May	2.95	November	2.20
June	2.15	December	2.27
Year			2.16
	1918		1918
January	2.233	July	1.134
February	2.150	August	1.000 (*b*)
March	1.901	September	1.106
April	1.800 (*b*)	October	1.000 (*c*)
May	1.250 (*b*)	November	0.875 (*d*)
June	1.250 (*b*)	December	0.850 (*d*)

(*a*) *Engineering and Mining Journal* quotations.

(*b*) Nominal. (*c*) Estimated—no market. (*d*) No regular market. A few sales reported at 87½ @ 85c.

The future of the molybdenite market is by no means assured. The production of the world, which amounted to less than 250 tons in 1915, has now been quadrupled and quintupled; yet the use of molybdenum in place of tungsten in tool steel and high speed steel has not been found entirely practicable. Its main uses during 1918 were for gun linings, armor plates, projectiles, and to a limited amount in the motor industry. Whether sufficient peace purposes will be found to keep molybdenite even at its present price remains to be seen.

Ferro-Alloys in 1918

BY ROBERT J. ANDERSON[†]

THE developments of 1918 centered the world's ferro-alloy industry in the United States, and this country now leads in the production of all kinds of ferro-alloys. The need of the special steels for numerous industrial and military purposes is so vital that the ferro-alloys entering into their manufacture must be esteemed a valuable aid in the successful prosecution of the war. Although the armistice has been signed, and peace will, in due course, be a matter of fact rather than of fancy, it is not to be expected that prewar conditions in the ferro-alloy industry will be attained in any brief period of time. Both future prices and demand are somewhat in doubt at the moment of writing, but the expected large domestic steel requirements should reflect favorably to the ferro-alloy producers.

Although the stimulation brought to the industry by the war was an incentive to enlarged development, the progress made lately would have been impossible without the electric furnace, as the production of the various ferro-alloys, with the exception of ferromanganese, is not possible on a large scale without the electric furnace. Railroad congestion in the early months of 1918 prevented shipments, with the result that all alloys for prompt delivery were scarce then, and the markets were firm. The sudden termination of the war was reflected marketwise at the close of the year.

---

[*] Ore broker, 50 Church Street, New York.

[†] Research metallurgist, Bureau of Aircraft Production, Detroit, Michigan.

Technical advances in metallurgical processes were noteworthy in one or two instances. In the literature, Robert M. Keeney's paper[1] before the American Institute of Mining Engineers, at Denver, was an excellent contribution. In short, it is no exaggeration to say that the year just brought to a close bordered on the marvelous when all aspects are considered broadly.

FERROMANGANESE

Ferromanganese imports in 1918 dropped about 10,000 tons from the 1917 figure, but both production and exports were larger than in the preceding year. There was at times anxiety as to supplies of 70-80% alloy, but this had no foundation. As a matter of fact, the available supply in March was about 331,000 tons, or more than enough to make 44,000,000 tons of steel. A departure in standards for the commercial iron-manganese alloys was witnessed: The 80% alloy was lowered to 70%, and 16-18% was adopted for spiegeleisen. Though the change in standards met general acceptance by the trade, a virtual increase of $40 a ton resulted for ferromanganese, and a differential of $4 was adopted for ferromanganese over 70 per cent.

An interesting metallurgical development is the use of the electric furnace for ferromanganese manufacture. Whether this alloy will be made in large tonnages in the electric furnace when normal conditions return, is in doubt; however, this constitutes one of the most important advances which have occurred. As 1918 closes, about 15% of the total ferromanganese made in the United States is the product of the electric furnace. The Anaconda Copper Mining Co. produced electric-furnace ferromanganese late in 1918, and the estimated output is 30,000 tons a year when in complete operation[2]. Domestic ferromanganese sold at $250 a ton in 1918. Spiegeleisen was quoted at $70@75. English ferromanganese sold at $325.

FERROSILICON

The present domestic capacity for production of 50% ferrosilicon is around 100,000 tons a year, or an expansion of 100% since the war started. Prior to the war, and even up to 1916, there was only one large producer in this country, viz. the Electro Metallurgical Co., Niagara Falls, N. Y. There are now four new large producers and several small ones. The United States Steel Corporation, in 1918, began the manufacture of 75% ferrosilicon, at the Duquesne plant of the Carnegie Steel Co., Pittsburgh, Penn. The output is to be absorbed by the corporation in the manufacture of high-silicon steel for electrical purposes. Insufficient market supply of the 75% alloy is given as the principal reason for the installation. Ferrosilicon had not been made heretofore by this company.

For the large demand for ferrosilicon, the greatly augmented output of shell steel is responsible to considerable extent. Shell steel requires a higher than usual silicon content. New and interesting uses have been found for ferrosilicon. For example, the 80-90% grade has been used in Canada in the preparation of hydrogen for military balloons, the alloy being used to decompose caustic soda or steam, the reaction giving hydrogen. Another important advance in the ferro-alloy industry has been the electric-furnace manufacture of low-grade 10-15% ferrosilicon. This is a departure, and the product has been in strong demand as a substitute for regular bessemer ferrosilicon. The latter commanded high prices in 1918, viz. $54 to $61.60 for from 9 to 12% grades, respectively, and the electric-furnace product was readily disposed of. Practically all the larger users of 50% ferrosilicon were covered on contract for all of 1918, and at lower prices, in general, than were paid in 1917. Although ferrosilicon is normally produced where electric power is cheap, under the conditions engendered by the war the alloy has been made profitably even where electric power is costly, as, for example, at Baltimore, Md., and at Anniston, Ala. New plant additions were made both in the United States and Canada. Raw materials were readily available. The 50% grade sold at $160@175, delivered, Pittsburgh, in the early part of 1918, and the price was maintained around $180@190 during the remainder. Contract prices varied, $100@175.

FERROCHROMIUM

In 1918, most of the ferrochromium used in the steel industry went into chromium-nickel and chromium-vanadium steels, either directly or indirectly, to satisfy Government requirements; and, in reality, all chromium was specifically conserved for Government purposes. Both the ferrochromium and chrome-ore situations were well in hand at all times, but the steel makers were behind on production of chromium-containing steels. Despite labor and transportation difficulties in the first half of the year, the domestic output of chrome ores was the highest on record. Much ore came in from Rhodesia and New Caledonia, notwithstanding the scarcity of ships, and Canada and Mexico shipped some ore by rail. In the United States, Oregon and California were the principal producers. Washington and North Carolina entered the list of producing states, and Alaska made some shipments. In Asia, the Turks continued to hinder the development of the enormous deposits of high-grade ore near Broussa, and these important deposits have not figured in the markets.

FERROTUNGSTEN

A commanding lead is now held by the United States not only in the production but also in the consumption of ferrotungsten. In 1914, Germany was the leader, but its supremacy has passed, doubtless never to return. The greatly increased demand for high-speed tool steel for machining shells stimulated the production of both ore and alloy. The world's largest producing district for scheelite is the Atolia district in the Mojave desert; the other large ore district in the United States is that in Boulder County, Colo., and mines in Arizona are also important. The extent and persistency of the deposits in California and Colorado have been thoroughly demonstrated, and the output of ores from these states largely supports the domestic ferrotungsten industry. Portugal is still the chief European producer, and though Burma's output is large, no figures are available to permit comparison with the United States. Fair progress in mining and milling has been made lately in Australia, and the milling of tungsten ores in the Colorado district, on ores not containing non-metallic impurities, has attained the highest development reached anywhere. No success has yet been attained in tapping high-grade ferrotungsten direct from the furnace. Ferrotungsten sold at \$2.25@2.40 per lb. of contained W throughout all of 1918.

---

[1] Bull. A. I. M. E. No. 140, p. 1321.

[2] Although a metallurgical success, the high-grade ferromanganese produced at Butte did not fulfill the requirements of the War Industries Board, in consequence of which none of the product has been sold, and the plant is idle.

FERROMOLYBDENUM

Prior to 1914, less than ten tons of ferromolybdenum was made per year in the United States. In 1918, several hundred tons was produced, mainly for export. The alloy has not been used much by domestic steel makers, because of a presumed scarcity of ore and also because of prejudice. As a matter of fact, there has never been a scarcity of ore deposits, but there was no reason for developing existing deposits and attempting to market a product for which no demand was apparent. The use of molybdenum in steel is comparatively recent, and it is also so intimately connected with military matters, both overseas and here, that little can be made public.

Though the increased demand for molybdenum since the start of the war created an unusual interest in the metal, it has not been used much in the United States. The ferro-alloy has been used principally by European governments for additions to steel for military purposes —for steel for trench helmets, gun linings, and armor-piercing projectiles. The standard grade of ferromolybdenum is not well established. Alloys are offered with 50 to 80% Mo and 1 to 3% C. Ferromolybdenum sold at \$5 per lb. of contained Mo from January to August, 1918; dropped to \$4@4.50, and closed at \$3.50@4.50.

FERROVANADIUM

The pioneer work in vanadium metallurgy was done in the United States, and this country is today the largest producer of ferrovanadium in the world. Ferrovanadium exports were the largest on record, and the alloy was in heavy demand for both domestic use and foreign shipment. The most important sources of ore are, as previously, the Peruvian patronite deposits and the carnotite and roscoelite deposits in Colorado and Utah. The entire Peruvian output goes to the United States for reduction. The market on ores in 1918 was poorly defined. About 75% of the ferrovanadium produced in the United States is made in the openhearth or crucible furnace by a modification of the thermit process, but the use of the electric furnace for its manufacture has increased lately. The electric-furnace ferrovanadium is made with 90% silicon as the reducing agent. Prices for the alloy in 1918 varied from \$3.50 to \$5, f.o.b. works.

FERROTITANIUM

In ferrotitanium, the standing of this country is preeminent. The principal producers are the Titanium Alloys Manufacturing Co., Niagara Falls, N. Y., and the Metal and Thermit Corporation, New York, N. Y. Both kinds of alloy continue to be extensively employed in the steel industry as deoxidizers, particularly for rail and sheet steel, but their use has extended to all kinds of plain steel made. There is an abundance of ore, both rutile and titaniferous-iron ore. The largest deposits of the former are in the Roseland district, Nelson County, Va., and the largest domestic deposits or titaniferous-iron ores are at Lake Sanford, N. Y., and at Iron Mountain, Wyo. Ferrocarbon titanium sold at \$160 per ton, f.o.b. Niagara Falls, N. Y., for the 15-18% grade, carloads, in the first quarter of 1918; round advances to \$200 went into effect in April, and the closing price was \$200@250, depending on the size of purchase. Ferrotitanium was higher in price.

FERRO-URANIUM

Originally, ferro-uranium was developed for the purpose of utilizing the large amounts of sodium uranate, $Na_2U_2O_7$, which accumulated as a byproduct of radium manufacture, and not because of any particular demand. The alloy is made from sodium uranate and from uranium oxide, U_3O_8, in the electric furnace. The claim has been made that 0.5% U will replace several per cent. W in tool steel, and consequently the price of ferrouranium is high. So much contradictory information is current, that it has been difficult to ascertain the facts to date. However, the alloy is finding further use in the steel industry for making ternary-uranium and quaternary-uranium-tungsten steels. The high price has acted as a deterrent to wider experimentation. Uranium oxide brought \$3.25@3.60 per lb. in 1918, and uranium ore (carnotite) sold at \$3 per lb. of U_3O_8 contained, for 2% minimum. Ferro-uranium was quoted at \$7@7.50 per lb. of contained uranium.

FERROZIRCONIUM

The possibility that zirconium may assume an important position as an additive element to steel has become fairly well recognized. The most important industrial ores of zirconium continue to come from Brazil from the deposits in the states of Minas Geraes and Sao Paulo. No production of zirconium ore has been reported in the United States for several years, although some formerly came from North Carolina. The Brazilian mining is very crude. Metallurgical ore sold at \$100 to \$140 for 80% ZrO_2, minimum. Ferrozirconium is made by the reduction of zirconia with aluminum by the thermit process, and is produced so as to contain upward of 3% Zr. In England, a 20% ferrozirconium has been used to a subordinate extent in place of ferrotitanium in scavenging steel. The zirconium-bearing steels are reported to be adapted for bullet-proof sheets, armor plate, and armor-piercing projectiles. Both ferrozirconium and ferrochromium zirconium were made in small lots in the United States in 1918.

MINOR FERRO-ALLOYS

Ferro-aluminum is not now being made, as it has been replaced by impure aluminum ingot in practically all steel works. Its electric-furnace production is a possibility, however, as a 50% ferro-aluminum might be made from ferruginous bauxite. The iron-bearing bauxites constitute an almost inexhaustible source for the manufacture of such an alloy. Ferroboron has not yet been manufactured on a commercial scale, but small quantities have been made, for experimental purposes, in the electric furnace. An enlargement of the domestic ferrophosphorus output is in prospect in the South in connection with the phosphate industry. In pyrophoric alloys, viz. ferrocerium, the New Process Metals Co. has vigorously developed the business in the last two years. Production is now several thousand pounds a month, and the domestic output supplies all the sparking alloy for use in igniters for mine lamps, lanterns, automatic cigar lighters, and other uses. This alloy has also found considerable application in hand grenades and in projectiles. Ferrocerium sold at from $15 to $30 per lb. in 1918. No noteworthy developments occurred in the complex ferro-alloys.

Metallurgy of Quicksilver

By Murray Innes*

The most interesting development in the metallurgy of quicksilver during the year 1918 was the pronounced success of the rotary furnace of the cement kiln type, as introduced at the New Idria mine by H. W. Gould. The first furnace of this type was installed early in the year, and has been in operation about nine months, during which time I am informed it has produced upward of 1500 flasks of quicksilver. Two others have recently been put in operation, and two more are in course of construction. This type of furnace has also been adopted at the Cloverdale and the Rutherford mine, which latter property is also under the Idria management, and there is no apparent reason why it should not be a metallurgical success at these properties.

During 1918 the U. S. Bureau of Mines, under the able direction in California of Dr. L. H. Dushack, continued research work in connection with the metallurgy of quicksilver, and will doubtless publish in the near future a résumé of its operations and conclusions, which should be of great interest to quicksilver operators.

For condensation purposes, Dr. Dushack is inclined to favor, I believe, a more extensive use of tile pipe to replace largely the brick and wooden condensers heretofore in use in connection with the Scott furnace, and I am inclined to believe that this is a decided advance, both in the matter of first cost and in simplicity of operation.

In comparing the cement kiln type of rotary furnace with the Scott type of shelf furnace, one has to consider both the installation and the operating costs, and I think that, with the exception of large mines like the New Idria, where dependable power and skilled labor are readily available, the Scott type of furnace is the most desirable.

In the matter of first cost one must separately consider the furnace and the condenser system, and if the furnace alone is considered there seems little choice under present conditions. In the matter of operating costs, the Scott furnace seems to have an advantage, for the reason that no skilled labor and no power are required, and also because it may be operated with either wood or oil fuel, whereas the rotary has not proved a success except with oil fuel, which is not always available in out-of-the-way places. Judging by results at the Chisos mine, in Texas, and at the Sulphur Bank, in Lake County, Calif., the rotary furnace has not proved satisfactory on ores containing large amount of sulphur nor on ores containing an excessive amount of fines.

The rotary furnace has an advantage in that it will handle wet or damp ores directly without the use of a drier, whereas the Scott furnace does not give perfect satisfaction except when a drier is used. This latter problem has been fairly well solved at the Oat Hill mine, where a small shelf drier containing about ten tons of ore has been superimposed upon a 40-ton Scott furnace, utilizing the waste heat from the burned ore. This drier has so far given perfect satisfaction, and seems to solve the problem at this property.

I am informed that the rotary plant of five furnaces at the New Idria mine has cost (including condensers, and other necessary equipment) about $200,000, and it is expected that it will soon replace not only the concentration plant but the coarse-ore furnaces as well. In a plant of this size, where the cost of skilled labor and dependable power may be distributed over a large tonnage, the installation will doubtless prove satisfactory and economical. On the other hand, the operating costs might be something of a burden at a small mine, as compared with the extreme simplicity of the old-fashioned Scott furnace.

The condensation problem seems to have been fairly well solved, and the research work by the Bureau of Mines has proved that the condensation losses in a carefully managed plant are small. The use of tile pipe condensers is in accord with the best European practice, and should considerably reduce the first cost of a condenser plant as compared with the old system of brick and wood condensers.

Arsenic in 1918

In the autumn of 1917 the arsenic situation was bad, owing to the cutting off of imports. The pre-war prices averaged 4c. per lb., but at the end of February, 1918, the prevailing price had risen to 15c. per lb., owing to the scarcity of the metal. Because 60% of the arsenic consumed in the United States is utilized in the manufacture of insecticides, the United States Food Administration called a meeting of the arsenic producers and agreed upon a price of 9c. as being large enough to yield a profit to the producers. This price fixing did not help the arsenic situation much, as contracts for the 1918 supply had already been made.

The annual consumption of the United States is equivalent to 12,000 short tons of arsenious oxide. The domestic production in 1917 was 6151 tons, and that of 1918 is estimated to be 20% greater. The principal domestic producers are the American Smelting and Refining Company's smeltery at Denver, Colo., and the Washoe Reduction Works at Anaconda, Mont., with 120 and 300 tons production, respectively, per month.

War demands increased the requirements for arsenic. Shipments were made to England and South America, whereas, previous to the war, England was supplied by her colonies and exported insecticides to South America.

The Anaconda Copper Mining Co., at a cost of $1,225,000, recently added new equipment in the form of additional stacks and flues and the installation of the Cottrell system for arsenic precipitation. The output of the company will in the near future equal the present entire annual demand of the United States.

---

*Mining engineer, 417 Kohl Bldg., San Francisco, California.

Metallurgy of Zinc

By W. R. INGALLS

IN REVIEWING the progress in a branch of metallurgy during a year just elapsed it is conventional to begin with the statement that there was nothing new. However, it is probable that that statement cannot be truly made for any branch of metallurgy in any year. In the metallurgy of zinc in 1918 there may not have been any striking revelations of new principles, but certainly there was a good deal of new thought, tending toward improvement in the art.

Roasting—There is perhaps no branch of the metallurgy of zinc in which there is more need for improvement than there is in means and methods for desulphurizing blende. The increase in supply of flotation slimes has simply aggravated old difficulties. Practice has settled down upon the Hegeler, Merton, Ridge, and Spirlet as the standard mechanical muffle furnaces, but among these only the Hegeler finds general application. Mr. Rissmann and his assistants have remodeled the Spirlet furnace, and find it satisfactory, but other American smelters who have tried it have not been so well pleased. Similarly, the Merton and Ridge furnaces have come into occasional use, especially in Great Britain, without as yet meeting with general approval elsewhere. The Wedge furnace has possibilities, but has not yet been tested adequately under conditions where dead-roasting is necessary. In places where hand-raked furnaces are still permissible, by virtue of labor conditions, the Delplace would probably be adopted in preference to any other.

Mr. Rissmann wrote me recently that he thought that entirely too little attention had been paid to the roasting of ore. He, and his aids, formerly entertained the conventional opinion that when the sulphur is low in the roasted ore there would be good results in the distillation. They have found in some cases, however, especially in the roasting of flotation slimes, that there are better results with 2.5% sulphur left in the ore, providing the roasting conditions were right, than there are with only 0.5% sulphur left in the ore when the roasting conditions were wrong, referring especially to too great excess of air. They find, moreover, that ore roasted without too much excess of air will sinter and become more porous and otherwise favorable for distilling than ore roasted with too great an excess of air. Bearing upon this subject is the remarkable experience in desulphurizing blende at Port Pirie that has been reported this year.

The Dwight & Lloyd sintering process has been applied by C. N. Warner and Gilbert Rigg with promising results for the desulphurization and sintering of zinc sulphide concentrates at the Port Pirie smeltery of the Broken Hill Associated Smelters, Proprietary, Ltd. It has been found practicable to reduce flotation concentrates from 26% sulphur down to less than 1½% sulphur at a very rapid rate. A portion of the gas, but not all, may be used for sulphuric acid manufacture. The desulphurization seems to be remarkably cheaper than in even the best types of roasting furnaces, and the first cost of plant is much smaller. Moreover, the sintered product gives astonishingly improved results in distillation, it having been found possible at Port Pirie to charge the retorts with 16.6% more ore with the use of 10% less of reduction material, while recovery of zinc increased 4.3% and there was slightly less loss of retorts. These figures were obtained by four months of operation with roasted and sintered blende, 50 tons per day being used, compared with the previous record of six months when the furnaces were distilling ore roasted in Hegeler kilns.

Distillation Furnaces—American zinc-smelting practice has settled down to two types of distilling furnaces, viz. the Hegeler and the Neureuther modification of the Siemens-Belgian. Only at Pueblo has the Rhenish type of furnace come into steady use in this country. This is the more interesting inasmuch as the Rhenish type of furnace is the favorite in Europe, and the new and modern metallurgy of zinc in Great Britain is trending strongly in its direction.

At Peru and Depew, Ill., the Siemens-Belgian furnaces use only 0.9 ton of heating coal per ton of ore charged into the retorts. At Rose Lake the ratio is about 1: 1. Between Rose Lake and Hillsboro, which are owned by the same company and are under the same metallurgical direction, we are able to get a good comparison of the Siemens and Hegeler furnaces. Rose Lake, with Siemens furnaces, uses about one ton of heating coal per ton of ore distilled and uses an additional half ton for the generation of power, a total of 1.5 tons per ton of ore. Hillsboro gets its power from waste-heat boilers, but its furnaces require about 48 tons of coal for distilling 18 to 20 tons of ore, or about 2.5 tons per ton of ore, wherefore Rose Lake is about a ton ahead of Hillsboro. Each plant uses about 0.5 ton of coal per ton of ore in roasting.

Mr. Ziesing has patented a modification of the Hegeler-Iola furnace in which the combustion gases pass longitudinally through the laboratory of the furnace. Between each section of retorts (4 x 5) he introduces a wing-wall extending outward nearly to the front of the furnace. The idea is to cause the burning gases to travel near the front of the furnace and eddy back in the several sections, with a view to securing a more uniform heating of the retorts. Mr. Ziesing tells me that he is building all of the Grasselli furnaces along these lines, and reports that "as in most cases of this kind, it is a difficult matter to state in absolute figures just what the advantages are." He feels, however, that he gets better results by reason of the fact that the fronts of the furnaces become hotter. The fact that the front half of the retort ordinarily, on account of the radiation, is colder than the rear half of the retort, is a matter that he has been trying to overcome for a long time, and by various means. He is also of the opinion that the furnace is more easily controlled as to uniformity of heat and that there is a slight saving in fuel consumption.

Distilling Practice—More and more attention is given to proper compounding of the charge, especially as to slag constituents. O. Mühlhaeuser, in *Metal u. Erz*, 1918, 15, pp. 303-305, says: "The amount of slag formed in the retorts during distillation should be small, and its composition should be controlled by mixing the charge in suitable proportions, so that it has as little action on the retort as possible. An average slag sample obtained by distilling a mixture of Joplin and Wisconsin ores was found to have an oxygen ratio of 1:2.8, approaching that of a trisilicate. It was very viscous at distillation temperatures and formed an internal coating, the thickest part of which was on the bottom of the retort. The latter was thus protected from corrosion, and the loss of zinc by escape vapor was decreased."

Behavior of Silver in Zinc Distillation—Butte & Superior ore assays 50.5 to 53.2% Zn, 2.4 to 4.7% Fe, 0.22 to 1% Mn, 2.4 to 3.6% Pb, 0.33 to 0.50% Cu, 11.6 to 14.1% insoluble, and 0.03 oz. Au and 14 to 18.5 oz. silver per ton (2000 lb.). One ton of spelter is obtained, roughly speaking, from 2.5 tons of ore containing 40 oz. silver. Of this spelter about 35% is derived from the first draw, 50% from the second, and 15% from the third. Spelter of the first draw assayed 0.164 oz. silver per ton and 1% Pb; of the second, 0.583 oz. silver and 1.5% Pb; of the third 1.178 oz. silver and 2.25% Pb. These analyses show that very little silver goes into the spelter. The first draw occurs 2.5 hours after charging and comprises the spelter distilled at the lowest temperature, wherefore the relatively low lead and silver contents. With the progressive increase of temperature, more lead and silver go over. The bulk of the silver remains in the residue. In a test extending a little over two years, figuring back to raw ore, the weight of the residue was 46.75% and its content of gold was 88.14%; of silver, 77.4%; of copper, 78.5%, and of lead, 47.75% of what was in the raw ore. The silver and lead figures for spelter and residue will not check back to the original ore, owing to losses in roasting. These data show that the loss of silver and gold in zinc distillation is very small.

Zinc Burning—The River Smelting and Refining Co. smelts partially desulphurized ore in reverberatory furnaces at Canyon City, Colo., the proper quantity of reducing material being added to the charge. By proper management it is said that slags low in zinc can be made. The volatilized fume is collected by bag filtration and is shipped to Keokuk, Iowa, for further treatment. At Keokuk the fume is dissolved in sulphuric acid and the solution of zinc sulphate is electrolyzed.

At Great Falls, on the other hand, Mr. Laist is reported to have given up the expulsion of zinc in his reverberatory smelting and is now volatilizing only the lead, letting the zinc go into the slag. The old principles of metallurgy obtain pretty well. If a highly siliceous and calcareous slag be made, zinc can be kept out of it to a large extent. Slag assays of 3% or even 2% zinc are not unreasonably to be expected. However, such slags require high temperature and may necessitate the introduction of barren slag-formers into the charge; wherefore it may be more profitable to make an ordinary ferruginous slag and let the zinc go into it.

Electrolytic Extraction—More and more is it evident that the greatest difficulties in the electrolytic process precede the electrolysis itself. Given the right kind of electrolyte, there is no great difficulty in performing the electrolysis; but it may be costly to remove impurities in the hydrometallurgical part of the process in order to obtain the right kind of electrolyte. Also, there may be difficulties in making an adequate extraction of zinc in leaching the ore. Mr. Laist ran up against the old difficulty from gelatinizing silica, and he has had to introduce a rather round-about method of dehydrating the silica and rendering it insoluble, which method is described in patents issued to him Oct. 8, 1918 (U. S., 1,281,031 and 1,281,032).

Metallurgy of Lead

BY H. O. HOFMAN*

EVERY lead refinery using the Parkes process for desilverizing lead bullion has Faber du Faur retort furnaces for distilling liquated zinc-silver crusts. The inventor, whose furnace came into use in 1870[1], died at Newark, N. J., Aug. 18, 1918, in his 92nd year[2]. He was born in Würtemberg, Germany, came to this country in 1850, served in the Civil War and was commissioned a captain. Later he engaged in engineering work. He was the first man to design a tilting furnace, which permitted pouring of metal without disturbance of the crucible. When his patents lapsed, the various distilling apparatus in use were replaced by what has become the standard furnace.

In the practice of smelting lead ore and refining lead bullion there were no radical changes in 1918, but improvements made in the general arrangement of plant and in the details of operation show that lead metallurgy is not stationary, even if the principal features have become largely standardized. This is brought out clearly in the new treatise on the "Metallurgy of Lead" by the present writer[3], especially when its content is compared with that of the preceding edition.

LEAD SMELTING PRACTICE

The "Report of the Smelter and Ore Investigation Committee, State of Colorado, 1917,"[4] prepared by O. R. Whitaker, deals in a thorough manner with a question that has been and is still a bone of contention between the ore producer and consumer. It analyzes the schedules in use in Colorado in the period of 1912 to 1916 and represents graphically the values of and the charges made for the different grades of ore, thus furnishing definite information of the actual state of affairs. The ores treated by the Colorado smelting works in this period averaged Au 0.526 and Ag 12.34 oz. per ton, Cu 0.61, and Pb 6.76%. To obtain a Pb-content of charge of 12%, outside lead ore had to be brought in. The lead slags made assayed 0.002 to 0.005 oz. Au and 0.50 to 1.0 oz. Ag per ton, 0.20 to 0.30% Cu, and 1.0 to 1.50% Pb. With blast-furnace charges containing from 8 to 10%

---

*Professor of metallurgy, Massachusetts Institute of Technology and Harvard University, Cambridge, Massachusetts.

[1] Ellers. *Trans. A. I. M. E.*, 1874-75, Vol. 3, p. 315.

[2] *Eng. and Min. Journ.*, Vol. 106, p. 368

[3] McGraw-Hill Book Co., New York, 1918.

[4] Denver, 1917; reprint in the *Metal Mining Journal*, Denver, Nos. 8 and 9, Dec., 1917, Jan., 1918; comment, *Eng. and Min. Journ.*, Vol. 105, pp. 539, 626.

Pb, the amount of slag made represented from 60 to 65% of the charge, or one ton of slag for each ton of ore. The matte fall was about 10%, the matte assaying Au 0.05 oz. and Ag 40.0 oz. per ton, Cu 10%, Pb 15, Zn 10, Fe 40%. The second or converting matte contained 40% Cu. The baghouse product assayed Pb 40 and Zn 10%. The losses in smelting were Au 0.005 oz., Ag 1 oz., Cu 6 lb. and Pb 30 lb. per ton of ore. In treating 3,140,018 tons of ore, a net profit of 95c. per ton was realized.

MODERN SILVER-LEAD SMELTERY

A comparison of the older smelteries, in which materials are handled mainly by manual labor, with a modern plant which employs machinery wherever it is feasible, brings out in a striking way the changes that have been made in the construction of lead plants. G. C. Riddell[5] has given the layout of a silver-lead smeltery which he considers meets all modern requirements. The plant is to treat daily from 1000 to 3000 tons charge and is to be erected on level ground which has a declivity on one side to serve as slag dump. Standard-gage tracks and a complete railroad circuit of the plant, with a loop-system for the charging of the blast furnaces, large storage capacities, automatic conveying and weighing, duplication of vital units in handling apparatus, and ample supply of electric power and water, are essential features.

The sampling mill, with a capacity of 50 tons of ore per hour, has a gyratory crusher, rolls, and Vezin samplers. The roasting division is provided with a Wedge furnace for pyritic material and a Dwight & Lloyd double roasting plant for leady ores. Three 42-in. machines are required for rough roasting and four machines of the same size for re-treating and sintering the rough-roasted material after it has been crushed. The smelting section has three blast furnaces, 52 by 180 in. at the tuyères, and a 25-ft. working height, provided with individual blowers supplying from 6500 to 8000 cu.ft. air per min. at a blast pressure of 60 to 70 oz. The proposed great height is borrowed from Australian practice. At the Cockle Creek plant, New South Wales, satisfactory work with ores running high in zinc was obtained only when the active height of the furnaces was increased to 25 ft. A furnace puts through, with 11.0 to 11.5% coke, 550 tons of charge per 100 sq.ft. hearth area in 24 hours, making slags with 12 to 13% ZnO and only 0.75 to 1.00% Pb. The furnaces have thimble tops, which consist of a central flue extending from the feed floor a short distance into the open top of the furnace for the withdrawal of gases, and being surrounded by the charge, which is fed from the side. The gases from the roasting and blast furnaces pass through dust flues and chambers and are freed from the remaining dust and fume by Cottrell treaters before they pass into the open. The treaters[6] are in four sections, each with 64 pipes, 12 in. in diameter. The gases pass downward through the pipes instead of upward, as is usually the case.

Working details of the new smeltery and refinery of the Bunker Hill & Sullivan Mining and Concentrating Co. have been given by C. T. Rice[7]. This plant[8] has made some important changes since it went into blast, on July 5, 1917. One of these is the use of pulverized coal for firing reverberatory furnaces, kettles, and retorts, besides heating a 150-hp. Geary boiler. The Bonnot system of pulverizing coal and separating the dust is in use. The pulverizers crush 20 tons of slack coal in an eight-hour shift; screen tests of the finished product show that 5% remains on a 100-mesh and 85% passes through a 220-mesh screen.

The roasting division was planned to have one Wedge roasting kiln, 21 ft. 6 in. in diameter, for pyritic ore, and four standard Dwight & Lloyd 42-in. sintering machines for leady ores. A rotating circular cast-iron cooling hearth, with stationary rabble-arm, has been added to the Wedge kiln, in order that the product may be air-cooled and sprayed before it is delivered to a traveling belt which carries the components of the blast-roasting charge. It was necessary to add three Dwight & Lloyd sintering machines to the existing four on account of the increase of blende in the charge. The pallets are provided with the self-cleaning grates such as are in use at Trail, British Columbia.

In this connection it may be stated that the clogging of the slots in the grate is governed largely by the care given to the making-up of the charge. Some smelteries have a grate cleaner for two machines; others have dispensed with grate cleaners entirely.

In the smelting division, one working blast furnace, 48 x 180 in. at tuyères and 14 ft. high, has been added. The blast is furnished by two Ingersoll-Rand turbo blowers, each having a capacity of 12,000 cu.ft. of free air per min. at a pressure of 48 oz. per sq.in. A furnace has two fore-hearths in series. The first is 6 ft. in diameter and 3.5 ft. deep; the second 5 ft. in diameter and 2.5 ft. deep. They are handled by the overhead crane. The waste-slag pots have a capacity of 130 cu.ft. The charge carries from 35 to 40% Pb, but only from 1 to 3% Zn. Slag analyses show SiO_2 32 to 33%, FeO 32, MnO 3, CaO 16, ZnO 2 to 4%, and Pb 1% (wet). The matte fall is 12%. A furnace puts through in 24 hours from 200 to 250 tons of charge and produces from 120 to 150 tons of dressed lead bullion.

The refinery, which uses the Parkes process, has been enlarged by two 80-ton softening furnaces, two 50-ton desilverizing kettles, one silver refining furnace, and a reverberatory furnace for the treatment of skimmings. The lead bullion from the blast furnaces is collected in two 50-ton drossing kettles, and the drossed bullion transferred by means of a Miller pump into the softeners. The mode of operating is the same as in other modern plants with the exception of the firing, in which coal dust is used, as noted above. The initial difficulties with the use of this fuel appear to have been overcome, but details are not now available.

The market lead is molded from four 50-ton merchant kettles with Miller casting machines. Four men with a machine cast and load into cars 20 tons of pig lead per hour in 100-lb. pigs. The market lead has the following composition: Pb 99.989, Sb 0.002, Cu 0.0005%, Zn trace, As none, Bi none, Ag 0.15 oz. per ton. The doré silver is parted with sulphuric acid, and the silver from the sulphate solution is precipitated in lead-lined tanks with copper strips. The cement silver is transferred in a car to and melted in a double Monarch furnace and poured from it into bars.

---

[5] *Eng. and Min. Journ.*, Vol. 106, p. 115.
[6] *Eng. and Min. Journ.*, Vol. 106, p. 120.
[7] *Eng. and Min. Journ.*, Vol. 106, pp. 91, 436, 649, 743, 771, 993.
[8] *Eng. and Min. Journ.*, Vol. 103, p. 50; Vol. 105, p. 93.

The smeltery at El Paso, Tex.[9], which started in the early 80's as a lead plant, has changed in the character of its work to such an extent that lead has become of secondary importance in comparison with copper. However, there are in operation five lead blast furnaces, 46 x 162 in. in section, with a charge height of 19 ft., each treating 145 tons charge per day, containing 10% Pb and 1.5% S. Since the last notice of this plant[10], the principal change has been the adaptation of thimble tops to the blast furnaces, which have down-comers at one end beneath the feed floor to carry off the gases. The throat of the furnace has been enlarged. Along the center line there has been placed an oblong iron box consisting of two truncated cones joined at the bases. The upper cone is 1 ft. 6 in. high and 4 ft. wide, and the lower 4 ft. high and 3 ft. 5 in. wide. The box, which is 7 ft. 8 in. deep and reaches to the ends of the furnace, extends 2 ft. 8 in. beneath the lower edge of the down-comer. Between the box and the furnace wall is a charge space 2 ft. wide. The work with the improved top has met all expectations.

The earlier lead plants gave little attention to carrying off the dust and fume set free in the various mechanical and chemical operations. The men became "leaded" and were replaced. The advance made in recent years is striking. Wherever dust is produced in crushing and sampling, or dust and fume in roasting, smelting, or refining, appliances are provided to carry off the noxious products at the places where they are formed. Practical experience has shown that these sanitary measures are not always an additional expense; on the contrary, filtering of the gases and the recovery of the dust and fume have more than paid for the cost of collections. Safety appliances[11] have been introduced at most plants, which make the work less hazardous than it was formerly. Further, cleanliness and order are enforced, which leads new men along the path of becoming interested in safety work. Accident records of the divisions of a plant are kept separately, so that a rivalry is created, which is also fostered by premiums. The result has been a great reduction of accidents and sickness among the employees.

Metallurgy of Copper

By ARTHUR L. WALKER*

The energies of copper smelters and refiners in 1918 were directed principally toward maintaining a maximum production to supply the Government and our Allies with the metal required for war purposes. Their operations were successful, and an ample supply of copper was maintained, although at times the amount on hand was dangerously low. This result was obtained despite great difficulty in securing a sufficient amount of labor to run the plants and refineries, even at the high wages offered. Not only has labor been scarce, owing to the heavy demand, but it also has been most inefficient. In many of the copper plants the amount of work performed per hour or per day has fallen very much below normal. An enormous increase in operating expense has resulted, and this is especially true in the case of copper refining, where the costs are more than double those of the period preceding the war.

Little Construction Possible

At the beginning of the year 1918, the capacity of the smelting plants and refineries was sufficient to treat the ore mined and crude copper produced, in spite of the fact that mining operations were largely increased in many properties. This was extremely fortunate, as it would have been impossible to build smelting plants and refineries, to treat any increased production, within a reasonable length of time. For this reason little, if any, new construction was attempted.

The only smelting plant put in operation was that of the United Verde Extension Mining Co.[1] The first unit of this plant was blown in July 18, 1918. The plant is arranged for extensive bin capacity, so as to carry and handle in an economical manner a large supply of ore.

The flues for collecting dust are elaborate and are laid out so that the dust-settling facilities are ample. If, however, it is later found necessary to install additional dust-collecting apparatus, Cottrell treaters may be used, especially in case increased capacity reduces the efficiency of the present system. The one blast furnace installed is 48 in. x 26 ft. 8 in. long and has a capacity of about 600 tons of charge per day. The ore for the reverberatory furnaces is roasted in six 21 ft. 6 in. Wedge furnaces and is then taken directly to two reverberatory furnaces 25 ft. wide x 120 ft. long, each of which treats from 500 to 600 tons of charge per day. The copper matte from the blast furnaces is converted in three 12 ft. converters of the Great Falls type. An interesting feature is the use of pulverized coal, not only in the reverberatory furnaces but also in the direct-fired boilers, thus entirely replacing fuel oil, which has been used extensively in Arizona.

The new roasting plant of the Consolidated Arizona Smelting Co.,[2] at Humboldt, Ariz., consisting of four Wedge roasting furnaces, each 22½ ft. in diameter, is arranged so that the gases from the roasting furnaces are treated by the Cottrell system in a most effective manner. These gases are carried upward from each furnace through proper flues to individual duplex Cottrell treaters, where the dust is precipitated and conveyed by pipes to hoppers below. By this means, not only the coarse dust, which is usually collected in the flue in the roasting buildings and returned directly to the roasters, is caught, but also the fine dust is immediately precipitated and returned to the furnaces for treatment. The clear gases from the treaters escape through individual stacks 4 ft. in diameter and 30 ft. high. This plant was completed and put into operation in 1918.

---

[9] de Kalb, *Min. and Sci. Press*, Vol. 116, p. 679

[10] *Eng. and Min. Journ.*, Vol. 101, p. 89.

*Professor of metallurgy, Columbia University, New York.

[1] *Eng. and Min. Journ.*, Vol. 106, p. 690.

[11] Douglass, *Eng. and Min. Journ.*, Vol. 106, p. 105

[2] *Min. and Sci. Press*, Vol. 116, p. 335

An interesting development in the settlement of matte from copper blast furnace slag has been made at the Granby smeltery[3], Grand Forks, British Columbia. The matte and slag tapped from the furnace are run through five settlers in series. The arrangement is such that each furnace has three independent settlers, and, after passing through the settlers, the slag from two furnaces is combined and run through two more settlers in series. The heavy flow keeps the last two settlers hot. After passing through the five settlers, the slag is granulated by four jets of water, the water being delivered under a pressure of 50 lb. through nozzles $\frac{5}{8}$ x 2 in., and falls into a launder, where it is carried away by overflow water from the jackets. For each ton of slag, 1400 gal. of overflow water and 800 gal. of pressure water are required. Placing the settlers in series reduces the danger of loss of matte in the granulated slag, as the arrangement for settlement is so perfect.

HEAP-LEACHING EXPERIMENTS

Some experiments in heap leaching, which may have an important bearing on the future treatment of low-grade lump ore, have been and are being conducted on a large scale in the southwestern copper centers. At Bisbee, Ariz., the Phelps Dodge Corporation has a heap of about 10,000 tons which is being treated by leaching. At Tyrone, N. M., the same company has another experimental heap of about 20,000 tons, and at the latter place plans have also been made for a systematic investigation of the subject, and a large leaching plant has been designed. At Santa Rita, N. M., the Chino company[4] is building a pile containing about 90,000 tons, and this is probably under treatment at this time.

In the experiments made to date it is estimated that the treatment of these large heaps or piles will last for three years, during which period 40% of the copper content in the ore will be extracted during the first year, 20% during the second year, and 15% during the third year, making a total extraction of 75%. It is thought that the time required to extract any portion of the remaining copper will make it unwise to conduct the operation further.

The difficulties connected with heap leaching are well understood. By taking Rio Tinto practice as a basis, and making the necessary changes such as experience dictates, it is hoped that these difficulties will be overcome. It has been found difficult to pile the ore so that the coarse and fine portions will be arranged in such a manner that channeling will not occur, and loss due to solutions penetrating into the ground is hard to provide against. The amount of ferrous and ferric sulphate in the solution is important, though ferric sulphate is desired for leaching, and excess in the liquor running to the precipitating tanks causes an excessive consumption of iron. It is now stated that under favorable conditions heap leaching will probably become commercially possible, and the experiments will be watched with interest.

The successful results which have attended other leaching operations started in recent years are gratifying. One of these is the leaching plant at Ajo, Ariz.,[5] where an interesting point is the method of treating the iron in the solution after it leaves the last leaching tank. The solution is sent to sulphur dioxide towers so that any ferric sulphate formed will be reduced to ferrous sulphate before the solution enters the electrolytic department. This is necessitated by the fact that ferric sulphate is an excellent solvent for freshly precipitated copper. The solution as delivered to the electrolytic tanks is complex in its composition, and consists of from 30 to 20% of its weight in sulphates. The copper content is 2.6%, and the total amount of iron in both ferrous and ferric state is between 2 and 3%, and, in addition, there is almost 3% of alumina.

The new leaching plant of the Utah Copper Co.,[6] designed to handle the oxidized capping that is stripped from above the principal mass of sulphide orebodies in Bingham Canyon, is giving satisfactory results. The capping contains about 0.65% copper, which is largely in the form of carbonates. The plant has a capacity of 2000 tons of ore per day, and is arranged so that the material is handled mechanically, with the smallest amount of labor.

The leaching vats, of which there are 12, are made of heavily reinforced concrete and are 100 ft. wide, 50 ft. long, and 17.5 ft. deep. The solution passes through 10 of these vats in series, beginning with the vat from which most of the copper has been leached and leaving the vat which contains a fresh charge of ore. Only 10 vats are in operation regularly, one being filled with fresh ore while another is being emptied. Acid is added to the solution after it has passed through three vats, so as to raise its acid content. In passing through the last seven vats, the free-acid content is gradually reduced, as sulphates are formed. The enriched solution from the last vat in the series contains about 3.1% copper, 0.35% iron in the ferrous state, 0.95% iron in the ferric state, and 0.20% free sulphuric acid. The copper-bearing solution is conducted from the leaching vats through wooden stave pipes to the precipitating vats, which have a total length of about 2700 ft., a width of 9 ft. and a depth varying from 6 ft. to 3 ft. In these vats the copper is precipitated on iron.

NEW ANACONDA FUME-DUST COLLECTOR

The Anaconda Copper Mining Co. is constructing a plant[7] on an enormous scale for collecting dust and fume, which will be the most notable equipment of its kind in America. Gases from the entire plant will be conducted to main flues running up the hill in a northerly direction from the present 300-ft. stack. It is estimated that 3,000,000 cu.ft. of gas per min. will pass through these flues. The gases will be discharged from the flues into Cottrell treaters, of which there will be 20 of the Anaconda plate type, where it is estimated 240 tons of solids per 24 hours will be recovered, equivalent to 88% of the dust now going to waste. From these treaters the clear gas will pass into the new stack. This stack will be 60 ft. in diameter at the top and stand 525 ft. above its concrete foundation. As this foundation is 454 ft. above the level of the reverberatory furnaces, the new stack will equal a draft column of 979 ft. In addition to the 3,000,000 cu.ft. of gas delivered to the stack, 1,000,000 cu.ft. of cooling air will be admitted, so that the stack will carry a total of 4,000,000 cu.ft. per min. of air and gas, at a velocity of 24 ft. per second. The flue dust and fume collected will be smelted in a special reverberatory furnace, 20 ft. x 120 ft., having a capacity of 240 tons of fume dust and 155 tons of calcine, flux, and other material per day. It is expected that there will be an output of about 50 tons of matte and 200 tons of slag per day from this furnace. The fume discharged from the reverberatory furnace will contain considerable dust and also all of the arsenic, which is volatilized. The gas containing the dust and volatilized arsenic will be passed through hot Cottrell treaters, where the dust will be precipitated. The escaping arsenic fume will be then passed through a flue into which cold air will be introduced to bring the temperature down sufficiently to allow the arsenic to be deposited. The arsenic fume will then be deposited out in a cold Cottrell treater. It is expected that about 35 tons of arsenic, 92 to 95% pure, will be recovered each day.

---

[3] *Min. and Sci. Press,* Vol. 116, p. 819.

[4] Private communication.

[5] *Min. and Sci. Press,* Vol. 116, p. 187.

[6] *Min. and Sci. Press,* Vol. 117, p. 787.

[7] *Min. and Sci. Press,* Vol. 116, p. 895.

REFINING CAPACITIES UNCHANGED

Little if anything was done in 1918 in the way of extensions or improvements in copper-refining operations, the maintenance of production having been difficult without considering additional construction.

The effect that smooth anodes have on the efficiency of deposition is being carefully considered, and the importance of this subject has not been lost sight of. At the U. S. Smelting, Refining and Mining Co.'s plant an extraordinary amount of care is taken in casting operations and in spacing the anodes so that the distance between electrodes is as small as possible, thereby decreasing power consumption, and, at the same time, the condition of the anode and cathode sheets is maintained at such a degree of excellence that the danger of short-circuiting is reduced to a minimum. The subject is also being studied carefully at the Raritan Copper Works,[8] Perth Amboy, New Jersey.

At the American Smelting and Refining Co.'s plant, at Maurer, experiments in using pulverized coal in reverberatory copper melting furnaces have been conducted for some time. At the beginning many difficulties were encountered, but these have been gradually overcome, and it is now the opinion of some refiners that pulverized coal will be extensively used for reverberatory furnaces in which copper is melted. The great trouble in the use of this class of fuel, as shown by the experiments at another plant, occurred in arranging for a proper distribution of heat and also in taking care of the ash, a much more troublesome proposition in a copper-casting furnace than in a reverberatory furnace used for smelting ore.

UNION MINIERE DU HAUT KATANGA OPERATONS IN THE BELGIAN CONGO

The operations of the Union Minière du Haut Katanga Co., Belgian Congo, Africa, present a most interesting proposition and one which carries one back to the smelting practice of the old days in the southwestern part of the United States. The ore is rich, containing from 10 to 15% copper, and the cost of fuel is extremely high (coke costing $35 a ton). At present the slag contains at least 2% copper, and probably more, which is similar to the slag turned out in Arizona 35 years ago. The company's production of copper in 1918 will be approximately 24,000 tons of black copper, containing 97% copper, which is about 3000 tons less than in the year 1917. The six or seven furnaces[9] which the company now has, when running full capacity on 10 to 15% ore, are capable of producing from 35,000 to 40,000 tons of black copper per year.

A leaching plant has been designed for this company which will have sufficient capacity to produce between 50,000 and 55,000 tons of copper per year, but this plant will probably not be in operation for three or four years.

Metallurgy of Gold and Silver

BY A. W. ALLEN

PROGRESS in the metallurgy of gold and silver has been hampered by war conditions, which precluded extension of operations in most instances. Work in connection with the production of silver has been encouraged by fairer prices, which, in the case of one important district at least, have been shown[1] to counterbalance the increased cost of operations.

All the principal producers of gold were told by their respective governments that the maintenance of output was imperative, and that they must consider themselves as directors of an essential war industry. Patriotic action was taken in a large number of instances, and work was continued where, economically speaking, it should have been discontinued.

Under these conditions technological progress has not been so vigorous as it might have been, but, at the same time, it is difficult to review the year 1918 without noting that gold metallurgists are alive to the need of keeping abreast of the times, and that sufficient enterprise and initiative exist to counteract any *laissez faire* policy. It is notable that a broader view is now being taken of the activities in other countries; and the brotherhood of arms which was recently consummated between the representatives of the world's principal gold- and silver-producing countries, on the European battlefields, will doubtless persist in the form of a welcome catholicity of view as regards foreign practice.

VISIT OF A. I. M. E. TO COLORADO

The visit of the American Institute of Mining Engineers to Colorado for the autumn session served to draw attention to Cripple Creek practice. A number of informative papers were published, which were, moreover, of general interest to metallurgists.

The value of continued research, and the variation existing under conditions which are, to a considerable extent, similar, were shown by the work of T. B. Crowe, whose recommendations with regard to the deoxidizing of cyanide solutions are radically different from those to be inferred from proved practice at the only other sulpho-telluride gold camp of importance—Kalgoorlie—about 17 years ago. Conditions are varying constantly, and practically every phase of the original process is in operation in some modified form. The need for greater economy is apparent, and so continued investigation and experimentation are not only justified but imperatively necessary, to avoid the error of assuming that a proved fact is inviolate, regardless of altered circumstances.

---

[1] *Eng. and Min. Journ.*, Vol. 106, p. 95.

[2] "Effect of the War Upon Tonopah Mining," by Jay A. Carpenter, *Eng. and Min. Journ.*, Oct. 5, 1918, p. 601

[3] Private communication.

NEW RECORDS FOR EFFICIENCY

The results[2] for the year ended Mar. 31, 1918, at the plant of the Dome Mines Co., Ltd., Porcupine, Canada, are of exceptional interest. The tonnage milled amounted to 247,000, and, whereas the gold in the head sample was worth only \$4.272, \$4.173 was recovered as amalgamation and cyanide bullion. This showed an actual recovery of 97.676%, and a loss in residue of less than 10c. per ton. Although there is little justification for detracting from such an excellent showing, the question of economic limit of fine grinding in cyanidation might be raised. There are other instances where the excessive reduction in particle size has been deemed impracticable, on account of the expense. Reduced to terms of percentage, the achievement, however, is significant. After amalgamation, the ore contained only 0.00021% and the residue assayed 0.000015% of gold.[3]

Cyanide consumption is being reduced to an almost unbelievable point in some plants. The results[4] at the Victor mill of the Portland Gold Mining Co. for six months of 1917 indicate that the amount of NaCN used has been lowered to 0.175 lb. per ton of ore. This is a creditable showing, and close to the record for the City Deep plant, at Johannesburg, for the month of August, 1917, when a consumption of 0.169 lb. per ton treated was recorded. High zinc consumption usually accompanies high cyanide consumption. Economies are, likewise, usually in synchronism. The Portland company's showing of 0.191 lb. of zinc dust per ton of ore treated exhibits a considerable saving as a result of the introduction of the Crowe modification.

AMALGAMATION PRACTICE

Practically nothing new was evolved during 1918, although various minor economies have been effected in certain districts. An excellent treatise on gold dredging in the United States[5] has drawn attention to the value and status of amalgamation in connection with one of the most important sources of the yellow metal.

The relation of amalgamation to cyanidation has been discussed at length[6]; and interesting notes have been published on amalgamation practice and economies[7], grease amalgamation of gold[8], and other phases of treatment.

An excellent summary[9] of the available information on the loss of quicksilver in amalgamation plants is supplemented by views and deductions of interest and value. This review is particularly pertinent at the present time, when there is so much misapprehension as to the facts relating to amalgamation practice. This may be exemplified by the circumstance that an important source of public information can publish the statement, apparently without fear of contradiction, that amalgamation in Colorado results in the loss of about 26 lb. of quicksilver per ton of ore treated!

SOUTH AFRICAN METALLURGICAL PROGRESS

South African practice at the principal gold-mining area—the Rand—has been standard for many years, and few modifications have been made. The primary method of gold recovery is by amalgamation, and the percentage of the metal obtained by this system has not been decreasing during recent years, despite positive statements to the contrary. Actual statistics are as follows:

RAND GOLD OUTPUT STATISTICS 1914 to 1917

Year	Total Yield Fine Gold, Oz.	By Amalgamation	
		Yield Fine Gold, Oz.	Per Cent of Total
1914	8,372,070.199	5,298,738.430	60.8
1915	9,071,339.581	5,730,631.125	63.1
1916	9,269,682.453	5,908,595.756	63.6
1917	8,995,898.571	5,725,482.675	63.6

There is no reason to assume that there will be any material difference in the proportionate recovery by amalgamation for 1918.

The outstanding feature of metallurgical practice on the Rand is the retention of the original method of milling in alkaline water, which permits such a comparatively high recovery of gold by amalgamation, and leaves a tailing in ideal condition for cyanide treatment. A further characteristic of procedure in this important district is the recognition of the cheapness of leaching large tonnages of comparatively finely ground ore in open vats.

Statistics show that minor improvements in operation are constantly being effected, one of the largest groups, controlling a number of important mines, reporting reduced gold content in residue, with increased actual recovery, of 97%, being obtained from comparatively low-grade ores without the adoption of sliming.

The gold-mining industry in South Africa, as in other parts of the world, has received no preferential consideration; neither has its income been adjusted to couterbalance the increasing cost of mining and treatment as compared with a stationary selling value of product. It is a testimony to the soundness of the fundamentals of Rand metallurgical practice that the district has more than held its own during the recent war crisis, its proportionate contribution to the world's supply of gold having risen steadily, in spite of all disabilities, from 38.3% in 1914 to 42.58% in 1917. When statistics are available it will probably be found that the last-named figure has been maintained or exceeded in 1918.

THE REINSTATEMENT OF CHARCOAL AS A PRECIPITANT

The difficulty in obtaining supplies in isolated districts, and the increased cost of the necessary materials, have led to the achievement of many economies, and to the exercise of not a little ingenuity among cyanide engineers. One of the most interesting developments in the metallurgy of gold, chronicled during 1918,[10] referred to the recognition of charcoal as a precipitant, and its resurrection from the obscurity to which it had been assigned for many years. This was achieved by the adoption of a new method of application, which has insured success. Briefly stated, it was found by the investigators that precipitation efficiency increased with fine grinding. The precipitant was therefore slimed in a ball mill, and formed into cakes on the leaves of a miniature filter of the Butters type, through which the pregnant solution was sucked by vacuum. In several instances the installation of the new method, in place of a zinc-precipitation process, resulted in an improved extraction of gold from the solution, together with reduced operating costs. Its wide application is doubted, as, up to the present, it has been found unsuitable as a precipitant for silver. It is probable, however, that further investigation may indicate the feasibility of using it prior to zinc or aluminum precipitation, or as a substitute for either, in the case of silver-gold or gold-silver ores.

---

[2] Seventh Annual Report, Dome Mines Co., Limited.

[3] *Eng. and Min. Journ.*, Oct. 12, 1918, p. 680.

[4] "Effect of Oxygen in Precipitating Gold From Cyanide Solutions," by T. B. Crowe. *Trans.* A. I. M. E., 1918.

[5] Chas. Janin, Bull. 127, U. S. Bureau of Mines.

[6] A. W. Allen, *Met. and Chem. Eng.*, May 15, 1918. p. 515.

[7] A. A. Pearce, *Eng. and Min. Journ.*, Nov. 2, 1918, p. 792.

[8] H. A. White, *Eng. and Min. Journ.*, Nov. 23, 1918, p. 904.

[9] W. J. Sharwood, *Min. and Sci. Press*, Apr. 6, 1918, p. 483.

Renewed interest in charcoal as a commercial precipitant resulted in a focusing of attention on the question of the theory of the process. Since the results of Morris Green's experiment, and his deductions thereon, were published in 1912, practically all contributions to the literature of the subject have been in support of the theory that the abstraction of gold was the result of a chemical action between the occluded carbon monoxide gas and the gold-potassium-cyanide solution. More recently[11] attention has been directed to the fact that, whereas surface tension and adsorption both play such an important part in the abstraction of gases and dissolved substances by charcoal, it is reasonable to assume that the action is physical rather than chemical, especially because a definite parallelism may be traced between many of the characteristic features of the so-called "precipitation" of gold by charcoal and other results that are admittedly due to adsorption.

GOLD EXTRACTION WITH COLLOIDAL CARBON

Perennial interest is displayed in the possibility of abstracting the gold which occurs in minute quantities in sea water; but all schemes to this end have been classed with the numerous suggestions for the insuring of perpetual motion without external influence or aid, and other "woolly" ideas.

A recent patent was allowed to which a certain amount of scientific, if not commercial, interest may be attached. It is proposed to attempt the extraction of gold from extremely dilute solutions, such as sea water, by means of treatment with colloidal carbon. Assuming that the action is one of adsorption, and that there would be a selective preference for the gold compound rather than for the other salts in solution, the idea might have a wider application.

Investigation into the question of the effect of the interaction of aurocyanide solution and colloidal carbon was proposed some years ago, but nothing further was heard of the subject until it was suggested that the excellent results being obtained in the new Moore-Edmands process were partly due to the fact that some of the ground charcoal used was in the colloidal condition. This would suggest colloidity by subdivision, and is no adequate explanation of the fact that precipitating power regularly increases as reduction in the particle size of the precipitant increases, although it is feasible to infer that colloidal carbon may be released by comminution.

ALUMINUM AND ZINC PRECIPITATION

The high price of aluminum has resulted in decreased attention being paid to the substitution of this metal for zinc as a precipitant. In one case[12], however, the change has been reported to have been followed by a marked saving in cyanide and lime. The only trouble experienced was due to an accumulation of calcium aluminate in the piping; and improvements are being made to prevent or decrease this. A further reduction in the amount of dust used is anticipated. Aluminum is also being used in place of zinc at the plant of the Cia Beneficiadora de Pachuca, Mexico, and considerable economies are being effected.

Apart from the introduction of de-aërating apparatus at several plants, no change is to be noted in zinc-dust practice, although attention has been drawn[13] to alternative methods of estimation of the purity of the product usually used.

A modification of normal practice is to be noted at the McIntyre Porcupine plant, where it has been decided to install the Miller chlorine process in order to produce a high-grade product, and so avoid the excessive marketing expenses associated with a comparatively low-grade bullion.

Zinc-shavings precipitation practice has progressed little, but is still widely adopted. Attention has been paid to the various refinements of operation which have been introduced during several years of progress; but it is to be regretted that prominence is still given to types of apparatus which have aided in bringing the process into disrepute. The practice of adding lump cyanide at the head of the box, in an effort to counteract the inertness of the solution met with in many close-circuit plants, is being more extensively discouraged, and, as a result, economies of both cyanide and zinc are usually achieved. A shortage of acetate of lead in one instance resulted in the local manufacture of lead nitrate by dissolving litharge in nitric acid[14].

REFINING GOLD BULLION

In view of the baseness of the bullion obtained by certain methods of cyanide treatment and zinc precipitation, it is of interest to note that a modification of Miller's chlorine process was evolved[15] in 1918. In commenting on the refining of gold bullion, the author draws attention to the fact that the major losses of the precious metal occur during the final stages of the process. The refining "end point" is determined by allowing the escaping fumes to condense on a piece of cold clay pipe. When a yellow color is obtained, indicating the escape of gold chloride, the process is considered complete. The difficulty in the Miller process has been to remove, without unnecessary loss of gold, the last traces of base metals.

---

[10] H. R. Edmands, *Trans. I. M. M.*, 1918.

[11] A. W. Allen, *Chem. and Met. Eng.*, June 15, 1918, p. 642.

[12] Annual Report of New York & Honduras Rosario Mining Co., 1917.

[13] L. A. Wilson, *Eng. and Min. Journ.*, Aug. 24, 1918, p. 334; and J. E. Clennell, *Eng. and Min. Journ.*, Oct. 12, 1918, p. 672.

[14] "The Supply of Lead Salts for Use in Cyanide Plants," by Thomas B. Stevens, *Journ.* Chamber of Mines of Western Australia, May, 1918, p. 117.

[15] "Refining Gold Bullion With Chlorine Gas and Air," by R. R. Kahan, *Trans. I. M. M.*, 1918.

The alternative method suggested combines the principal features of the Miller process with Rose's method of toughening gold bullion by means of oxygen or air. Two clay pipe stems are introduced into the refining crucible. One is connected to an air compressor delivering air at a pressure of 6 or 7 lb. per sq.in. and the other to a chlorine generator. Maximum air and minimum chlorine are used during the initial stages of refining, the amount of air is gradually reduced to nil, and the air pipe is then removed and chlorine used alone. The advantages in the modified process are seen in reduced losses of gold and a shortening of time required to effect the purpose. It is also noted that the most refractory bullion absorbs chlorine with avidity after having been treated by the combination method.

SODIUM SULPHIDE IN CYANIDING

An interesting development in the metallurgy of gold has taken place in connection with the cyanidation of the quartz ore at Prestea mine, Gold Coast Colony, West Africa[16]. The deposit is crossed with seams of carbonaceous schist, which is also found in close proximity to the vein; and, during cyaniding operations, some of the gold is prematurely precipitated on the graphite. This resulted in high residues; but subsequent experimentation indicated the feasibility of using sodium sulphide as a corrective in a later stage of treatment.

As practiced at the Prestea, the new modification consists of drainage, after cyanide treatment in leaching vats, and re-treatment with 0.2% sodium sulphide solution. The material is then water washed, and the residue discharged. The gold-sodium sulphide solution is passed through copper shavings, where the precious metal is deposited, and receptacles similar to ordinary zinc boxes are used. The gold precipitate is filter-pressed, dried and smelted. Copper-gold bullion, matte, and slag result, which assay 100 fine, 33 oz. per ton, and 12 oz. per ton, respectively. The new process recovers an additional 50 cents' worth of gold per ton of sand treated.

With regard to the theory of this interesting development, it has been proposed[17] that the sulphide was a solvent for the gold precipitated on the carbon. More recently a hypothesis has been advanced[18] which draws attention to the evidence in favor of the theory that a gold solution is adsorbed by the carbon rather than chemically acted upon by occluded gas, and that the addition of sulphide introduces new factors of surface-tension influence, with the result that a part of the adsorbed gold compound is released and is available for treatment with a precipitant.

A comparatively recent modification in connection with the precipitation of gold and silver received publicity in 1918. A brief account of T. B. Crowe's experiments and the practical results achieved by deoxidizing cyanide solutions by means of a vacuum, prior to zinc-dust precipitation, was published[19], but few details were given. The new system was used throughout 1917, and results for six months' operation were given in the paper which was read at the September, 1918, meeting of the Institute at Colorado. It is to be noted that considerable savings have been effected in the consumption of zinc dust and cyanide.

Mr. Crowe's explanation of the theory of the reactions involved assumes that nascent hydrogen is the active precipitating agent, and that its combination with oxygen in the solution reduces the precipitating efficiency. This view is opposed by O. P. Watts,[20] who draws attention to the fact that the dissolving of zinc in a solution of pure sodium cyanide is an example of the displacement of one element by another; and that, when zinc is immersed in a dilute cyanide solution containing gold, two reactions occur simultaneously—some of the zinc is dissolved by the double cyanide of gold with precipitation of the precious metal, and a portion of the zinc dissolves in the sodium cyanide, forming hydrogen.

The distinctive feature of the new modification is undoubtedly the saving of zinc and cyanide resulting from the feasibility of abolishing the practice of adding lump cyanide at the head of the presses. In this connection it is interesting to note that the Crowe modification is a radical departure from the practice, so often found beneficial in improving precipitating efficiency with zinc-shaving precipitation, of *oxidizing* the solution, before it reached the boxes, by treatment with air. The purpose was doubtless to accelerate action by insuring the prompt removal of occluded hydrogen from the surface of the zinc shavings, and so exposing fresh areas of the precipitant. Such a method would be unlikely to insure any economy in the consumption of either zinc or cyanide, although improved precipitation results were often obvious.

The theory that the presence of oxygen assists in depolarization is questioned by H. A. White, who has contributed[21] a new method for the estimation of this element in cyanide solutions. Typical analyses of solution in a Rand zinc box showed that there was little precipitation of gold in the first compartment, although the percentage of oxygen in the solution was high. In this instance, however, other factors are to be taken into consideration. The first compartment of the box may contain the bulk of the white precipitate common in that district, so that vigorous action would be unlikely in any case. The white precipitate is found when free cyanide content is low, and it would be interesting to know whether its formation could be prevented by means of a preliminary deoxidizing of the solution.

The whole subject of the reactions involved during the precipitation of gold in aurocyanide solution by zinc shavings or dust constitutes a field for investigation, particularly in relation to the interfering or helpful influence of oxygen. Comparative figures will doubtless be available at a later date, and a more complete hypothesis may be suggested to account for the results.

Apart from theories as to the cause of the abstraction of gold from an aurocyanide solution by charcoal, and the proposals as to the actual reactions occurring during precipitation, little advance in the chemistry of the process can be recorded. White's method[23] for the estimation of oxygen provides an apparently reliable system of testing, which it is hoped will lead to the publication of data of interest.

---

[16] "The Sodium Sulphide Process of Gold Recovery," by F. Wartenweiler, *Trans.* I. M. M., 1918.

[17] "The Precipitating Action of Carbon in Contact With Auriferous Cyanide Solutions," by W. R. Feldtmann, *Trans.* I. M. M., Vol. 24, p. 329.

[18] "Charcoal Precipitation of Aurocyanide," by A. W. Allen, *Met. and Chem. Eng.*, June 15, 1918, p. 644.

[19] *Trans.* A. I. M. E., 1918.

[20] *Chem. and Met. Eng.*, Nov. 1, 1918, p. 652.

[21] "The Estimation of Oxygen in Working Cyanide Solutions," *Journ.* Chem. Met. & Min. Soc. of S. Africa, June, 1918, p. 292.

The new method is based on the fact that the addition of alkali to many photographic developers causes a darkening of color, due to the formation of quinones; and the use of alkaline pyrogallol to absorb oxygen is one of the standard methods of gas analysis. Experimentation has shown that there is a close connection between the color developed and the amount of oxygen in the solution. Standard color flasks are prepared for comparison, and a 250-c.c. sample of the cyanide solution is treated with 0.100 gm. pyrogallol and 1 c.c. of twice-normal NaOH. By comparing the coloration produced with the standards, the amount of oxygen may be estimated within 0.5 mg. per liter.

Gravity Leaching Practice With Gold Ores

The leaching of gold ores in open vats is still one of the major methods of metallurgical treatment, but there is no technological progress to report. Copper metallurgists have adopted the method extensively, and installations like the Ajo leaching plant of the New Cornelia Copper Co. indicate that the last word had not been said as to improved and economical leaching practice. The principle involved is often the same with both metals, though conditions differ. The applicability of leaching to gold ores is extensive, but there has been an inclination in some quarters to consider the method out of date, and to reserve research and improvement for other and more complicated processes, which necessitated more frequent readjustments to the varying conditions encountered. Hence the neglect of leaching.

The opportunity remains. There is no question as to the comparative cheapness per ton capacity of a large leaching plant, as compared with the equipment necessary for any other wet-chemical method. The resulting low cost of operation would be an added incentive to the inclusion of a large tonnage of gold-ore reserves, now considered as unprofitable because of the expense of reduction to slime, the difficulty of entirely isolating, for precipitating purposes, dissolved gold associated with slime, and the high cost per ton when operations are carried out on a small basis.

It is interesting to note that during 1918 experienced expressions of opinion[24] in favor of leaching treatment for gold ores have been in evidence. A few years ago the logic of such views would have been questioned. It would have been recalled that leaching was the first system adopted on a working scale to recover gold from cyanide solutions, and that new methods should receive greater attention. Such a line of argument was favorably received by many engineers. In spite of this, however, it is interesting to note that the bulk of the gold recovered by the cyanide process is still obtained by leaching. In view of its general applicability to all classes of simple gold ores, I predict that it will survive so long as cyaniding is in practice.

Attention has been drawn to the neglect to realize that the economic leaching of gold ores involves comminution according to requirements. Certain ores will leach satisfactorily when crushed to ¼ in., or even larger, but, where the gangue is hard and the gold finely disseminated, fine crushing is imperative. The scope of leaching is little understood. A very fine sand, passing an 80-mesh screen, will often leach satisfactorily, and can be treated with only a fraction of the expense involved if sliming is practiced. It is certainly too common for metallurgists to attempt experimental leaching on, say, 20-mesh material; and then, because the results are unsatisfactory, as they almost invariably will be, go to the other extreme and finally affirm that sliming to 200-mesh is the only solution of the difficulty. Had this last-mentioned policy been adopted more extensively, it is probable that many, instead of comparatively few, gold properties would have failed to pass the recent crisis without suspension of operations, and would have been obliged to close down, at least temporarily, on account of the high cost of treatment. As matters stand it is probable that greater attention will be paid to the refinements of leaching practice as applied to the metallurgy of gold, in the near future, in an effort to solve the problem of the treatment of low-grade deposits, even as the copper metallurgists have done, although, of course, on a smaller scale.

The features of successful practice needing emphasis are (1) the feasibility, in many instances, of treating by gravity leaching a large proportion if not all the slime produced; (2) upward percolation; (3) countercurrent enrichment of solution and the avoidance of unnecessary precipitation; (4) degree of grinding and depth of charge to insure (a) avoidance of slime being washed through the crevices between adjacent coarse particles, (b) normal percolation rate, and (c) satisfactory extraction of the metal; and (5) the ability to distribute homogeneously a leaching charge after dry crushing or dry crushing and roasting. The practicability of the amalgamation of leaching plant residues has received little or no attention.

Magnesium

Four producers of magnesium in the United States in 1916 made 75,400 lb., valued at $311,570. Production of magnesium, according to the U. S. Geological Survey's report, was 116,938 lb. during the first six months of 1918. This amount exceeded that of the entire year 1917. War needs and the increasing use of light alloys absorbed the increased production. The average price fell from $4.13 per lb. in 1916 to $2.10 per lb. in 1917. The price early in 1916 reached $5 per lb. Late in 1917 it fell to $1.85 per lb. The price at the end of 1918 was $2 per lb. for lots less than 1000 lb., and $1.85 per lb. for lots greater than 1000 pounds.

In 1916 magnesium was made by the Electric Reduction Co., Washington, Penn.; Norton Laboratories (Inc.), Lockport, N. Y.; Rumford Metal Co., Rumford, Me.; and General Electric Co., Schenectady, N. Y. The American Magnesium Corporation, the successor of the Aviation Materials Co. at Niagara Falls, made an output in 1917, and the Dow Chemical Co. began production at Midland, Mich., but was prevented from operating at its full capacity by shortage of coal. The General Electric Co. closed its plant in 1917.

---

[23] Ibid.

[24] E.g., A. L. Blomfield and J. M. Trott in a paper on Cripple Creek ore treatment, *Trans.* A. I. M. E., 1918.

The Flotation Process

By A. W. ALLEN

THE litigation over the basic flotation patents reached another stage during 1918, but, to appreciate the most important finding of that year, it will, perhaps, not be out of place briefly to recall the gist of the Bourquin decision, given in the U. S. District Court of Montana on Aug. 25, 1917. This decision was in favor of Minerals Separation, Ltd., and led to an appeal being lodged by the defendant—the Butte and Superior Mining Co. The decision supported the claim of the plaintiff company that oil used in excess of 1% was inert and valueless, the judge making a sharp line of demarcation between what he considered effective and non-effective oils. The result was an opinion which stated that the defendant company could not escape the charge of infringement of the patent by the addition of non-effective oils to make the total amount in use more than 1%. This decision was reviewed by the U. S. Court of Appeals for the Ninth Circuit at San Francisco, which, on May 13, 1918, filed a decision reversing the Bourquin verdict. There was, apparently, no dissension among the judges in their refusal to recognize the distinction between effective and non-effective oils, an experimental showing by a Minerals Separation engineer at the hearing having failed to convince them that the so-called non-effective oils were inert so far as froth formation was concerned. The decision hinged a good deal on the interpretation of the phrase "a fraction of 1%," and the San Francisco judges appear to have concluded that this is equivalent to less than 0.5 per cent.

This decision will be reviewed by the highest tribunal in the country—the Supreme Court. Minerals Separation, Ltd., claims that two findings in the Supreme Court decision in the Hyde case (where it was contended that the process involved violent agitation and the use of less than 1% of oil, and that a more or less permanent froth resulted) were misinterpreted in the most recent decision. It disclaims the limitation of the patent to the use of 0.5% of oil or oily substance, or its extension to any oil or oily substance having preferential affinity for metalliferous matter over gangue; and contends that the scope of the patent must be considered only in connection with specified results. The last-named view would exclude from consideration all classes of oil which are different from those with which the most satisfactory result can be obtained.

In the Hyde case it was shown that the flotation was effective only when the proportion of oil used fell below 1%—to one-third or one-half. Hence the San Francisco decision. The Supreme Court will be called upon to define precisely the phrase "a fraction of 1%," and at the same time to give an opinion on the decision as to whether or not a patent is infringed when the literal interpretation of its specifications is evaded and where inferior results are obtained by the evasion.

The most recent action of interest was taken by the Federal Trade Commission, on Nov. 16, 1918, when it issued a formal complaint against the various Minerals Separation companies, impugning, by inference, pro-German proclivities, and contending that the companies' attitude toward clients was unjust, and that the terms under which licenses were issued were unjustifiably harsh.

A lull occurred during the period under review with regard to suppositions as to who practiced flotation first, and where. Attention was, however, drawn to the fact that the natives of Brazil had been in the habit of using the juice obtained from certain herbs which they mixed with the water used in washing and panning auriferous ground. It was suggested[1] that the practice forestalled the invention of flotation as applied to the extraction of metals. This view was shown to be erroneous[2] and the action was explained by the fact that gold tends to flour when fine, and that the addition of the extract was for the purpose of neutralizing the infinitesimal quantity of oil or grease present on the gold and so permit it to be be wetted, and thus to sink. The effect was, therefore, the opposite to that desired in flotation work.

New Flotation Machines

Two different types of flotation apparatus came into prominence in 1918. The Groch and Ruth machines are in one category and have much in common. The former consists essentially of a number of impellers operating in a V-shaped box 14 ft. long by 5 ft. wide, divided both longitudinally and transversely into compartments.[3] The impeller operates in the manner of a pair of centrifugal pump runners, air and oil entering the top section through a vertical hollow shaft, and pulp entering the lower section through a short intake. There is a common horizontal discharge of mixed oil, air, and pulp from the impeller. In the Ruth machine[4] the oil and air also enter through a hollow vertical shaft, but are discharged, through four hooded ports, from the upper surface of the distributor. Simultaneously the pulp is drawn with the distributor from below, and is discharged through four ports, also on the upper surface of the distributor, which are unconnected in any way with the air ports. The feature of the machine is, therefore, that the pulp and air are mixed as they emerge from the distributor by a method which tends to throw the product upward. Counter currents are thus minimized.

The Hynes machine has been used successfully on the silver-gold ores of Guanajuato. It consists of a suitable trough in which a number of perforated disks, 30 in. in diameter and spaced 1¼ in. apart, are attached to a horizontal shaft, which is caused to rotate at a speed of about 100 r.p.m. Only the lower portions of the disks are submerged, so that air in the perforations is carried down into the pulp, and this, together with the actual movement of the disks, causes agitation and facilitates intimate contact between mineral and oil.

Excellent work was done in the Guanajuato district of Mexico during 1918 in determining the suitability of flotation as a method for the extraction of a concentrated product from silver-gold ores. At the Cubo company's property there considerable success was achieved by the treatment of freshly broken crushed ore in Hynes flotation machines. Important data were secured, and it was found that the extraction of gold was above expectations, and that the newer process was unsuitable for the treatment of material from old fills. The ratio of gold to silver is high in this particular instance, and the average extraction of both metals in concentrate form, by flotation, is consequently higher than the average recovery by cyanidation. The differentiation between the two products obtainable by these rival processes is pertinent, as the advantage of securing a final output as bullion is obvious, and this is a feature which detracts from the popularity of flotation. The silver extraction by flotation appears to have been lower than the recovery by cyanidation. Flotation was used entirely by the Cubo company, and the concentrate produced was shipped to the Aguas Calientes smeltery of the American Smelting and Refining Co. At the plant of the Guanajuato Consolidated Mining and Milling Co. six Jones-Belmont flotation machines were in successful operation, and the concentrate was cyanided on the property.

---

[1] Kirby Thomas, *Met. and Chem. Eng.*, June 1, 1918.

[2] E. Jordan, *Chem. and Met. Eng.*, Nov. 1, 1918.

[3] F. O. Groch and W. E. Simpson, *Trans.* Can. Min. Inst., 1918.

[4] "The Ruth Flotation Machine," by J. P. Ruth, Jr., *Eng. and Min. Journ.*, Apr. 20, 1918, p. 752.

Flotation of Silver Ores in Canada

Flotation at Cobalt, Ontario, Canada, passed the experimental stage in 1918, and published results[5] show that it has almost completely displaced gravity concentration. Various questions of comparative economy have arisen, and in some instances it was considered preferable to sacrifice extraction to insure a high-grade concentrate, and so evade high marketing expenses. The majority of the producers depend on United States smelteries to absorb their products, but charges have been excessive. At the Nipissing Mines plant, however, the difficulties encountered in treating the concentrate successfully, coupled with the alternative expense of shipping it, led to the abolition of flotation early in 1918, and the reinstatement of the practice of gravity concentration, followed by cyanidation of the product.

Little progress was made in the flotation of gold ores during the year, and the newer but less complete process is now considered unlikely to become a serious rival to established methods of treatment. The major tonnage of gold ores is treated by a leaching process, and the substitution of flotation would probably necessitate additional reduction plant to insure a finer product than is now economically practicable. There is, however, a possibility for the introduction of flotation for the concentration of the residues from some cyanide mills treating gold ore, in the same manner as has been found beneficial in Canada. In the few instances where the tailings from amalgamation plants are too refractory for cyanide treatment it has been shown that flotation may be adopted with a fair chance of success.

Progress in Selective Flotation

Advance in the practice of selective flotation in 1918 was chiefly concerned with the separation of lead from zinc. Accounts of standard practice where oils are used has been published;[6] and a detailed account of the Bradford process in use at Broken Hill[7] contains much information as to this somewhat novel and certainly successful process.

In the Bradford system no oil is used. The material treated consists of accumulated and current zinc-lead slime. This is pulped, acidified, and treated with sodium hyposulphite. Mixing then intervenes to insure ample time of contact between the SO_2 liberated from the hyposulphite, and the zinc sulphide. Ideal conditions are as follows: Acidity, 0.025 to 0.03%; temperature, 85 to 90° F.; density, 23 to 26% solid, by weight.

Agitators of special design are used and are connected with sulphur burners by means of which a supply of air and SO_2 is insured. The agitators deliver to separation boxes, where the lead sulphide floats, forming a deep froth. The concentrate is subsequently filter pressed in an apparatus of the Dehne type. The zinc middling from the separation boxes is dewatered, and acid added and heat applied. The pulp is agitated with centrifugal pumps and subsequently treated in separation boxes similar to those in the lead section. A deep froth is obtained, which is mixed, diluted, and refloated, as in the first zinc section.

Small-scale tests indicate the feasibility of re-sulphidizing the oxidized lead now passing out with the tailing, and recovering this, together with the silver. A plant is being designed along these lines, and it is expected that the assay of the residue will be reduced to about 1% lead and 1 oz. silver per ton.

In the Terry process[8] advantage is taken of the fact that ammonia in solution promotes oxidation of certain sulphides. A closed tank and a circulating system are suggested as suitable.

Development of Galena Flotation

An example of a successful change from gravity concentration to flotation is shown[9] by the result of operations at the Central Mine, Broken Hill, New South Wales, where the flow sheet has been gradually modified, stage by stage, and where the elimination of 54 gravity concentration tables and vanners has been brought about by introducing the more modern system. The change has resulted in an additional extraction of 8% of the lead and 15% of the silver content of the ore. These results have been achieved by the installation and operation of a galena flotation plant, which consists of a series of boxes set one above the other and in which the pulp, in descending from box to box, passes through nozzles by which the necessary air is added. The concentrate overflows the lip of each box, and the tailing passes on to the next in series. A small quantity, about 2 oz. per ton, of a mixture of coal tar and eucalyptus oil is added to the pulp to assist flotation.

The material handled by the new unit is the tailing from jigs (which produce a lead concentrate) and which is ground to 40 mesh before reaching the cascade machines. After treatment in the "lead cascades," as the new addition to the plant is called, the tailing is dewatered and passes to the selective plant, where the pulp is treated in flotation boxes equipped with stirrers driven from below and operated on the sub-aëration system. Lead concentrate is produced, and the tailing passes to the zinc plant, where a lead-zinc concentrate is obtained, presumably by flotation. A final separation into zinc and lead products is made by means of Wilfley concentrating tables.

---

[5] Excerpted from 26th Annual Report of the Ontario Bureau of Mines.

[6] E.g., C. T. Rice, *Eng. and Min. Journ.*, Sept. 14, 1918, p. 482 and *Eng. and Min. Journ.*, Sept. 21, 1918, p. 528.

[7] "The Bradford Process at Broken Hill," by E. T. Henderson, *Min. and Sci. Press*, Sept. 28, 1918, p. 107.

[8] U. S. Patent 1,254,173 of Jan. 22, 1918, to Joseph Terry, Jr.

[9] "The Development of Galena Flotation at the Central Mine Broken Hill." By R. J. Harvey, *Trans. I. M. M.* 1918.

COMBINATION TREATMENT OFTEN APPLICABLE

The fact that a combination of two or more processes is often preferable to a strict adherence to the latest evolution in modern practice is obvious in many instances. An interesting example of triple concentration was described[10] during 1918 in connection with an installation where table, flotation, and magnetic concentration are practiced in one plant. Mechanically operated concentrators—jigs, Wilfley tables, and Frue vanners—produce a high-grade tin-wolfram-lead concentrate, which is handled in an M. S. flotation machine. The leady concentrate is floated off for re-treatment, and the tin-wolfram product handled by magnetic separator. A Berdan pan is used for regrinding, and the flotation unit gives an extraction, in concentrate form, of 98% of the lead.

FLOTATION IN THE GRAPHITE INDUSTRY

Particular interest attaches to the rapid acceptance of flotation, among graphite producers, as the best process to adopt. A number of new plants were erected in 1918, particularly in the Southern States, and there was opportunity to take advantage of recent invention. Modern flotation apparatus, including such recent innovations as the Lowden drier, has been successfully adopted in this important industry. In a number of instances a mixture of clay and graphite slime, previously run to waste, is now being economically treated by the newer process.

Among recent patents is one flotation device[11] that has been designed primarily for graphite ore treatment. The principle involves the impinging of a fluid jet, free from ore, upon a pulp surface containing ground ore and suitable contaminants. A number of jets are used in each machine, and these entrain air into the liquid, causing the formation of a froth carrying the graphite, which is finally recovered in the usual way. There is a continuous flow of ore pulp into each machine, and a continuous discharge of tailing and flotation concentrate. The water pressure may vary from 2 to 200 lb. per sq.in.; and the entrainment of air is said to be accompanied by static electrical effects which may tend to accelerate separation.

THE INFLUENCE OF COLLOIDS ON FLOTATION

In many metallurgical processes colloids have received more than their fair share of blame for the uncertain and unsatisfactory nature of results. Failure to explain adequately why flotation operates successfully in some instances has been followed by frequent attempts to account for the reason why it does not work in others.

It is unfortunate that a haze has been allowed to envelop the question of colloidity by the confusion which followed the partial acceptance of the particulate theory, which aims to explain that colloidity is merely a state of subdivision. Experience, however, indicates in many instances that there is a marked difference between mechanically subdivided matter and colloidal matter, which it is impossible to consider as wholly due to particle size. Mechanical reduction to a slime inevitably produces a proportion of material which is infinitesimally fine. This can be separated by hydraulic methods, but cannot be made to give the true reactions of a colloid.

The pendulum has swung too far; and the diversion of attention from the particulate theory might well be explained as a needed reaction to discourage the inclusion of too many finely divided substances into the colloid category. The peculiar characteristic of a colloid is that it is colloidal, or glue-like. The originator of the term probably realized the necessity of adopting a synonym that indicated, by its very derivation, the distinction which must, of necessity, be recognized between colloids and non-colloidal subdivided matter.

Of late years, however, there has been an inclination to disregard the line of demarcation, and less attention has been paid to the physical peculiarities of colloids. The fluidity of water is greatly decreased by the inclusion of a true colloid, such as weathered plastic clay. It is, however, not appreciably altered by the addition of many of the so-called colloidal metals. It would seem reasonable to infer that viscosity or fluidity should be one of the factors in determining colloidity.

Keeping the idea of the probability of undue reference to colloidity in mind, it is important to note that several contributions of interest were published in 1918, dealing with the physical aspects of flotation. Judging from the majority of them, there seems to be a general opinion that colloidal matter is a nuisance in flotation work, as in other metallurgical processes.

SEPARATE TREATMENT OF COLLOIDS

In one contribution[12] it is suggested that separate treatment of sand and slime by flotation merits wider consideration in those instances where it might be found to be applicable. In cases where a variety of ores are being floated, the advisability of separate treatment will be obvious, especially where the amount of ore at each crushing is so small, comparatively speaking, that exhaustive preliminary experimental work would be impracticable. In the same paper the author draws attention to the advisability of eliminating and discarding colloidal matter where practicable. Slime may carry as much metal or more metal than the original ore, but, when considering the ground product as being made up of two parts of different physical characteristics, it is often more economical to classify and discard the untreatable slime, and recover only from the remainder, than to attempt to treat the original mixture and recover practically nothing. A further point brought out is that a certain definite degree of comminution is needed to liberate the colloidal matter forming a part of an ore. In one instance reported it was found that mechanical separation of slime, after the ore was crushed to 3½ mesh, was so imperfect that subsequent flotation results were poor. This was remedied by separating, after crushing to 16 mesh.

---

[10] "Triple Concentration Practice for Tin-Wolfram-Lead Ore," *Eng. and Min. Journ.*, Sept. 21, 1918, p. 530.

[11] U. S. Patent No. 1,282,730, Oct. 29, 1918, to W. O. Arzinger.

[12] "Colloids in Flotation." By Jackson A. Pearce, *Min. and Sci. Press*, Oct. 12, 1918, p. 491.

Colloids and Adsorption

The advent of the flotation process has given a new and vigorous lease of life to the term "adsorption"; and the catholicity of interpretation is now the cause of some confusion. A recent publication[13] on colloids and flotation begins with the premise that "few attempt have been made to explain the theoretical side of the process," and, to remedy this alleged deficiency, a number of hypotheses are advanced based on the contention that wetting and adsorption are analogous phenomena. The adsorption of pure water, or air, or oil, or gas, by sulphide particles, and the adsorption of finely divided substances, or oils, or compounds in solution by colloids, offers a field for an immense amount of conjecture to those able to invest a phenomenon, generally conceded as resulting in a change of surface concentration, with such characteristics.

Dewatering and Drying Flotation Concentrate

The preparation of flotation concentrates for shipment is not an unimportant phase of the process, although one which is often neglected. Considerable improvements have been made in individual plants, and the revolving-drum type of vacuum filter has been widely adopted for the dewatering of the thickened concentrate. The difficulties in the way of satisfactorily handling colloidal material are as much in evidence with flotation work as they are in any other process. Various methods to minimize trouble from this cause have been adopted, including the building up of a bed of fine table concentrate on the filter drum before putting on the froth concentrate, as described by C. T. Rice.[14] The scraper is then set so that it does not take the cake off closely, the retained bed of fine concentrate acting as a sand filter to catch the froth concentrate before it can be sucked into the cloth.

The drying of flotation concentrate was a problem until the introduction of a mechanical drier in which the material as it progresses along a series of hearth plates is chopped by the downward action of the rabbles, and leaves the machine in an ideal condition for shipment and smeltery treatment. This apparatus, which is known as the Lowden drier, was proved at the plant of the Federal Lead Co.; and all the large Flat River installations, as well as several in other districts, are now equipped with these machines. Its wide applicability in handling flotation products is shown by the fact that the machine was adopted in 1918 to handle gold ore concentrate at Cripple Creek and silver-ore concentrate at Guanajuato, Mexico.

Notes on Ore Dressing

By A. W. ALLEN

THERE were no developments in the practice of primary crushing in 1918, but results in more than one instance demonstrated the ultimate economy of obtaining the maximum reduction in a simple machine such as the average rock breaker, where power consumption is more or less in proportion to the crushing performed, and where the power consumption "running light" is small or negligible.

The stamp mill, as a unit in any new installations, is a thing of the past, although Rand practice is still uniform in this respect. No progress has been made with heavy stamps in the United States, and considerable difficulty would be experienced in supplanting the ball mill with any less fool-proof competitor. Greater attention has been paid to the screening of ore before crushing, and, to this end, shaking grizzlys are becoming more widely adopted, and a miniature trommel has, in some instances, been interposed between stamp-mill feeder and mortar box to insure the elimination of fines, and so increase crushing duty.

The Efficiency of Tube Mills

The delay in discharge of ground particles in any type of trunnion-discharge ball or pebble mill is becoming better realized, and the tendency is to reduce the length to the minimum. Ample feed and prompt discharge are considered essential, and efficient outside classification is a feature of good practice.

Individual prejudices and leanings in different districts are generally responsible for the type of liners adopted. No new design has been reported; but the experience gained in ferro-alloy work in 1918 should be of value in determining the most suitable material for future needs in this direction. A certain amount of local stone has been used for the manufacture of silex liners, but steel is generally considered far preferable.

Tube-Mill Pebbles and Steel Balls

Some progress was made in 1918 in the matter of the manufacture of small steel balls to take the place of pebbles. The elimination of practically all hand labor, which, however, is still necessary in the case of the larger balls, should result in a cheapening of production and a greater ability to compete with stone grinding media.

Attention has been drawn[1] to the feasibility of using local stone rather than imported or transported flint pebbles, and comparative data given to illustrate the frequent superiority of an available but common stone over an imported flint. The factors concerned are toughness and hardness, and these may be estimated with comparative facility by means of standard apparatus.

The laws of Kick and Rittinger seem equally popular, and are used and quoted with general impartiality. As long as each exponent keeps to the one system, which is highly probable, there is likely to be little confusion. But results would be of greater comparative value if a general agreement were reached.

A distinct step in advance has been made by Luther

---

[13] "Colloids and Flotation," Technical Paper 200, U. S. Bureau of Mines.

[14] *Eng. and Min. Journ.*, Nov. 23, 1918, p. 899.

[1] "Artificial Pebbles for Tube Milling." By A. W. Allen, *Eng. and Min. Journ.*, June 8, 1918, p. 1038.

W. Lennox, whose interesting paper,[2] describing a method of determining the comparative friability of ores, will suggest a simple system of eliciting facts which will materially influence the design of crushing plants and will aid in the work of forecasting, with greater accuracy than is possible at present, the equipment necessary.

PROGRESS IN BALL-MILLING PRACTICE

Advance in ball-milling practice has centered in a wider recognition of the merits of outside classification and closed-circuit operation. In addition, large-scale results tend to show[3] that it is not good practice to ignore the efficiency of a crusher for primary reduction and expect results from a ball mill fed with too coarse a product. This has led to even greater attention being paid to classifying and screening devices, and to a closer control of adjustment based on calculation of efficiency of operation. A sizing analysis without any information as to tonnage to which it refers is valueless when two or more products are being made. An exact calculation from a formula shows the precise efficiency of separation; and it is only after this is obtained that logical steps can be taken to improve results where improvement is possible.

The reports of a large number of experimental tests and the publication[4] of discussions and personal opinions have resulted in a better understanding of the situation and the elimination of many prejudices and generally accepted though unsound theories.

Future improvement in ball milling will be concerned chiefly with the prevention of sliming in those cases (e.g. amalgamation, gravity concentration, and flotation) where it is undesirable. Progress in metallurgy in 1918, in many instances, proved the contention that metal or mineral should not be reduced in size beyond that required to free it from the accompanying gangue. To do so is to invite an otherwise avoidable loss.

The ball mill has come to stay. Its simplicity has appealed to all concerned, but its efficiency as a machine to deliver an even grade of product without any appreciable production of fines, i.e. material passing a mesh below the necessary minimum, still leaves something to be desired. There are numerous instances where it is maintained that sliming is immaterial. There are more cases where the production of slime involves a loss in residue or an extra expense in treatment. In those instances where sliming should be avoided it is pertinent to draw attention to the fact that, whatever the rate of feed through a ball mill of ordinary design, a certain amount of material will be ground to the required size within a few inches of the feed end, in addition to an additional proportion that must, of necessity, be introduced with the feed. The discharge of the already ground material should be immediate. Further unnecessary and harmful reduction can be lessened by shortening the length of the mill, but there is no method of absolute prevention without the adoption of some scheme of positive separation, such as peripheral discharge through a screen.

In early flotation work it was often maintained that sliming the mineral resulted in no ill effects, and that a feature of the new process was that a mixed feed was most suitable. As with all innovations, a number of enthusiasts predicted that flotation would entirely displace table concentration, just as others still persist in celebrating the demise of the amalgamation process, which, in certain circles, is believed to have occurred when cyanidation was introduced. To achieve this consummation, the promiscuous sliming of ores was beneficial in both instances, reducing the efficiency of the older process to a point where it was comparatively easy to argue the superiority of the more up-to-date method. There are, however, a number metallurgists who are unwilling to share the infectious optimism that pervades the atmosphere whenever a new process is under consideration. So long as a metal or mineral can be extracted in its original state of purity, they argue that a preliminary saving should, wherever possible, be made by positive means and methods without unnecessary reduction in particle size. The logic is not unsound; it is far less so than the inference that, because a ball-mill product may be unsuitable for either amalgamation or table concentration, therefore both these phases of treatment should be abolished.

A ball mill built so that the pulp, after it can pass a punched screen, is automatically classified, and the oversize returned, is, theoretically speaking, an ideal apparatus; and improvements and simplifications in the design of the original Krupp type of ball mill may be anticipated in an effort to supply a real want.

SIZING FOR CONCENTRATION

The relation of ample preparation to the efficiency of concentration was discussed from two aspects during 1918. In one paper,[5] dry sizing as a means of preparing feed for concentrating apparatus is advocated. The disadvantages in such a system are well known to all engineers who have had experience with dry-crushing mills, but the fact that dusting can now be reduced to an almost inappreciable quantity with certain types of apparatus is seldom recognized. The advantages of dry sizing are seen in (1) ease of control of subsequent pulp dilution to exactly suit the requirements of the concentrating machine, and (2) the improved results obtained as a result of positive separation into sizes by means of screening. The efficiency of hydraulic classifiers is often poor, and screen separation into sizes is certain to produce more satisfactory results.

As soon as the inefficiency of many installations of classifiers is realized, there will doubtless be a reaction. Screening apparatus will then receive the attention it may be said to merit, and there will be a wider recognition of the feasibility of wet as well as dry separation by such means, although, of course, within narrower limits as regards the finer sizes. The advantages of sieve separation have been emphasized[6] in a suggestive paper on the mechanical screening of wet pulp in which attention is drawn to the unsuitability of classifying particles according to weight, rather than size, as a preliminary to concentration, and suggesting the advisability of replacing hydraulic classifiers with screens in certain instances.

---

[2] *Trans.* A. I. M. E., 1918.

[3] E.g., "Changes in Alaska Juneau Mill," *Eng. and Min. Journ.*, Aug. 24, 1918, p. 352.

[4] C. T. Van Winkle, E. H. Kennard, A. E. Wiggin, Parke Channing, and B. B. Gottsberger, *Trans.* A. I. M. E., 1918; A. Del Mar, *Eng. and Min. Journ.*, July 6, 1918, p. 14; D. H. Fairchild, and Editorial, *Eng. and Min. Journ.*, Aug. 17, 1918, p. 310; F. E. Marcy, *Eng. and Min. Journ.*, Sept. 7, 1918, p. 451; E. W. Lawler and A. Tellam, *Eng. and Min. Journ.*, Sept. 28, 1918; p. 582.

[5] "Dry Sizing as a Means of Preparing Feed for Concentration." By George V. Bland, *Eng. and Min. Journ.*, May 18, 1918, p. 908.

[5] "Mechanical Screening of Wet Pulp." By H. A. Megraw, *Eng. and Min. Journ.*, Sept. 21, 1918, p. 522.

When vibratory screens were first introduced, the heavy duty required was seldom realized, with the result that there were frequent breakdowns. Standard apparatus in this direction has, however, been mechanically perfected during recent years. In proportion to screen area, the output is exceptionally high, and the separation is made by positive methods which insure 100% efficiency in all the products except the final oversize, which sometimes carries a small percentage of fines. Misapprehension exists as to the large tonnage which can be put through a modern vibratory screen equipped with a comparatively small area of screen cloth; but the fact is often overlooked that a deep bed of feed is permissible because the vibration of the screen tends to stratify the grades into layers, the coarsest coming to the surface of the bed and the finest accumulating near the screen. The high capacity of such an apparatus is partly due to the vibratory action, which tends to keep the apertures open, but it is mostly to be attributed to the stratification produced by the motion, which, in itself, results in a primary classification into sizes.

Heating Ores as a Preliminary to Reduction and Metallurgical Treatment

Interesting data have been published[7] on the results, from the mechanical point of view, of heating ore preparatory to crushing. A number of tests demonstrated that heating (to about 800° C.) makes the ore easier to crush; and that heating and quenching leads to a still greater friability. The principle is neither new nor unrecognized, but the figures given are informative. By comparing the outputs of a standard crushing machine with raw and treated material, respectively, it was found that, with three classes of Cornish tin ores, a preliminary heating and quenching treatment resulted in an increase in output varying from 65 to 313%. It was also demonstrated that the effect of heating, and still more of heating and quenching, is to yield a crushed product with a greater proportion of middle-sized particles and a smaller proportion of fine slime.

Roasting Destroys Colloidal Envelope

Roasting or heating an ore prior to crushing or grinding has seldom or never been attempted other than in the case where the elimination of some interfering element or compound was desirable. From the mechanical point of view, however, there are several features of interest. Roasted ore may be ground finer than raw ore and still be in excellent condition for leaching treatment. The heating or roasting tends to change the physical characteristics of the colloidal portion of the ore, with the result that absorption is considerably decreased, and the final displacement of dissolved metal is made with greater facility. A second advantage of roasting is the reduction in weight of material to be crushed, and the possibility of recovering a valuable byproduct from the gases evolved during the process.

In one instance in the tests quoted there was little advantage to be seen in quenching after heating. In similar cases the preliminary heating or roasting of the ore would result in a product in ideal condition for dry crushing. In other cases where experimentation showed that quenching would result in a material increase in friability, the advantages of wet crushing would be obvious.

An important adaptation of roasting is seen in the new Caron process for the treatment of manganese-silver ores[8]. The MnO_2 is converted into MnO by means of a reducing roast in a revolving kiln, and cyanidation is then found to be economically practicable. In the case of the low-grade manganese silver ore of the Buffalo-Hunter Mining, Milling and Development Co. less than 15% of the silver can be extracted by direct cyanide treatment, though after the reducing roast the amount reaches 85 per cent.

Bismuth

By W. R. Ingalls

Most of the bismuth of the world is obtained from Bolivia, where it is produced as crude bullion, which goes to London for refining, the well-known firm of Johnson, Mathey & Co. being specialists in that. For many years, that concern, together with some German producers, had an absolute control of the world's market, and they were very dictatorial about it. In recent years a considerable quantity of bismuth has been produced in the United States as a byproduct of electrolytic lead refining. The American producers are supposed to have an understanding with Johnson, Mathey & Co., but that is only a surmise, for all parties preserve great secrecy. It is safe to say, however, that anyone who is contemplating the competitive production of bismuth should be careful as to his movements.

In general, the pyrometallurgy of bismuth is similar to the metallurgy of lead, but a great deal of skill is required in adequately refining the crude metal, and the value of refined bismuth varies greatly according to its character. The best grade of the metal is that which is used for pharmaceutical purposes, which constitutes the major consumption, and commands a price that is far superior to what is fetched by ordinary metal, suitable for making fusible alloys and for other industrial purposes.

The electrolytic lead refiners recover bismuth in their slimes when they are working up lead bullion that contains any bismuth. What is the procedure in recovering bismuth from the slimes, I do not know, nor has it been described in technical literature, but no doubt the process is more or less intricate. In brief, the essential part of the metallurgy of this metal, viz. the refining, constitutes an art that very few persons know about, and they have taken very good care to keep the knowledge to themselves.

Bismuth prices do not fluctuate greatly. During 1917, the price was $3.50 per lb. for the last half of the year; in 1918, in February and March, the price dropped to $3.35 per lb., but returned to $3.50 per lb. and held there during the remainder of the year.

---

[7] "Effect of Heating, and Heating and Quenching, Cornish Tin Ores Before Crushing." By Arthur Yates, *Trans.* I. M. M., 1918.

[8] Communicated by Harry Wolf, consulting engineer, Denver, Colorado.

General Review of Mining in the United States In 1918

A SHORTAGE of labor, increasing wages, and high costs all around were conspicuous features of the mining situation in the United States during 1918, as they were of American industry in general. The labor scarcity was at its worst in the late autumn, owing to the universal epidemic of influenza. Before the year had closed, however, the sudden termination of the war released men to such an extent that many camps were able to obtain their desired quota. Conditions in gold mining, already bad in 1917, became worse in 1918, and, with the closing down by one company after another, the outlook for gold production was most unpromising. The situation in this regard was somewhat easier at the end of the year. Advancing smelting charges, together with the increased freight rates that became effective on June 25, put additional burdens upon producers.

The campaign to increase the production of war minerals, begun in 1917, continued with increasing effectiveness in 1918, imports still being restricted, until in the case of chromite an oversupply was discovered, and cancellation of contracts for other minerals, due to the armistice, left producers in the lurch. The War-Minerals Act, signed on Oct. 5 after prolonged discussion, was intended to stimulate production, but proved needless. Up to the end of 1918, financial aid for those who had engaged in producing such minerals did not appear possible under the act.

ARIZONA

The copper situation in Arizona throughout 1918 is the subject of a separate article appearing elsewhere in this issue. The various camps throughout the state operated steadily, being virtually free from strikes during the year, in notable contrast to conditions in 1917. Only one strike of importance occurred, that in February at the Hayden plant of the American Smelting and Refining Co., and the trouble was quickly settled. Copper production increased markedly, despite the labor shortage. Thousands of skilled mechanics and miners were taken away for Government work and by the draft. However, the need for mechanics was lessened by restrictions on new construction and by the high cost of supplies. The regular influx of Mexicans in the spring was augmented by high wages and by unrest in Mexico. Many had left the United States fearing the draft. In the September registration, the matter was better understood. Influenza made inroads in the autumn, as elsewhere. At the end of the year, the gold mines of the Oatman district were reported to have their full quota, which was generally true throughout the state, due in part to the return of workers from war industries and to the annual winter migration of workmen to the southern climate.

New projects completed included the Ray Hercules mill, United Verde Extension's new smeltery at Verde, and the dry process plant of the U. S. Vanadium Development Co. The latter property was leased to the Allied Metals Co., of Denver, for 10 years. The Gold Road mines, in Mohave County, built a 300-ton crushing plant, and the Hackberry Silver Mining Co. a 200-ton concentrator and power plant. Milling plants were also erected by the Yucca Tungsten Mining Co., the McCracken Silver-Lead company and the Arizona Ore Reduction Co., all in the same county. The Standard Minerals Co., at Kingman, erected a test mill for floating molybdenite ores. The Flux and the World's Fair mines, in Santa Cruz County, also erected mills. A mill site was graded near Warren by the Copper Queen Branch of the Phelps Dodge Corporation, and much of the Sacramento Hill overburden stripped by shovels. Erection of a 500-ton experimental flotation plant was begun by the New Cornelia company.

Most of the transfers of mining property in Arizona during 1918 were by way of working bonds. The American Smelting and Refining Co. added the Sasco smeltery and the Silver Bell-Red Rock railroad to its purchase of the Imperial mines. The World's Fair group, near Patagonia, and the George Washington group, in Mohave County, changed hands. The Shannon Copper Co. took over the Yeager Canyon property at Prescott. Magma Chief acquired the Sombrero Butte holdings and closed down its operation at Superior. Ray Broken Hills Mining Co. bought the Sherlock Schillings group. Transfer of property and the increase in small stock companies, so prominent in 1916-17, were noticeably lacking. The Schuylkill Mining Co. purchased the adjoining Tennessee mine, a lead-zinc producer practically worked out. The Golconda mine, a zinc property in Mohave County, shut down. According to the U. S. Geological Survey, considerable zinc shipments came from the Duquesne property, in Santa Cruz County, and from the Hillside property, in Yavapai County.

In the latter part of 1918 there was a betterment in car supply. Economy was effected by substituting motor trucks for wagons in hauling ore to railroad points. Transportation was further improved by the construction by Ray Hercules of three miles of track to its mine and mill at Hercules, and by a railroad extension from Clarkdale to United Verde Extension's new smeltery at Verde. Work still in progress at the end of the year included a switchback road from the Verde Valley up to United Verde's old smeltery site above Jerome, also a broad-gage line to the main shaft of Verde Extension through its 12,000-ft. tunnel.

The only legislation affecting mines by the Arizona Legislature was a bill originally intended to prevent vagabondage, but amended to cover such matters as the Bisbee deportations. This became law without the Governor's signature. A memorial to Congress asked for a grant of 640 acres to discoverers of oil. A workmen's compensation act was defeated.

CALIFORNIA

Mining in California in 1918 was pursued on a wider and more varied scale than ever before. Gold mining suffered. But the state, ranking high as a producer of tungsten, chrome, magnesite, and other war minerals, was able to respond to the great demand for them. Results were good at first, but the ending was unprofitable for many. Thirteen out of 19 companies producing magnesite in 1918 shut down before the close of the year, owing to market conditions. As for chrome, the market disappeared before the armistice was signed. Overproduction of tungsten became apparent in October, with its consequent effect upon operations.

During 1918, about 47 gold dredges were in operation, 22 of them by two companies, the Natomas Consolidated and the Consolidated Goldfields. Operations were confined principally to the American and Feather rivers. Natomas' Feather No. 2 dredge, at Oroville, shut down after 10 years' operation. The Pacific Gold Dredging Co. closed its No. 4 dredge at Oroville. A new dredge was launched at Trinity Center by the Estabrook Gold Co. La Grange hydraulic gravel mine, in Trinity County, was shut down, as was the Excelsior Gravel mine, in Placer County. Various other properties were similarly affected. A set of safety rules for gold dredges was prepared by the State Industrial Accident Commission.

The Grass Valley district was active to the end. The North Star mines operated at a small profit, with milling curtailed. In Amador County, the Fremont mine shut down. Both the Old Eureka and Central Eureka deepened their shafts, the latter taking good ore from the lower levels. The gold situation generally improved at the end of the war.

Chrome mining was active in Siskiyou and many other counties until the market changed. Steps to aid chrome production by road building were taken by the Government through the Forestry Service. Chrome on railroad land was held by the U. S. Land Office to be open to location.

The main Mammoth property, at Kennett, underwent development. The 40-stamp mill of the Keystone Copper Co. at Kennett lost only 17 hours' running time in the first six months. A large copper production was maintained by the Penn Copper Co., Calaveras County, and by the Iron Mountain and Hornet mines of the Mountain Copper Co., at Keswick. Development of the Walker mine, at Portola, was pushed, and a tunnel started from mill to mine.

The Tomboy lead-silver property was opened at Lone Pine, Inyo County. Silver mining was resumed after 20 years at the Silverado mine, in Lake County. The Crystal mine, in Shasta County, was relocated as the White Star and opened after 30 years' idleness.

Tungsten production was maintained by the Atolia company, in San Bernardino County, and by other properties. The Noble Electric company shipped manganese from the Crescent Mills region to the Heroult smeltery and also developed it in the Tesla district in Alameda County. Many other properties also produced tungsten. Pumice stone was produced in Siskiyou County, lithia ore in San Diego County. Graphite was shipped by the California Graphite Co. at Los Angeles. Quicksilver mining was active and miscellaneous other minerals were produced to some extent, particularly potash at Searles Lake.

Various properties changed hands. Anaconda acquired the Walker, at Portola, and the Pacific Gold Mines Corporation took over the Dutch-Sweeny and App properties, in the Jamestown district. Allison Ranch was operated by Grass Valley Consolidated. The Keystone Copper property, at Kennett, was sold to the U. S. S. and R. Co. A Los Angeles syndicate bought the Armada Tungsten holdings at Inyokern. The Bloomer Hill property, at Oroville, was purchased by the California National Gold Mining Co. At the end of 1918, the Idaho Maryland mine, at Grass Valley, was sold to Eastern interests. The increase in the use of motor trucks was notable.

Colorado, Utah and Idaho

Mining in Colorado, Utah and Idaho will be reviewed in detail in separate articles in the following issue. In Colorado, 1918 was unprofitable on the whole, conditions bearing extremely hard on small producers. Federal regulation was at its worst. Fixing of the silver price proved less advantageous in the end than it had seemed at first. In general, development was retarded by labor shortage, especially at Cripple Creek. The more important developments were the new Camp Bird lower crosscut tunnel; the work of the U. S. Smelting interests in the Sunnyside mine, in San Juan County; fluorspar operations in the Jamestown district; and the work on oil-shale properties near De Beque and Grand Valley. The closing down of the Leadville unit of the United States company was a blow to that district.

Mineral production in Idaho was in 1918 probably 20% less than in 1917, according to R. N. Bell, due to the same causes that affected mining elsewhere. Mines secured their labor quota after the armistice, but, owing to the uncertainty of the market, displayed a tendency to curtail production. In Utah, the tonnage and value of the output were considerably less than in 1917. There was a marked decrease in leasing, caused by the high wage rates and the cost of supplies. A tax on net proceeds of mines, levied in 1917, met solid opposition when it became payable in 1918. Western Utah Copper and Columbus Rexall entered the list of dividend payers.

Michigan, Minnesota and Wisconsin

A general review of iron mining in the United States will be found elsewhere in this issue; likewise a résumé of operations in the copper country of northern Michigan. Zinc mining in Wisconsin is also separately covered. Comparatively little prospecting was done in Wisconsin, and power shovels helped offset the labor shortage.

Missouri, Oklahoma and Kansas

Lead and zinc mining in Missouri is discussed in detail in special articles in this issue. The zinc districts of Kansas and Oklahoma are also the subject of a separate article on another page. In the latter part of 1918 the Oklahoma Ore Storage Association, at Picher, undertook the construction of warehouses for the purpose of storing zinc ores. It was planned by the organization to develop independent markets abroad for sulphide ores. In Missouri, there were few new developments, but practically every mine in the state was in operation during 1918. Labor was scarce, as elsewhere.

MONTANA

Until the armistice, the Butte and Philipsburg districts of Montana shipped an average of 600 tons each per day of manganese ores to Eastern steel companies, namely, the Tennessee Coal, Iron and Ry. Co., Carnegie Steel, Cambria Steel, Billrowe Alloys, Burgess Minerals, National Carbon, Lavino, and Miami Metal companies. The market stopped suddenly with the armistice, causing hardship to producers and throwing about 1000 men out of work. The largest body of manganese ore developed was in the Emma mine, at Butte, which in October produced 10,000 tons. In Philipsburg, the largest producers were the Philipsburg company and the Western Ore and Mining Co., each with a monthly output of about 3000 tons. At the request of the Government, Anaconda erected a $750,000 ferromanganese plant at Great Falls, with five furnaces. Started on Oct. 15, it shut down on Dec. 6 without having sold one pound of the 1000 tons of ferro made. The undertaking of this project had given impetus to the search for manganese ores.

Mining and development work were pushed vigorously in the Butte district throughout 1918. Anaconda's High Ore mine resumed operations in January, after the shut-down due to the Modoc fire, but was later closed down to fire-proof the shaft. The Alice mine was down three months. Both properties resumed before the end of the year. Sinking was pushed at the Mountain View shafts and at the Belmont and Original mines. Butte & Superior reduced its operations 50% in December, when Anaconda suspended receipt of custom zinc ore. The Davis Daly drove the Belmont crosscut in the Colorado mine and opened copper-silver ore on the 2300 and 2500 levels.

In Jefferson County, the Legal Tender mine changed hands; the 500-ft. shaft was retimbered, unwatered to the 200 level, and drifting begun. The Amalgamated Silver Mines shipped silver ore; the controlling interest was sold, the purchasers taking steps to develop the Free Coinage mine. The Mount Washington mine, at Wickes, an old silver producer, was opened up and shipped some galena. The Angelica made daily shipments. The Economy, at East Helena, installed a new mill, and the Comet at Boulder did development work. Mining was active in Lewis and Clark County. Gold dredging yielded a smaller output. The Snowstorm, in Lincoln County, began a 2200-ft. tunnel. In Beaverhead County, the Pearl Smith shipped graphite ores for Government use. The Southern Cross mine, at Georgetown, made a good production of gold.

Properties that changed hands included the Butte Central, bid in by Anaconda; the Margaret claim at Butte, sold to New York interests; the Polaris mine, near Dillon, sold to the new Silver Fissure company; the Crystals Copper property, optioned to Crystals Goldsmith Co.; the Butte Copper Czar; and the Ophir mine and mill, taken over by the newly formed U. S. Manganese Corporation. The Barnes King leased and optioned the Mount Pleasant mine and also operated the Shannon and Piegan-Gloster mines.

Butte & Superior won its case against Minerals Separation, but lost to Elm Orlu in regard to extracting the latter's ore. The former case was later ordered reopened. Damage suits against North Butte for deaths in the fire of June 6, 1917, were thrown out of court.

NEVADA

Much activity was displayed in most districts in Nevada during 1918. Labor shortage caused a decrease in production of all major metals. Discovery of high-grade ore in the Tonopah Divide mine stimulated development in that section. Deep development in the Comstock mines was rewarded with a large gold production.

The Unevida company worked old Comstock tailings from the Carson River bed. The important copper producers maintained a steady output, Nevada Consolidated and Consolidated Coppermines, in White Pine County, leading in production, and the Bluestone and Nevada Douglas companies contributing a good output.

In Clark County, the Yellowpine district yielded a large tonnage of lead and zinc ore, leading in the production of the latter. The Yellowpine mine installed a new crushing and sorting plant. The Sultan dry concentrator, at Goodsprings, was enlarged, and the Boss mine shipped ore carrying platinum to the Palau Metals Co., in Los Angeles. Manganese mining was active around Las Vegas, and vanadium ore was shipped from the Mountain Top property.

In the Searchlight district, the Wesselhoft Copper began shipments of copper glance ore. The Big Casino mine rebuilt its mill, adding a flotation unit, and shipped a high-grade concentrate. Leaching tests were made on Quartette low-grade copper ores with success. The Techatticup mine discovered a rich new oreshoot. In Lincoln County, the Prince Consolidated shipped a large tonnage of fluxing iron-manganese ore. The Virginia Louise property resumed operation and improved its plant.

The Silver Dyke, at Sodaville, and the Edmunds Buchanan group at Winnemucca shipped tungsten ore to the mill at Toulon. Sulphur was mined by the Nevada Sulphur in Humboldt County; also in the Cuprite district of Esmeralda County. Rochester Combined completed its mill. A good oreshoot was opened on the Spearhead property. In the Jersey section of Lander County, the Farretta cinnabar company started a new reduction plant. Oil shale was discovered near Eureka. Antimony was shipped from the Austin district by the Nichols-Layng Chemical Company.

The Bluestone property at Yerington was sold to the Dominion Reduction Co., of Canada. The Nevada Hills mine, at Churchill, changed hands, as did the old Harrold property at Spruce Mountain. Claims near Rose Creek in Humboldt County were purchased by the Pacific Tungsten Co., and the Como Consolidated, in Lynn County, was taken over by Truett, Taylor & Bonneau, of New York. The Hoosier property at Goodsprings was acquired by Los Angeles interests, and the Manganese Association at Las Vegas was leased for three years. A receiver was appointed for Nevada Austin. Manhattan White Caps won its suit against Manhattan Morning Glory, the latter being restrained from sinking on former's ground.

NEW MEXICO

The Chino Copper and Burro Mountain Copper companies operated steadily during 1918. The former company purchased about 40 claims of the Hermosa Copper Co. At Hanover, the Empire, Republic and other mines shipped zinc ore and the Hanover Bessemer, iron ore. A new shaft was started by the Republic company; also by the United States Copper Co. At Steeple Rock, the Carlisle plant shut down, the mill being restarted later. Erection of a cyanide mill was begun by the Mount Royal company. At Pinos Altos, development of the Calumet property was undertaken; the Cleveland mill ran steadily.

At Lordsburg, no great labor shortage was experienced. Manganese and fluorspar properties were opened in the vicinity. Truck lines for hauling ore were established to both Red Rock and Cap Rock. The Viola and Last Chance properties were taken over by Pittsburgh interests and a 50-ton mill put into operation. The Lawrence Mining Co.'s lease on the Bonney mine expired, and the owners began blocking out milling ores preparatory to erecting a mill; steady shipments were maintained. Exploration of Southern group showed good milling ore. Great Eagle mine, at Red Rock, attained a monthly production of 600 tons of high-grade fluorspar. Cap Rock mines made monthly shipments of psilomelane.

In Taos County, the R. & S. molybdenite property developed ore and rebuilt its flotation mill. The Grubnau zinc oxide plant, in Santa Fe County, operated continuously. At Mogollon, in Socorro County, the Socorro mill was burned, but quickly replaced.

SOUTH DAKOTA

Development work was practically at a standstill throughout 1918 in the Black Hills district of South Dakota, owing to acute labor shortage, especially of shovelers, despite increased wages. Golden Reward suspended early in the year. Homestake maintained full tonnage until October, when Mineral Point mill, having 100 stamps, shut down, followed by Golden Star mill, with 200 stamps, on Nov. 1. At the year's end, Homestake was operating at about 70% of normal tonnage and with a much smaller proportion of deep-level ore produced.

The Mogul, at Terry, built 1600 ft. of tramway from tunnel to mill bins. Mogul and Trojan both operated below normal capacity. Bismarck was worked on lease for gold and tungsten for several months. Custer Peak enlarged its main shaft and purchased the Jungle property. Tinton resumed after 10 years' idleness. The Titanic started a 1200-ft. tunnel, and the Cutting, at Deadwood, erected a shafthouse and prepared to sink a shaft.

In Pennington County, the Keystone shipped mica and lithia ores. The Bob Ingersoll changed hands and shipped columbite-tantalite ores, also recovering amblygonite, for which there was no market. The American Tin and Tungsten Co., at Hill City, remodeled its tin mill; a new hoist was installed at the Cowboy mine. In Custer County, the Rare Minerals Co., at Custer, installed a 50-ton concentrator to handle tin and tungsten ores. The Old Mike mica mine was sold to the Berne Mica Corporation.

OREGON

Labor shortage was marked in Oregon in 1918. Chrome mining was vigorously carried on, especially in Josephine and Jackson counties, many deposits being opened in the latter. Several hundred miles of wagon roads were built to market these ores. From September on, the market for chrome and manganese ores became demoralized, the latter having also been mined to considerable extent.

Gold mining fell off, particularly dredging, three dredges being in operation at the end of the year. In the Gold Hill region, only three properties were under development, namely, the Sylvanite, Whitney, and Nellie Wright. The Rainier Mercury Co. took over the Utah Mercury Co.'s claims and increased its number of retorts. In Baker and Grant counties, a large gold production was made.

In Baker and Josephine counties copper mining was active. The Alameda Copper Co. at Grant's Pass began the erection of a 200-ton concentrator and a 150-ton blast furnace. At Homestead, the Iron Dyke company began sinking, and the Azurite blocked out ore carrying zinc, lead, silver, and copper.

WASHINGTON

Shipbuilding drew heavily upon the mine-labor supply in Washington in 1918, conditions improving after the armistice. The Northport lead plant early resumed operation and ran steadily, though with a falling off in output in the latter part of the year. The Tacoma smeltery steadily sought siliceous ores and silica for fluxing purposes. Shipments of war minerals, except magnesite, were small. Transportation was improved by the introduction of motor trucks on highways built over the routes of former roads. Little roadbuilding was done within the year, owing to war restrictions.

Development of magnesite deposits in Stevens County was rapid, the Northwest Magnesite Co. and the American Mineral Production Co. being the only producers. The Neutral group, at Chesaw, Okanogan County, shipped iron ore to the calcining plant of the Northwest company. The Republic district shipped gold ore steadily, the Lone Pine-Surprise, Last Chance, and Knob Hill being among the more active properties. The Boundary Red Mountain Co. was inactive. Properties shipping copper ore included the United Copper, Copper World Extension, Lone Star and Washington, Loon Lake, and Reardon. The Sunset was reopened on a moderate scale; a 150-ton mill was completed in August and operated; railroad connection was made with mine and mill. The Belcher mine changed hands. The Tago mine began production. The United Copper ceased shipments to Trail and signed a contract with the Tacoma smeltery.

In the Metaline district, the Lead Zinc mine shut down. A three-year option was taken by the Diamond R company on the Diamond R and Bella May properties of the Spokane Lead Co. The Electric Point mine near Northport began erecting a tramway. Tin was discovered on Moran prairie south of Spokane.

TEXAS

Quicksilver mining and the sulphur production of the Freeport Sulphur Co. were the notable operations in

Texas in 1918. Quicksilver producers included the Chisos, Warfa, Mariposa, and Big Bend mines, at Terlingua, and the W. K. Ellis mine, near McKinney Springs. Exploration and development of sulphur deposits in Culberson and Reeves counties continued. The Presidio silver mine operated continuously, according to the U. S. Geological Survey, and desultory mining was carried on in the Van Horn and Sierra Blanca districts. The state's output of silver was 590,000 oz. Small shipments of copper were made from the "Red Beds" of Foard and Knox counties. The Texas Copper and Refining Co. was incorporated to exploit these beds. In Burnet County, the Southwestern Graphite Co. started an electrostatic-process mill and purchased flotation equipment to treat graphite dust.

ARKANSAS

The Batesville manganese field of Arkansas was active in 1918, investments for the year exceeding the total up to the beginning of the year. A steady production was maintained. Shortage of labor restricted the output and affected the installation of washing plants. Until 1918, most of the ore produced was nugget ore, mined with pick and shovels. During 1918, the big deposits of wash, or fine ore, were the main attractions for the larger operators, who spent most of the year in proving such bodies and designing plants to prepare the ore for market. The finer contents were lost with log washers and screens, so Joplin-type jigs were installed. Jigs and washers were found the most efficient combination. Only a small tonnage of concentrates was shipped. Labor shortage was overcome to some extent by using steam shovels.

In the zinc field of northern Arkansas, the largest production came from the Zinc camp in Boone County. With the shipping point close by, and mining done mostly in ground requiring little powder, operations were profitable. Practically all the output was sold on the open market.

KENTUCKY AND OTHER STATES

Wages advanced in the fluorspar district of Kentucky over 100% in 1918, but failed to draw sufficient labor. Car shortage and railway embargoes in the first quarter interfered with shipments. Motor trucks largely supplanted wagons for haulage to shipping points. Fluorspar was classed as a war mineral too late to stimulate its production. Many properties changed hands during 1918 in both the Kentucky and Illinois portions of the fluorspar district, but no substantial new producers were brought in. The chief development brought about by the entrance of new capital was the reopening of old mines. The one transaction of importance during 1918 was the sale of the Kentucky Fluorspar Co., with other mines differently owned, namely, the Susie Beeler and Mary Belle, to one holding company, for $500,000, which company has not assumed a corporate title. Several new concentrators were built, and there was a marked advance in installing more substantial machinery and mine equipment. One important development was the change, on a large scale, from steam to crude-oil-burning plants and electrical installations for pumping.

In Tennessee, operation in the Ducktown basin was steady throughout 1918. Many small manganese properties were under development in Johnson and Carter counties. In Virginia, manganese mining was pursued in various localities. The Crimora company put both mills in operation. In Georgia, the Chestatee Pyrites and Chemical Co. started an experimental mill, built 10 miles of railroad, and enlarged its hydroelectric plant. In North Carolina, the Moody Mica Co., at Franklin, was sold to Philadelphia interests after producing $40,000 worth of mica. In Maine, the old Douglass property, at Blue Hill, was developed by the American Smelting and Refining Co.; 100-150 tons of chalcopyrite was mined and milled daily and the concentrates were shipped to Perth Amboy.

ALASKA

According to the advance statement of the U. S. Geological Survey, the value of Alaska's mineral output in 1918 decreased $12,000,000 from that of 1917 and was the smallest since 1914. The decrease was chiefly in copper and gold, and was due to shortage of labor and ships and to high costs.

Fourteen copper mines were operated, against 17 in 1917. Six mines in the Ketchikan district yielded 1,781,000 lb.; four in the Prince William Sound district, 15,060,000 lb.; and four in the Chitina district 52,585,000 pounds.

About 28 gold dredges were operated in 1918—20 in Seward Peninsula, three in the Iditarod district, two in the Fairbanks district, and one each in the Circle, Yentna, and Kuskokwim districts. About 25 gold-lode mines were worked, compared with 31 in 1917.

About 94½ tons of cassiterite, containing 113,000 lb. of tin, was mined during the year. Most of this came from the York district, Seward Peninsula, where one dredge was operated. Stream tin was also obtained by sluicing at one mine in the district and at several mines in the Hot Springs district.

Palladium was produced for the first time, coming from the copper ore of the Salt Chuck mine, near Ketchikan. Platinum also was derived from this ore, as well as from the gold placers of the Dime Creek district, on Seward Peninsula. The new Salt Chuck concentrator is said to have operated successfully.

In the Juneau district, the Alaska Gastineau, Alaska Juneau, and Ready Bullion mines were operated steadily, though at reduced capacity. In the Sitka district, the Chichagoff mine ran throughout the year, and development work was done at the Hearst Chichagoff.

In the Copper River region, the Kennecott Bonanza and Jumbo mines were operated steadily, except for a two-weeks' shut-down at the Bonanza. Jumbo shipments were curtailed for six weeks. The ammonia-leaching plant at the end of 1918 was able to treat all the concentrator tailings.

The Mother Lode shipped ore during the winter, and continued shaft sinking. The Nugget Creek mine of the Alaska Copper Corporation was operated part of the year, and shipped ore and concentrates. The North Midas Copper Co.'s gold mine was operated part of the year.

In the Cook Inlet-Susitna region, the chromite mine at Port Chatham was operated throughout the season, producing somewhat more than in 1917. A wharf and tramway were built, and a stamp mill was installed. Chrome discoveries were reported on Peters Creek.

Mining in Ontario in 1918

BY THOMAS W. GIBSON*

WHEN all the figures are compiled, it will probably be found that the value of the mineral production of the Province of Ontario during 1918 will considerably exceed that of any previous year. The staple metals of Ontario are nickel, copper, silver, and gold. The first two were produced in greater quantity than ever before. Gold will show a slight increase over 1917, but a reduction as compared with 1916, whereas silver will show a falling off of about two million ounces. The prices of nickel and silver have both advanced; the price of copper has receded, and gold, of course, remains stationary. The net result is a decided increase in the aggregate value of these metals.

Gold Production Increased

The production of gold in 1917 was valued at $8,698,735; in 1918 it was about $9,200,000. This increase of about 5 or 6%, although not great and made in face of the severe and accelerating handicap under which gold mining has been laboring for the last four years, shows the essentially sound position of gold mining in the province. The main gold field is that of Porcupine, where only two mines, the Hollinger and McIntyre, remained in operation throughout the entire year. The mill at the Dome mine, normally a large producer, was idle for all of 1918, and Porcupine Crown, Schumacher, and Vipond-North Thompson were likewise unproductive for most of the year.

At the Kirkland Lake camp six mills are now in existence. At the Lake Shore mine, milling operations began in March, and, up to the end of September, 11,253 tons of ore had been treated and a recovery of $271,265, or $24.10 per ton, had been obtained. The Kirkland Lake's new mill started work in December. The Patricia, at Boston Creek, and the Davidson, at Porcupine, were also new producers in 1918. At Boston Creek a new find of gold telluride on the Miller Independence attracted considerable attention.

Hollinger Operates at Half Capacity and McIntyre at Full Capacity

The Hollinger mine, at Porcupine, is preëminently the leader in gold production in this province, and is, in fact, one of the great gold mines of the world. In 1918 it yielded in bullion about $6,200,000. Up to the end of 1918 its total output was about $26,000,000, and it has paid over $9,000,000 in dividends. The mill operated 100 stamps during the year, or half capacity. Scarcity and inefficiency of labor, combined with high wages and increased cost of supplies, were formidable obstacles, yet the mine was kept in operation and made good profits. The new central six-compartment shaft was placed in service down to the 800-ft. level, and sinking was continued to the 1250-ft. level. P. A. Robbins, director and general manager of the mine from the beginning, resigned to join the United States overseas forces, and was succeeded by A. F. Brigham.

The McIntyre mine continued its active development and operated the mill at capacity. The property now includes what was formerly the McIntyre property, the Pearl Lake, the Jupiter, and Plenaurum, and an option has been taken on the Newray. Production in 1918 was about $1,600,000. Ore reserves of June 30, 1918, were $4,490,432. At the Dome mine, although the mill was closed, underground development was continued. The Dome Lake and West Dome operated for a few months only. In the northern part of Whitney Township, the Davidson property was worked with fair regularity throughout the year, and apparently with favorable results. At the more recent gold-mining camps, Fort Matachewan and Lightning River, development work has been continued, but they have not yet reached the producing stage. The Otisse claims, in the former field, give much promise.

Value of Silver Production Second to Banner Yield in 1912

Silver production for 1918 was 17,500,000 oz., with a value of about $16,675,000, as against 19,479,692 oz. in 1917. In value the production of 1918 was second only in the history of Cobalt to that of 1912, when the output at 60.8c. per oz. was worth $17,408,935. The Cobalt area is still producing freely, though on a declining scale. The total yield, including the output of Casey Township, South Lorrain, and Gowganda, from the beginning to the end of 1918, has been about 292,000,000 oz. Nipissing, Mining Corporation of Canada, Kerr Lake, O'Brien, Coniagas, McKinley-Daragh-Savage, Buffalo, and Temiskaming were the leading producers. Considerable work was done during the year in the southeastern part of the camp in the hope of encountering rich veins, such as those found in the Keewatin series at the Temiskaming and Beaver mines. The lower contact of the diabase sill, reached at 1675 ft. in the latter mine, has not proved very productive. On the north, in Bucke Township, the old Green-Meehan property has been reopened and has yielded some good ore. The Mining Corporation is sinking a shaft at North Cobalt.

The Miller Lake-O'Brien, the best mine yet found in the Gowganda area, is proving a rich deposit, and its exploition has stimulated interest in nearby claims. In South Lorrain, the Wettlaufer and Keeley properties were operated.

There were no labor troubles in Cobalt during 1918, a sliding scale being in operation by which wages increased 25c. per day with every 10c. increase in the price of silver.

Reorganization of International Nickel Company

The nickel contents of the Sudbury mattes amounted to 44,700 tons in 1918, compared with 41,887 tons produced in 1917, and the value of the nickel in the matte was $26,800,000, as against $20,943,500 in 1917. An important reorganization took place, by which the International Nickel Co. of Canada absorbed the old Canadian Copper Co., the power companies, and the refinery at Port Colborne. The head office of the new company is in Toronto, through which all export business will be handled. The International Nickel Co. of Canada will sell nickel, blister copper, and matte. A. D. Miles is president, and J. L. Agnew is vice-president and general manager. The chief supply of this company's ore came from the Creighton mine, although a small production was taken from the Cream Hill mine. The extensive program that has been under way at the Creighton mine for the last four years, by which the method of mining was changed and a new surface equipment installed, has been completed, and the mine is now yielding approximately 125,000 tons per month. To avoid shortage of water-power during the dry season, the International Nickel Co. is putting in a large dam on the Spanish River above High Falls, and this development is not expected to be completed until 1921.

---

*Deputy minister of mines for Ontario, Toronto, Canada

OPERATIONS OF MOND NICKEL CO. AND BRITISH AMERICA NICKEL CORPORATION

The Mond Nickel Co. operated the Garson, Worthington, Levack, and Bruce mines. The last named yields a siliceous ore which is valuable for flux, and also carries some copper. Developments at the Levack mine have been satisfactory; it has now been shown that this deposit is one of the large orebodies of the Sudbury district, and that the ore is of a grade above the average. The Mond company did considerable diamond drilling on property adjoining the Creighton mine, in the hope of striking an extension of this rich orebody. Four drill holes from 2500 to 3000 ft. deep were put down, but the results have not been announced. The output of the Alexo nickel mine, Porcupine district, amounting to about 10,000 tons, was shipped to Coniston and smelted with the Mond company's ore.

The British America Nickel Corporation was engaged chiefly in construction work in 1918. Many of the buildings at the smeltery are now completed, and it is expected that smelting will be begun before the end of 1919. Development at the Murray mine was continued, and a shaft house, ore house and storage bins were erected. Electric power in the neighborhood being practically all in use, the company decided to build its refinery near Hull, Quebec, where power from the Ottawa River was available. Active construction on the refinery plant has been going on for the last eight months. About 115 tons of metallic nickel, besides a quantity of nickel oxide, was produced by the refineries treating the silver ores from the Cobalt mines.

COPPER MINING UNPROFITABLE IN ONTARIO

High operating costs, increased freight and smeltery charges, and the lack of a customs smelter made copper mining in Ontario in 1918 unprofitable. The only non-nickeliferous ore shipment was a trial lot from the Hudson Copper Co. at Havilah. The Sudbury mattes contained about 23,000 tons of copper, valued at $8,500,000, as compared with 21,197 tons, worth $7,842,290, in 1917, the copper being valued in the matte at 20c. per lb. Blister copper is one of the products of the International company's new refinery at Port Colborne, which has a capacity of refining 10,000 tons of nickel and a corresponding quantity of copper per annum.

During the first nine months of 1918 154,243 tons of iron ore was shipped, of which 69,357 tons was exported. The principal production was by the Algoma Steel Corporation from the Magpie mine, and by Moose Mountain, Ltd., from the mine of that name. The Magpie ore is siderite, which is roasted and nodulized. Moose Mountain ore is subjected to magnetic concentration, and is then briquetted. In both cases the product is first-class for bessemer use. Small shipments were made by the Poe Mining Co. from Palmerston Township, and by the Canadian Union Iron Mines Corporation from Drummond Township. There was charged into the blast furnaces of the province upward of 1,500,000 tons of iron ore, mostly imported, producing about 890,000 tons of pig iron. In 1917 the quantity of ore smelted was 1,316,199 tons, and the quantity of pig iron produced, 691,233 tons. For the nine months ending Sept. 30, 1918, steel production amounted to 668,333 tons, most of which was shell steel.

COBALT, NICKEL, LEAD, AND NON-METALLIC PRODUCTS

The silver refineries recover the cobalt, nickel, and arsenic contents of the Cobalt ores, as well as the silver. Hitherto, the two former have been largely produced as cobalt oxide and nickel oxide, but there is now a strong tendency to convert these substances into the metallic form. During the first nine months of 1918, 217,291 lb. of metallic cobalt and 582,992 lb. of metallic nickel were produced, in addition to 397,728 lb. of cobalt oxide and 5592 lb. of nickel oxide. Other cobalt and nickel compounds, amounting to 367,923 lb., were also made. The value of these subsidiary contents of the silver veins for 1918 is probably not less than $2,000,000. Much of the metallic cobalt is utilized in making stellite, a cobalt-chromium alloy of value for high-speed tools.

For the nine months ended Sept. 30, the lead mine and smeltery at Galetta, on the Ottawa River, produced 1,291,571 lb. of lead, valued at $115,117. This mine is owned by the James Robertson Estate, Montreal, and the entire product is shipped to the company's works in that city.

Three feldspar quarries were in operation in Ontario in 1918, producing until November, when the demand slackened, an average of 2500 tons per month. The productive feldspar area is near Verona, on the Kingston & Pembroke Ry.; the principal operators being Feldspar, Ltd., Eureka, and Feldspar Quarries, Ltd. The product goes, in peace times, to the potteries of East Liverpool, Ohio, and Newark, N. J., but a large proportion of the 1918 output was used by the United States for war purposes.

Mica was produced by the Lacey mine, near Sydenham, the output being about 6000 lb. per week of rough-cobbed mica. The mine, which is operated and owned by the General Electric Co., was worked on the seventh level, about 185 ft. below the surface. All the other mica properties were inactive, owing to the war.

Three companies operated graphite mines: Black Donald, at Calabogie; Globe Graphite, at Fort Elmsley, and Timmins, in North Burgess Township. The first two mines are worked by old-established concerns, the former employing about eighty men and the latter about fourteen. The vein on the Timmins property has been stripped for a short distance and traced for about a mile and varies in width from 25 to 75 ft. A 200-ton mill is being erected, and is expected to be in operation by Feb. 1, 1919.

The demand for pyrites was urgent in 1918, the principal producer being the Nichols Chemical Co., whose mines are at Northpines, Goudreau, and Sulphide. This company has also an acid plant at the last-named place.

The yield of petroleum in Ontario in 1918 was greater than in 1917, owing to the development of the new field in Mosa Township. From appearances, however, Mosa is not likely to have a long life. The natural-gas areas are situated on the east and north shores of Lake Erie, and supply a large part of the population there with fuel. Severe weather conditions in the winter of 1917-18, concurring with a shortage of gas, led the Legislature to confine the use of gas to domestic consumers, thus cutting off the supply from industries and from all classes of manufactures.

Salt from the Lake Huron area, quartz from Dill and other places, talc and fluorspar from Madoc were also produced in increased quantities. The last-named was in active demand up to $30 per ton for use in steel plants. A small quantity of gypsum is mined annually in the valley of the Grand River. Building materials, such as cement, brick, stone, and lime, continued in fair production, notwithstanding the lessened activity in the building trades.

Mining in British Columbia in 1918

BY ROBERT DUNN*

THE outbreak of war in 1914 served to stimulate British Columbia's mining industry, which settled down to a steady advance during the following year, and in 1916 reached its peak, the value of the output for the latter period creating the new record of $42,290,462. There was a decline of $5,280,070 in 1917, and the completion of 1918 brings much speculation in the Canadian West as to what the official returns for the year will show and what the future holds in store.

The copper output for 1918 was probably greater than that of 1917, and the same may be said of coal.

The Department of State has definitely declined to consider the restriction on Brazilian manganese and chrome, which was suggested by the War Industries Board.

Silver production was about the same, but the final figures will probably show that there was a decline in the output of gold, lead, and zinc. High costs and the difficulty of obtaining labor were mainly responsible for the unsatisfactory indications in respect of the three last-mentioned products. In fact, these handicaps affected adversely all mining enterprise in the province throughout 1918.

The market quotation for copper, fixed by the government, remained firm throughout 1918 at a good figure, and the big companies naturally adopted and maintained a policy of keeping their output as nearly as possible at the maximum. Under the circumstances it was to the advantage of concerns having extensive facilities to meet the increasing schedule of wages and thus avoid the danger of labor troubles. The slogan was "Get out the ore!"; and the larger companies, particularly the Granby Consolidated Mining, Smelting and Power Co., Ltd., adhered to it with good results.

British Columbia's copper output during 1916 was 65,378,364 lb. and in 1917 it was 59,007,565 lb. So far as the figures available permit analysis, the output for the first nine months of 1918 is as follows: Granby Consolidated Mining, Smelting and Power Co., Ltd., 29,081,635 lb.; American Smelting and Refining Co.,[1] (British Columbia ores treated at the company's Tacoma, Wash., smeltery), 16,344,376 lb.; Ladysmith Smelting Corporation, (now closed), 92,212 lb., making a total of 45,518,223 lb. The last quarter of 1918, therefore, must attain a production of 13,489,342 lb. to equal the output in 1917. Inasmuch as the Granby and Tacoma smelteries have been producing at the rate of 13,779,972 lb. per quarter, and no mention is made of the production of the Trail smeltery of the Consolidated Mining and Smelting Co., Ltd., of Canada, it is to be presumed that the final figures for 1918 will be somewhat better than those for 1917.

The coal output of British Columbia up to the end of October, 1918, was 2,204,255 gross tons, so that to equal the 1917 production of 2,398,715 tons it is patent that the output of November and December must total 194,460 tons. Considering that the production for October totaled 217,482 tons, it is probable that the production for 1918 will exceed that of 1917 by at least a quarter of a million tons. The coal operators faced some hard problems during the year, especially on Vancouver Island and in the Crowsnest field, which are the greatest producing districts. On Vancouver Island, in addition to costs and labor, there was the difficulty, at least in one instance, of replacing the worked-out ground with a new mine and maintaining production. There was also a serious accident in Nanaimo, 16 men losing their lives through the breaking of a cable on a descending cage, and the ravages of Spanish influenza curtailed the tonnage to a large extent. In the Crowsnest field, the strike at Fernie and Michel camps to obtain a single shift at some of the mines, which were said by the miners to be dangerous under the two-shift system, caused a drop in production of at least 60,000 tons.

Gold production was affected more than that of any of the other metals because of its fixed price. The Rossland camp, operated by the Consolidated Mining and Smelting Co. of Canada, and the greatest single producer of gold in the province, was closed early in the year. Similarly, the placer camps were hard hit, and the gold output for 1918 will undoubtedly reflect the conditions described.

Lead and zinc production was also hampered by high costs and lack of labor. Many of the small operators of the Kootenay and Boundary districts found it impossible to continue shipments at a profit. A comparative statement, recently issued by the Consolidated Mining and Smelting Co. of Canada, shows the tonnages received at the Trail smeltery for treatment during the first nine months of the last three years. These were 415,983 tons in 1916; 327,639 in 1917, and 217,417 tons in 1918. At the end of October, 1917, 148 mines were shipping to the Trail smeltery more or less regularly, but on Oct. 31, 1918, the total number of mines shipping was only 122.

---

*Mines Department, Victoria, British Columbia

[1] The Tacoma smeltery produced 273,626 lb. of copper from ores of the Yukon Territory during the same period

It is interesting to note that the Trail smeltery has been a storm center throughout the year, it being charged by small-mine operators that its custom rates are excessive. The reply from the management was to the effect that the increases that have been announced are fully justified by conditions. As a result of the former's agitation, the Dominion government authorized an investigation of the affairs of the Consolidated Mining and Smelting Co., with particular reference to the conduct of the Trail smeltery.

Under war pressure, some minerals were brought to light in British Columbia of which formerly little had been known in the Canadian West. Most important of these is manganese, of which several promising deposits have been located in the Cowichan district, Vancouver Island. Chromite also has been discovered, and several of the deposits are encouraging. A large molybdenite property at Alice Arm, scheelite deposits in the Cariboo district near Barkerville, and platinum in the Tulameen River district are among the more notable developments.

The phrase "the mineral resources of the country have been but scratched" can be applied to British Columbia literally and without exaggeration. Naturally the annual output fluctuates considerably, but an upward curve has been steadily maintained. This tendency has been more marked during the last few years, and with the return to normal conditions, and in view of the demands to the reconstruction period, the importance of the mining industry of the province is bound to be demonstrated to an increasing extent.

Mining in Manitoba in 1918

By R. C. Wallace*

In northern Manitoba, 6300 tons of copper ore was shipped from the Mandy mine to Trail, B. C., in 1918. A minimum of 10,000 tons will be hauled by wagon during the winter, to be ready for water transportation in the spring. At the Flin Flon property, diamond drilling was continued until June, when the preliminary mapping of the orebody was completed. It is expected that work will proceed on this property, now that the difficulties of development incident to war conditions have been removed. Necessary development work includes the building of a railway approximately 80 miles long from The Pas, the erection of a smeltery on the property, and the development of power and power transmission over a distance of at least 35 miles, and probably 60 miles. Several discoveries of copper sulphides were made in 1918 in the Athapapuskow-Copper Lake areas.

The Rex mine, on Wekusko Lake, is responsible for the first continuous production of gold in Manitoba. On this property a 40-ton Lane mill started operations in May. The ore is stoped from a 100-ft. level. The vein, the width of which continues to average 4½ ft., shows uniformly high assays. Development is proceeding on other properties on Wekusko Lake, and gold discoveries as well have been made on Copper Lake and on Knee Lake, on the historic fur-trade route from Norway House to York Factory.

In the Rice Lake district, sinking has continued on the Gold Pan property to the 200-ft. level, and a small stamp mill will be installed during the winter. North of the Hole River, the Luleo property, a wide shear zone mineralized with gold has been surface prospected, and plans are now formulated for extensive development. Machinery will be installed this winter to operate the property on a large scale.

In the Falcon-Star Lake district, considerable interest has been taken in the development of scheelite and molybdenite properties. The molybdenite occurs in pegmatite veins, parallel to the granite contact, and the scheelite in stringers in epidotized zones of greenstone also parallel to the contact. Several tons of tungsten ore have been shipped to the Mines Branch at Ottawa for treatment, that the values and milling methods might be determined.

During 1918 a Manitoba branch of the Canadian Mining Institute was established. This branch will undoubtedly be of assistance in promoting the best interests of the industry in the province.

Mining in Cuba in 1918

The center of mining activities in Cuba in 1918 continued to be the Province of Oriente, which during the first six months of the year produced nearly 13,000 tons of copper concentrates, 407 tons of chrome ore, 471,317 tons of iron ore, and 40,781 tons of manganese ore. These are official figures. Those for the second semester are not yet available, but there is no apparent reason why they should not be about the same.

Owing to shortage of labor and shipping tonnage, the production of copper and iron decreased 16% and 30%, respectively, as compared with the second half of 1917. The pressing demand for manganese, however, creating special sea transportation facilities for this mineral, made it possible to surpass by 47% the output of the previous semester. There is no doubt that, with the aid of good roads, this amount might have been exceeded, in view of the abundance of manganese deposits; but the Province of Oriente is still almost destitute of highways. As high as $22 per ton for freight has been paid from mine to railway—a particularly excessive amount in a country of such a size and shape as Cuba. No gold was produced in the first semester of 1918, as compared with an extraction of 2650 tons of ore in the second half of 1917.

A large amount of exploration was done during 1918 throughout the province, and results indicate a probable increase of considerable importance in Oriente's copper production in the near future; and the same may be said of the remaining five provinces of Cuba.

New companies organized during 1918 are absorbing the comparatively large number of concerns created in recent years. Many failures have been registered, as was to be expected; but the work thus far accomplished has provided a wholesome stimulant, and, as a result, Cuba may be classed as a copper country. Actually, however, but one mine outside of Oriente has produced copper in commercial quantities during the year, namely, the Matahambre mine, in the Province of Pinar del Rio. Its output for the year is approximately 75,000 tons of ore. The erection of a 1000-hp. power plant at the coast is reported, and a mill at the mine, 10 miles inland, has been completed. Silver and coal deposits were prospected during the year in various parts of the island.

---

*Commissioner of Northern Manitoba, The Pas, Manitoba, Canada.

Another phase of mining which has displayed great activity, but which at present is at a low ebb, is oil mining. Havana Province has been the main field of activity. Three wells have been sunk to 2000 ft. and over, but by far the majority have been let down to about 1000 ft. Three companies, of a total of about 40, have met success in obtaining productive wells, one having sunk 13. The output for the year will be about 32,000 barrels, of which 24,000 is credited to the company alluded to. This does not include oil used as fuel on the oil properties by themselves, of which no figures are available. The price obtained during the latter months of 1918 was 12½c. a gallon at the nearest railway station.

Surface indications of oil are to be found over a large stretch of territory, and the total of about 60,000 barrels which has been obtained to date represents the output from wells in an area of about five acres. It should be added that, if efforts so far have achieved less success than was expected, this has been due chiefly to the unsound basis on which the matter has been handled.

Mexican Mining in 1918

THE payment of dividends during 1918 by a number of concerns operating in Mexico, such as the Amparo Mining Co., the Greene Cananea Copper Co., the Lucky Tiger Combination Gold Mining Co., the Mexico Mines of El Oro, Ltd., the Esperanza Mining Co., the Santa Gertrudis Co., Ltd., the El Oro Mining and Ry. Co., and the two important American smelting companies, is an indication that conditions in some parts of the country have been better than in others. A number of other properties started operations during the period, in some instances following the blowing in of American-owned smelteries in the neighborhood.

The resumption of work, however, has arisen largely from necessity, coupled with a confidence in the future which was born of a hope that a return to activity on the part of the operators would engender a certain consideration on the part of the Mexican authorities. It was also hoped that Mexicans would recognize the fact that the evils existing are serious deterrents to national progress and development; and that the very existence of their own people is at stake.

The fact is patent to all careful observers, however, that Mexico is rotten at the core, and that no amount of initiative on the part of the citizens of foreign countries will have an appreciably favorable effect on the general conditions. The line of demarcation between the various groups of bandits in many districts and the federal authorities has grown indistinguishable, and the aims and objects of all factions in the country seem to be much alike. Law and order and respect for human life are at a discount, the German element being, apparently, the only section which receives special consideration from the authorities. Drastic action may be expected to be taken in the near future to remedy a state of affairs that has become intolerable. As soon as the European tangle has been unraveled, the powers that are interested in the maintenance of law and order in Mexico will be able to give the matter the attention it deserves.

THE NORTHERN STATES

Mining in the State of Tamaulipas has been at a standstill. The mountainous sections of the state are still occupied by revolutionists, and each pack train of burros has to be convoyed by Carrancista soldiers. In addition to this, it is not possible to secure explosives with which to continue mining. Neither camps nor commissaries can be established, because the revolutionists, as well as the Carrancista soldiers, rob them. The federal troops, in fact, when away from general headquarters, are as dangerous as the revolutionists. Of the number of properties formerly in operation in this state, no more than 20 are now paying the federal taxes which are required to insure a continued official recognition of ownership. Labor around the towns is abundant at from 75c. to 1 peso per day, with lack of employment for the poorer classes. As a consequence, stealing, suffering, and sickness are rampant, and a high mortality rate is apparent.

A gradual resumption of mining is in evidence in the states of Coahuila, Chihuahua, and Sonora, and several smelting plants are in active operation. The Mazapil Copper Co., Ltd., which has extensive interests in Coahuila, including a small railway, smelteries, and various mines, conducted successful operations, and it is expected that the favorable results will continue. The reopening of coal mines, which have been practically inactive for more than four years, was announced, and a good output for 1919 is expected. A railway is being built between Sierra Mojada and Cienegas, which, when completed, will bring a large tonnage of low-grade silver-lead ores to the smelteries of Monterey. The repair of railroads, which were allowed to get into bad condition during the earlier years of the revolution, is now being gradually achieved. The Mexican Northwestern Ry. has lost several bridges at various periods of disturbance, and is now operating to Pearson, Chih., from Ciudad Juarez.

A number of mining properties in the western part of the State of Chihuahua will resume operations as soon as practicable. Regular shipments are being made from the Cusi property to the Chihuahua smelteries. Plans are under way to extend the Tigre transmission line, belonging to the Copper Queen works at Douglas, Ariz., to supply power for the mill of the North Tigre mine, in Sonora, Mexico. The Carnegie Lead and Zinc Co. continued operations at its property near Cananea, Sonora. The Cia. de Minerales y Metales has obtained a lease on the Santa Eulalia property, in Chihuahua, and successful expansion is expected. The Compagnie du Boleo, operating in Baja California, continues to produce from its 1000-ton plant, and progress has been free from the interruptions common to the mainland.

THE CENTRAL STATES

In the Guanajuato district all the more important mining companies operated throughout 1918. These include the Guanajuato Reduction and Mines Co., the Guanajuato Consolidated Mining and Milling Co., the Guanajuato Development Co. (the Peregrina and San Matias units), and the Cubo Mining and Milling Co. The Guanajuato Reduction Co. operated mostly on fill ore, the Guanajuato Development Co. on fill and freshly broken material. Both used cyaniding exclusively; but a large amount of flotation experimentation was carried on. The Guanajuato Mining and Milling Co. started the construction of a new mill in the La Luz district.

The Cubo company treated only freshly broken ore from its Villalpando mine at the mill of the Providencia Mining and Milling Co., which it has under lease and with an option to purchase.

In the El Oro district, the El Oro Mining and Ry. Co., Ltd., made progress in increasing output in an effort to lessen costs per ton. Ore reserves have been reduced to exclude any material having a combined gold and silver content valued at less than $7 per ton. Governmental and unofficial interference hampered progress at this property, as in other districts.

At the property of the Cia. de Santa Gertrudis mining operations were carried out during 1918, and the ore was sold. Developments in the mine have not added materially to the reserves. Milling operations at the Cia. Beneficiadora de Pachuca were under capacity, on account of the difficulties in the operation of the settling and filtration plant. It is expected that the installation of additional equipment will remedy the trouble. Flotation experiments were concluded, with results which showed that the process, in its present stage of development, cannot compete commercially with cyanidation for the treatment of the company's ore. Aluminum is now being used in place of zinc dust for precipitation purposes. A considerable saving is already assured, which will be increased as operations are extended.

The Amparo Mining Co., operating at Etzatlan, Jalisco, has been a constant producer and a steady dividend payer. It is reported that flotation tests have been satisfactory and that the necessary modification in the arrangement of the plant may be expected in the near future.

THE SOUTHERN STATES

Little progress has been made in the opening up of properties and the development of the mineral industry in the southern states. The majority of the mines remained idle throughout 1918. In many cases road and railway construction must be carried out before further development can be expected.

Central and South America

FROM the mineral-exports standpoint the recent period of prosperity has been unevenly appreciated in Central and South America. Generally speaking, all operations have been hampered by a shortage of supplies, especially of oil and other fuel. Another drawback was the diversion of shipping from the usual routes, which was especially felt in connection with the exportation of low-valued material and inferior-grade products. A third detriment to progress was the stationary price for gold, which, on account of the steady rise in the price of all supplies needed to produce it, was somewhat neglected.

Bolivia did well, and prospered exceedingly. The principal product—tin—is exported in the form of a high-grade concentrate of considerable value per ton. The metal was urgently needed; and, for the most part, the necessary shipping space was forthcoming. Chile's principal product—nitrate—was in urgent demand, also for war purposes. The Allies had no synthetic plants, and were dependent on Chile. Prices rose, and output was stimulated. Exports to the United States were so largely increased that a lack of shipping for the purpose developed, and agriculturists had to go without. Chilean copper was exported in quantity, the two large producers straining every effort to take maximum advantage of the high prices prevailing. Peru's copper and gold output was stimulated for the same reason. Brazil suffered from shortage of ships for the transportation of manganese ore, and from lack of fuel; and the development of domestic deposits in the United States temporarily tended to relegate Brazil to a position of less importance in this respect.

Chile

Chile's great copper mine at Chuquicamata maintained a high level of activity throughout 1918. Following a slight reduction, caused in some measure by lack of shipping facilities, the end of the year showed increased output, the amount produced in October amounting to 9,854,000 lb. Operations have been somewhat hampered by the difficulties in obtaining sufficient fuel oil and other supplies, but it is anticipated that the copper output for 1918 will total about 100,000,000 lb. The plant has been working at a capacity in excess of that for which it was designed, and has been handling between 11,000 and 12,000 tons per day. Construction work, to provide for an ambitious scheme of extension, was continued throughout 1918 in spite of difficulties; and it is expected that, by June 1, 1919, the property will be producing at the rate of 160,000,000 lb. copper per annum. To obtain such an output the milling capacity will be raised to 15,000 tons of ore per 24 hours. Further additions will be made subsequently and as conditions warrant. The Chile Copper Co., as is the case with other foreign producing companies operating in Chile, is benefiting by the present rate of exchange, which is now about 10½d. per peso. Work at Chuquicamata has been helped by the circumstance that the local labor has proved itself to be efficient and unusually adaptable, with the result that skilled work is now being mostly performed by Chileans.

OPERATIONS AT THE BRADEN COPPER COMPANY'S PROPERTY AT RANCAGUA

At the Braden Copper Co.'s property the continued driving of levels and crosscuts in the upper part of the Teniente side of the mine has developed large tonnages of ore of a highly satisfactory grade. The new electric railway from the mine to the coarse ore bins was completed early in 1918 and started operating on Apr. 27. This railway has a total length of 5750 ft., of which 5000 ft. is entirely underground and nearly all is of a uniform grade of 0.5%. The area of cross section of the tunnel is about 12 x 11 ft. Over its rails a 25-ton locomotive can handle up to 14 cars containing about 22 tons of ore each. By way of comparison it is interesting to note that the old railway is 6000 ft. long, 4½% grade, and covered with snow sheds for its entire length. Moreover, transport is subject to delay on account of snow slides. Over the heavy grade of 4½% a 25-ton locomotive could handle only three cars.

During September the first one of the two units of the new underground compressor station was put in operation. The station itself is about 3500 ft. from the portal of the tunnel and is roughly 290 ft. long, 34 ft. wide, and 28 ft. high. The sides are lined with concrete, and the roof is a reinforced-concrete arch. Compressed air is furnished by two reciprocating units capable of delivering 5000 cu.ft. per min. of free air each, compressed to 100 lb. per sq.in. To operate each of these units a 2300-volt 927-hp. motor is required.

During 1918 shaft "A" was sunk 690 ft. This shaft, when completed, will be 1650 ft. deep. It is 24 x 12 ft. in cross section, and when finished will consist of three compartments, a manway 6 x 9 ft., and two cageways 7 x 9 ft. each.

Plans for the new ore-pass gathering system, Teniente side, have been completed, and the work is well under way. In 1919 this system will be in operation, whereby all tramming will be reduced to a minimum and hand tramming nearly eliminated.

Since Jan. 1, 1918, six more Marcy mills have been put into operation, making the total installation of 18 ready for operating, of which 15 are being operated (these are all in a row); and a 60-ton crane has been erected in this aisle to facilitate repairs. Furthermore, 30 Hardinge mills have been equipped with new drives and 150-hp. motors. In addition, eight new gear-driven Minerals Separation flotation units of 20 cells each have been installed to replace similar belt-driven machines.

There are 35 Callow air cells. These will eventually be placed two in series, and there will then be 84 roughers and 12 cleaners. The air for these cells is supplied by two Ratteau-Battu-Smoot turbo-blowers, each requiring 810 hp., and capable of delivering 20,000 cu.ft. of free air per min. at a pressure of seven pounds.

The more important developments in the smeltery during 1918 were the completion of the enlargement of the No. 2 furnace from 25 ft. to 50 ft. in length, and the replacing of one of the original old converters of 10 ft. diameter and 15 ft. long by one made on the property which is 12 ft. diameter by 26 ft. long. The other blast furnace is now in process of lengthening from 25 to 50 ft. A new copper receiver was built, and a rotary driver is being installed in connection with the coal pulverizing plant, so as to make the smeltery independent of the supply of fuel oil for the nodulizers.

In the smeltery power house the present equipment of Ratteau-Battu-Smoot turbo-blowers was duplicated by the addition of one 1700-hp. 3600-r.p.m. converter turbo-blower, capable of delivering 24,000 cu. ft. of free air per min., and one 800-hp. 3600-r.p.m. blast furnace turbo-blower, which can deliver 39,000 cu.ft. of free air at a pressure of three pounds.

Two units of the new 20,000 kw. Pangal power project will be in operation before the middle of 1919. At about the time this starts, the new tailings-disposal basin and dam will be ready to receive the mill waste. This basin is at Barahona, and the flume line will be over eight miles long, with a grade of 3%. The construction of this flume line has involved driving about 12,350 ft. of tunnel, 10,000 ft. of snow-shedding, and the erection of several elaborate trestles and three suspension bridges of 276 ft. span each. Most of the work on this project has been done in 1918.

At Coya, the installed capacity of the power house has been increased from 10,000 kw. to 15,000 kw. by the installation of a fifth generating unit. During 1918 construction at the new smeltery site at Caletones was temporarily suspended, on account of the difficulty in getting supplies from the United States.

THE TACNA-ARICA CONTROVERSY

Toward the end of 1918 attention was directed to the smoldering political differences between Chile and Peru, which threatened to be translated into aggressive action failing an amicable settlement of the Tacna-Arica controversy. Consular representatives were withdrawn by both countries late in November. By the treaty of 1883, Peru agreed to cede the territory to Chile temporarily, provided that a plebiscite was taken after 10 years to decide the subsequent form of government. Difficulties have arisen from time to time as to the exact condition under which such a vote should be arranged. Peru demands that only those belonging to the territory concerned should be allowed to vote, and that the polls should be presided over by third and impartial persons. Chile maintains the right to extend the franchise to practically the whole population, even those residing there temporarily, and insists that the vote be taken under the direction of the Chilean authorities.

The situation is delicate, and there are a number of factors that deserve consideration. Apart from the immense deposits of sulphur that are known to exist in the Province of Tacna, the estimated wealth of the region is small. Although the district may show unsuspected potentialities as a result of future development, there are no existing indications of nitrate or other deposits. The total mineral production of the region amounts to only a small fraction of 1% of Chile's total output in this class.

Since the cession of the territory Chile has used the district to great advantage as a stepping stone to Bolivia The Arica and La Paz Ry., completed in 1913, is already totally inadequate for the traffic available, and this fact will give an idea of the expansion that has occurred. The line is owned by the Chilean government. Further development is expected as soon as additional equipment is available, and improvements which will facilitate traffic have already been carried out at the port of Arica. The railway has served its purpose in helping to expand Chilean interests in Bolivia, and Chile is naturally interested in the territory through which it passes.

It seems probable that the matter in dispute will be submitted to foreign arbitration. It is possible that it may be discussed at the peace conference at Paris. If this is done, it will be difficult for the conferees to overlook the circumstance that both Bolivia and Peru placed themselves unreservedly on the side of the Allies, by severing diplomatic relations with Germany, on Apr. 14, 1917, and Oct. 6, 1917, respectively. It will also be recalled that, previous to the Pacific war of 1879-1882, Bolivia possessed an outlet to the sea and the port of Antofagasta, and valuable nitrate deposits belonged to Peru. Chile, on the other hand, has, officially, maintained an attitude of neutrality throughout the Great War.

DEVELOPMENT OF THE CHILEAN NITRATE INDUSTRY

The fact that the Great War was won with Chilean nitrate has served to attract attention to Chile's foremost industry, which has an annual value of about $150,000,000 at the port of shipment, and which brings in an annual revenue to the Chilean government of about $35,000,000. There is a vast supply of caliche awaiting beneficiation, and large amounts doubtless remain on lands that have been incompletely prospected. To these may be added the enormous tonnages of discarded residue and caliche which will certainly be available for treatment by any improved method that may be adopted. The fact that all this material contains considerable quantities of sodium nitrate will doubtless act as a further incentive for research, in connection with the utilization of modern machinery for extraction purposes.

The veil of secrecy that has so long enveloped the Gibbs process for nitrate treatment was drawn aside to a certain extent during 1918 by the appearance of a brief description of the new process.[1] From this it would seem to embody (1) wet crushing in a ball mill, (2) classification, (3) counter-current treatment of sandy product in Dorr classifiers, and (4) filtration of thickened slime in Oliver filters. Multiple-effect evaporation of the liquor has been adopted. The plant has been in operation for about a year. Results showing the actual recovery of nitrate by the new process and the cost of treatment are being awaited with interest, and it is hoped that they will be published in full detail.

Germany has produced an immense amount of synthetic nitrogen products, and her chemists may be credited with a fairly complete knowledge of the subject. It is significant that, previous to 1914, she absorbed about 25% of the Chilean output of natural nitrate, and also laid up extensive stocks. The production of the synthetic product in the United States will doubtless encourage the introduction of economies, large-scale working, and improved extraction of nitrate from the Chilean caliche, so that the natural product will be shipped at a cost to compete with the synthetic.

Bolivia

The high prices paid for the principal metals produced in Bolivia were a powerful stimulant to increased production. The most striking example of this has been the Cia. Estañifera de Llallagua, which raised its production from less than 1000 tons of tin concentrate per month to over 1500 tons during the first months of 1918, and is now producing about 1800 tons. This is principally due to the increase of capacity of the milling plant, which is treating 400 tons per 24 hours and will be brought up to 600 tons, making it, in all probability, the largest tin concentrator in operation. This company is now one of the most noteworthy dividend payers among mining enterprises of the world, as it probably distributed over 400% on its original capital of £425,000 in 1918.

Labor was scarce during 1918, on account of the abundant crops that were raised as a result of the exceptionally heavy rainfall; and this factor has prevented an increase in production to the extent desired and which would, under normal circumstances, have followed the establishment of high metal prices.

The Uncia mines of Señor Simón I. Patiño are now the second largest producers of tin, with about 1000 tons of concentrate per month. No change can be reported from the Huanuni mines, which belong to the same owner, as long as the new concentrator and tailing plant remain to be completed. This should require another eight to ten months.

ACTIVITY IN THE COLQUECHACA DISTRICT

There has been considerable activity in the district of Colquechaca, once known for the famous wealth, in ruby-silver ore, of the Unificada mine. This mine has been idle for over 20 years on account of its lower levels being under water, but Señor Patiño has lately acquired an option on the property and will proceed to open it up again. Other old silver mines in the same district have found tin lodes on their properties, which were years ago worked only for silver, and active exploitation has started. Nearly all these mines are in or around the Cerro Hermoso, and near the old mining town of Aullagas, about three days on mule-back east of Challapata, on the Antofagasta-Bolivia railroad. If the Unificada mine and other properties develop well, there is a possibility of a railroad which is now being built by Señor Patiño from Machacamarca to Uncia being extended from Uncia to Colquechaca. Construction work, which had been suspended for four years, was resumed in August of 1918, and by next May it ought to be completed as far as Bombo, about 60 km. from Machacamarca, leaving 30 km. more to be built before it reaches Uncia.

The tin ore in the Colquechaca district is easily milled when it comes from the oxidized parts of the veins; but in nearly every instance the tin lodes, when they reach the sulphide zone, contain considerable quantities of blende and argentiferous galena. These ores require a special and complicated treatment, embodying a combination of flotation, roasting, leaching and gravity concentration, to separate the lead and silver from the tinstone. The Cia. Gallofa-Consolidada, of Sucre, is now erecting a small experimental plant, which will work along these lines.

---

[1] "The Advent of Modern Mill Mechanism to Nitrate Leaching," by D. F. Irvin, *Eng. and Min. Journ.*, June 1, 1918, p. 987.

The Austral-Bolivian Co., which operates dredges near Potosi for the recovery of tin from tailing deposits, started operations in 1918 and was apparently doing well, until one of its dredges was burnt by accident, in September. Although this is a serious setback, it will probably not impair the final success of the enterprise.

TIN SMELTING IN BOLIVIA A FAILURE

Two small smelteries at Potosi have been active most of the time, producing bars of about 95% tin, for which they received attractive prices during the tin famine of last summer. But under more normal conditions such operations would hardly pay. The electric furnace in La Paz has been dismantled, having proved to be a complete failure, both technically and commercially. The metal produced by the furnace was of good grade, running over 99.99%, but the slags carried about 15% tin, and they could not be resmelted at a profit. It seems that either the temperature was too high, or that too much flux was used, as the slag was altogether too glassy for a tin slag.

A Cottrell installation for precipitating fumes from a bismuth furnace at Quechisla is under construction. Electrostatic precipitation of silver fume from chloridizing-roasting furnaces was considered by a few operators, but could not be adopted, owing to the difficulty of treating the fume by wet methods. During 1918 a new chloridizing-roaster of the reverberatory type was developed at Machacamarca, which makes so little flue dust, and the temperature of which is so easily controlled, that stack losses are reduced to a minimum, and a Cottrell installation will hardly be needed.

The flotation process has been introduced on a working scale into the Uncia mill, with apparent success, and is used to separate pyrite from cassiterite in high-grade middlings. It will probably be installed in the near future in both the Uncia and Llallagua mills as an auxiliary process for recovering bismuthinite, of which the ores contain appreciable quantities.

The Chilean company at Corocoro is treating with success a sulphide copper ore by the Callow process; and the Anglo-French company in the same district has just completed a new flotation plant for the same purpose, in which Minerals Separation machines are to be used.

FUTURE DEVELOPMENTS IN BOLIVIA

As regards new mines, some remarkably rich deposits of tinstone and stannite have been found north of La Paz, and are being worked at a good profit by the owners. Not enough development has been done to prove whether the orebodies are large, and, even if they are, it will be a long time before these mines are opened up, because they are situated at nearly 17,000 ft. above sea level where the climate is exceedingly wet and cold, which makes it nearly impossible to obtain labor of any class. Increase in the production of tin will, for the first few years to come, hardly be from such mines as these, but will be due to improved methods of mining and milling, and work on a larger scale at the existing mines. Much will depend on the price of the metal when normal conditions are again restored.

The extension of development of tin and tungsten properties in Bolivia is foreshadowed in the announcement of the formation of an influential mining company, a subsidiary of the well-known house of W. R. Grace & Co. Bolivian tin concentrate is now being smelted in New Jersey, and it is expected that this will result in a deflection of the bulk of Bolivia's tin output from England, where it was originally shipped.

Chileans are largely interested in Bolivian industry—in copper and tin mines and in the oil fields—and regard the country as a promising field for Chile's excess productions of manufactured articles. This circumstance is a factor in the frontier trouble between Chile and Peru, because the region in dispute contains the short-route railway from the Pacific Coast to Bolivia.

The Central American Republics

A concession has been granted to a well-known firm of engineers which permits of the prospecting and development of oil deposits in Costa Rica. As an indication of the extent of the project, it may be mentioned that the concessionaires must expend not less than $20,000 within two years and $125,000 within three years, after which, and extending over a period of seven years, about $500,000 must be spent in operation and development work. A payment to the Costa Rica government on the basis of 25c. per ton of hydrocarbons extracted has been agreed upon; and both unskilled and skilled labor is to be recruited, so far as practicable, from native sources. Attention has been drawn to the gold deposits in the neighborhood of Buenos Aires and Buena Vista, and steps have been taken to carry out more systematic prospecting than has been attempted hitherto.

Interest in the manganese field in the Guanacasta section was stimulated by increased demand, although the addition in production was not maintained at the rate indicated by the expansion of operations after the first exports were made in 1916. Cost of transportation precluded any further exploitation of the coal deposits in the Talamanca region; and a similar disability will prevent the development of a number of prospects, containing copper and other minerals, which were denounced during 1918.

The two principal companies operating in the republic are the Abangarez Gold Fields, of Costa Rica, and the Aguacate Mines, Inc., and profitable operation is feasible only on account of the low wages paid to native labor.

GUATEMALA DEVELOPS CHROME-ORE INDUSTRY

The only gold produced in Guatemala comes from placers, and two American companies operate in this field. The larger, the Quebradas Mines Co., which took over the old placer mines of Potts and Knight, worked on an extensive scale during 1917, but continued only with a small force in 1918. The second, operating on the Rio de Las Vacas, worked with a full force until June, 1918, and then suspended operations on the death of the manager and promoter. No silver was produced, but enough lead for home consumption and for a small exportation comes from the veins of Heuhuetenango. A local company has installed a small blast furnace and made regular runs, but probably the greater part of the output is produced by Indians from small beehive furnaces. Their mines are much like gopher holes, but the veins are large, and the district is undoubtedly one of the important lead fields of the future. During 1918 the Alotepeque Zinc Mines Co. shut down on account of high expenses and the difficulty of getting supplies from the United States.

A number of tons of mica was shipped and some of it in exceptionally large sheets. Two or three companies are operating in this field. Chromite is by far the most important mineral exported from the country. Two mines are operating and shipping, and both are controlled by the International Railways of Central America. The output of about 2500 tons of chrome oxide during 1918 will probably give an average assay of 56% Cr_2O_3. All ore was marketed in the United States. The field is a large one and offers bright hopes for the future if a good price is maintained.

Mining in Honduras was affected by the war, and a number of small properties were closed. Recently, interest is being attracted to the Departmento de Comayagua, where a silver-gold property is being opened and a hydroelectric power plant will be installed.

Brazil, Argentina, and Uruguay

Exports of manganese ore from Brazil indicate that there has been a steady expansion in this direction in recent years. During February, March, April, and the greater part of May, however, the Central Ry. would accept no manganese ore for shipment at Rio de Janiero, on account of lack of coal to run the trains, and also, possibly, because of the low rates which had been established by contract with the principal producers at an earlier date, but largely as a result of the lack of bottoms at the port of Rio, which were needed to remove the ore to importing centers. The condition was, of course, brought about by the commandeering of much of the shipping by the United States Government for war purposes. The manganese mines are nearly all situated in the State of Minas Geraes, and large outputs were recorded from the Morro de Mina property and from the Minas de Manganez de Ouro Preto.

There has been extensive development in Brazil in the production of diamonds and carbons. Platinum is known to exist in several localities in the State of Minas, but no actual steps have yet been taken for the development of the deposits. The gold and silver output is being maintained. Developments of ore at the famous Morro Velho mine of the St. John del Rey Co. are encouraging, and extensive reserves are being blocked out at a vertical depth of over 6000 ft. Troubles due to high temperatures encountered in the lower levels are being minimized by the installation of an extensive cooling and ventilating plant.

Brazil entered the ranks of pig-iron producers in 1917; and, although this industry has developed, the numerous factors which have mitigated against expansion in other countries, at a distance from the great metal markets of the world, are responsible for the fact that, comparatively speaking, little has been done toward the opening up of the vast domestic iron-ore deposits.

WOLFRAM PRODUCTION STIMULATED IN ARGENTINA

Little progress is to be reported with regard to the mineral industry of the Argentine Republic. Some expansion was noticeable, however, in connection with the mining of wolfram ores in the Province of San Luis, the output being stimulated by the war and the urgent demands of the British government. Mica, which is found in the provinces of Córdova, San Luis, and San Juan, was also produced in increased quantity. There were indications of an attempt to increase production of oil from the fields at Comodoro Rivadavia, and an output of over 100,000 tons for the first half of 1918 was reported.

As in most other countries, no railroad construction was undertaken during the period under review, and little was done to facilitate the opening up of mineral areas in many inaccessible parts of the country. There are extensive deposits of lead in the Andean cordilleras. A new company was formed in 1918 for the purpose of smelting domestic lead and Bolivian tin in Argentina.

A discovery of copper ore has been reported from Colonia, Uruguay, and it is hoped that satisfactory confirmation and development will ensue, which should reawaken interest in mining in this diminutive republic. There are gold mines in the vicinity of Cuñapiru, but work has practically been suspended for some years, following an attempt to introduce up-to-date methods of treatment by sliming and cyaniding a simple but very low-grade ore.

Colombia

The demand for platinum in 1918 stimulated activity in the working of the alluvial deposits of the Choco River and in the basins of the San Juan and Condoto rivers of Colombia. It has been estimated that the output for the year will be close to 35,000 oz., and that estimate may not be excessive.

Rumors have been current from time to time that the Chamber of Deputies of Colombia was desirous of taxing and limiting the exportation of the metal, a step which might be considered as a retaliatory measure aimed at the United States for its failure to ratify the treaty between the two republics under which $25,000,000 would be paid to Colombia in consideration of former concessions in connection with the Panama Canal scheme, but no serious attention was paid to these reports, for such a step would manifestly be contrary to the interest of Colombia itself.

Apart from the few large corporations, such as the Frontina and Bolivia Co., which operated steadily throughout 1918, the output of gold in Colombia is from small plants. Of the total, a large proportion is obtained by amalgamation treatment. In some cases the output declined, on account of the extremely high prices of supplies; but in many instances the simplicity of operations permitted the continuance of work on a small scale. For several months those operators who were able to produce under the difficulties prevailing encountered additional trouble as a result of the prevailing low exchange rate, and were unable to market their product. This condition improved, however, and recent reports indicate that the Medellin mint is able to coin all the gold produced. A number of small properties suspended operations until conditions would be more propitious. The Quindio quicksilver-mines company deferred construction of its mill. The extension of the Tolima Ry. as far as Ibague is now assured, and it is expected that the line will be completed in 1919. The realization of this project will have a potent effect on the development of the district.

Transvaal Mining in 1918

BY H. F. MARRIOTT

AT THE beginning of the year 1918 the difficulties experienced by the mining industry of the Transvaal were still further increased. The profits of 16 of the low-grade mines were being reduced to vanishing point on account of the increase of costs due to the war, and a select committee was appointed to report on the conditions. The finding of the committee's report is recorded elsewhere in this review. In addition, the abnormally heavy rains of the early part of the year caused a serious setback to many of the mines on the Rand. The pumping installations were worked to their utmost capacity, and to relieve the strain it was found necessary to bring the hoisting plants into use for bailing. In consequence of this, the results of many of the mines for the first two or three months of the year were considerably below normal. The lowest levels of several of the mines of the Central Rand and the new shafts at Brakpan Mines and Daggafontein Mines were flooded.

The mines had only just recovered from this excessive rainfall when in September the epidemic of Spanish influenza extended to South Africa and speedily spread all over the Union. There were thousands of cases on the Rand, and the mortality was heavy, particularly among the natives. The returns of most of the mines were adversely affected in consequence. All these unfortunate circumstances combined to bring down the Transvaal gold output, and for these reasons the current results are not strictly comparable with those of previous years. Even at the end of the year, when hostilities had ceased, the difficulties of gold production were not in any degree lessened, and it will be many months before costs show material improvement.

NUMBER OF PRODUCING MINES PRACTICALLY UNALTERED

At the end of September, 1918, there were 48 producing mines on the Rand, as against 49 in September, 1917. The Durban Roodepoort mine is worked out, and the company is being wound up. This mine has had an excellent record. It began operations in 1888, and has paid in dividends over 1200% on its capital, and a liquidation dividend is expected. Milling operations at the Glencairn Main Reef G. M. Co. ceased in November, the payable reserves being exhausted. This mine has had a moderately successful record, and was a regular dividend payer until 1915.

Twenty-eight mines paid dividends in the first half of the year, as against 35 for the corresponding period in 1917, the Consolidated Langlaagte, Durban Roodepoort, Ginsberg, Jupiter, Knights Deep, New Goch, New Heriot, and Witwatersrand Deep being those which suspended dividend payments. Springs Mines entered the list of dividend payers.

Tables I, II, and III show respectively the yield, milling capacity, and the labor position in 1918, as compared with previous years.

The problem of the maintenance of operations of the low-grade mines of the Rand was the subject of much discussion during 1918. The peculiarity of this industry in contradistinction to all others, is that, as the price of gold is fixed, all the extra high costs have to be borne by the producer, and not by the consumer. The increase in the cost of supplies is the greatest item, but in addition to this there are increased realization charges, war bonuses to employees at home, and allowances to those on active service, and the Special War Levy. These increases have become such a burden on low-grade mines, whose margin of profit even in normal times is never high, that, unless something is done to alleviate present conditions, the cessation of work on the mines affected will result in an annual loss to the Empire of gold to the value of about £7,000,000.

At the beginning of the year a select committee was appointed by the Union government to report on this question. After hearing evidence given by representatives of the Transvaal Chamber of Mines and the chief gold producers of the country, they published their report in April. They did not recommend that help should be given by the government. They suggested that the Bank of England should reduce the insurance and freight on raw gold from 25s per £100 to 17s 6d, and that the government should remit its share of claim licenses. It was also proposed that, in the event of the low-grade mines being compelled to close, a fund should be established to continue pumping, and otherwise keep the mines in position to reopen after the war.

TABLE I. TRANSVAAL GOLD PRODUCTION

Witwatersrand District

Year	Tons Milled	Value	Value per Ton Milled, Shillings	Outside Mines, Value	Total Value for Transvaal
1884-89	1,000,000	£2,440,000	48 8	£238,231	£2,678,231
1890	730,000	1,735,491	47 4	134,154	1,869,645
1891	1,154,144	2,556,328	44 2	367,977	2,924,305
1892	1,979,354	4,297,610	43 3	243,461	4,541,071
1893	2,203,704	5,187,206	47 0	293,292	5,480,498
1894	2,830,885	6,963,100	49 2	704,052	7,667,152
1895	3,456,575	7,840,770	45 2	728,776	8,569,555
1896	4,011,697	7,864,341	39 2	739,480	8,603,821
1897	5,325,355	10,583,616	39 7	1,070,109	11,653,725
1898	7,331,446	15,141,376	41 3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48 8	661,220	15,728,693
1900	459,018	1,510,131	65 8		1,510,131
1901	412,006	1,014,687	49 2	81,364	1,096,151
1902	3,416,813	7,179,074	42 0	74,591	7,253,665
1903	6,105,016	12,146,307	39 8	442,941	12,589,248
1904	8,058,295	15,539,219	38 5	515,590	16,054,809
1905	11,160,422	19,991,658	35 8	810,416	20,802,074
1906	13,571,554	23,615,400	34 8	964,587	24,579,987
1907	15,523,229	26,421,817	34 0	981,901	27,403,738
1908	18,196,589	28,810,393	31 6	1,147,217	29,957,610
1909	20,543,759	29,900,359	29 1	1,025,429	30,925,788
1910	21,432,541	30,703,912	28 5	1,297,823	32,001,735
1911	23,888,258	33,543,479	28 1	1,498,006	35,041,485
1912	25,486,361	37,182,796	29 2	1,574,765	38,757,560
1913	25,628,432	35,812,605	27 8	1,545,435	37,358,040
1914	25,701,954	34,124,434	26 5	1,463,641	35,588,075
1915	28,314,579	37,264,992	26 3	1,362,469	38,627,461
1916	28,525,252	38,107,909	26 7	1,377,025	39,484,934
1917	27,251,960	37,017,633	27 1	1,306,288	38,323,921
1918 (a)					36,142,591

(a) Estimated

The opinion of the committee appeared to be that, if the low-grade mines closed, the other mines would benefit by the use of their labor, and thus keep up production. The native labor thus freed could, no doubt, be utilized, but it is questionable whether all of the white employees of the low-grade mines could be taken over by the higher-grade producers. The question remained in abeyance until July, when a representative gathering of the gold producers of the Empire was held in London, and the attention of the government was called to the urgency of the position. A government committee was appointed in October to deal with the question, and its work is not yet concluded. Details are given herewith of three of the low-grade mines whose careers are restricted by the altered conditions.

A Few Mines Discontinued Operations

Owing to the increased costs, it was found impossible to continue milling operations at the Bantjes mine without incurring a heavy loss. It was decided, therefore, to cease crushing at the end of the year. Development will continue in the lower portion of the mine by means of an arrangement with the Consolidated Main Reef, under which an exploratory drive will be pushed forward under the present workings to connect with the Bantjes main shaft.

At the East Rand Proprietary Mines it was found necessary to abandon the southern development scheme, owing to lack of funds, the expected profit from the present mine having been absorbed in the increased costs. This great undertaking has produced nearly £25,000,000 of gold since the amalgamation of the several properties in 1908.

The serious position of the Knight Central raised the question of liquidation. The property is a difficult one to work, as it is practically cut in half by the Simmer and Jack dike. The fortunate addition to the reserves of a patch of higher-grade ore has, however, made it practicable to continue milling, and profits appear to be assured for 1919.

TABLE II. STAMPS AND TUBE MILLS IN THE RAND

	Stamps at Work	Tube Mills at Work	Duty per Stamp per Day
1909, December	9,250	148	6.8
1910, December	9,150	184	7.2
1911, December	9,565	244	7.9
1912, December	9,440	277	8.4
1913, December	9,170	278	8.7
1914, December	9,291	294	9.1
1915, December	9,495	314	9.7
1916, December	9,185	313	9.8
1917, December	9,350	333	9.9
1918, August	8,879	343	10.3

Excellent results have been attained on the Far Eastern extension of the Main Reef Leader at the Sub-Nigel mine, in the Heidelberg district. The program of expansion includes the sinking of a new five-compartment vertical shaft, and an increased treatment plant to raise the output to 30,000 tons per month within four years. The necessary capital is to be provided by creating 300,000 £1 shares. The outcrop mine, the Nigel, is worked out, and closed at the end of 1917.

City Deep Shows Excellent Cyaniding Results

The development in the South Nourse section of the Nourse Mines continues to be satisfactory, and favorable results can be expected, provided that more native labor is available. At the City Deep, Ltd., a new vertical circular shaft was started in July, to provide air and means of transport to the deeper levels. It is estimated that its depth will be 7000 ft., divided into two sections of 3500 ft. each, and it will therefore be the deepest vertical shaft in the world. The cost is estimated at £430,000, and it is expected that the shaft will be completed in 1925. The metallurgical treatment on this property was still further improved in 1918, and the loss in dissolved gold per ton of slime treated has been reduced from 6.4d to 1.9d (i.e. to under 4c per ton.)

At the Crown Mines a second circular shaft, No. 15, to deal with the large unexploited area south of the dike, has been started, and at the end of September had reached a depth of 319 ft. It is expected to cut the reef at about 5000 ft. In this section of the property, the Main Reef leader has now been exposed on the 19th level south of the dike, with a value of 84 dwt. over a reef width of eight inches, thus confirming the high values previously shown in the vicinity by a borehole.

The seven-compartment rectangular shaft in the Booysens area cut the reef at a depth of 4148 ft., and was connected by a crosscut with the Robinson Deep mine during 1918.

A new circular shaft is being sunk at the Durban Roodepoort Deep about 400 ft. from the southern boundary. Its depth will be about 3000 ft., and the equipped cost is estimated at £182,500. This shaft will eventually deal with all the tonnage hoisted from the mine. At the Witwatersrand Deep good ore has been exposed in the bottom of the mine, averaging 11.4 dwt. over a stope width of 50 inches.

Earth tremors continued during 1918 in some of the mines of the Central Rand, owing to the extension of the worked-out areas, the chief being the Village Main Reef and the Ferreira Deep. The most severe shocks were those of July and August, in the Village Main Reef. This mine, being nearly worked out, contains large unsupported areas, which are readily affected.

The address of the president of the Institution of Mining and Metallurgy included the total results of the gold contents of the Main Reef Leader as disclosed by the workings of the Central Rand over a distance on the strike of eight miles. The average assay values per ton for succeeding depths on the reef of 1500 ft. each to a total of 9000 ft. were 44.7s, 31.2s, 37.1s 32.4s, 29.8s, and 30.6s. These figures are important as bearing on the continued stability of the Rand banket deposit as a gold producer, and as comprehensive evidence on the general question of the continuation of values at depth.

Far Eastern Rand

In 1917 the government decided against mining operations being conducted directly by the state, and therefore a Mining Leases Bill to deal with the areas still under state control was passed early in 1918. The law established a Mining Leases Board, the members of which are Sir Robert Kotze, government mining engineer; H. E. Farrer, the Secretary of Finance; F. E. Kantback, Director of Irrigation, and Sir William Hoy, the general manager of the South African Railways. It also fixes the maximum and minimum scales for the government's share in profits, and makes provision for larger mynpachts (mine leases).

The 2235 claims on the west section of the Farm de Rietfontein, No. 14, which were put up for tender in June, 1917, but were unallotted, were offered again for tender early in 1918. The tenders received by the government were from the Anglo-American Corporation, the Central Mining and Investment Corporation, and the General Mining and Finance Corporation. The result was announced on Mar. 21, and that of the Anglo-American Corporation was accepted. A new company has been formed to deal with the ground under a title of West Springs, Ltd., with a capital of £1,400,000 in £1 shares, to be issued at par.

Springs Mines, Ltd., will grant facilities for beginning development from its property pending the sinking of the two shafts arranged for. In return for this accommodation it has been given an option over a block of reserve shares. The technical management is in the hands of the Consolidated Mines Selection.

New State Areas and Springs Mines

The lease of the 2050 claims on Farm de Springs acquired last year by the Johannesburg Consolidated Investment Corporation was transferred at the end of February, 1918, to a new company registered as New State Areas, Ltd. Two vertical shafts are to be sunk forthwith, and it is estimated that the reef will be cut at about 3600 feet.

In 1917 Springs Mines obtained an extension to its property of 2235 claims on the eastern section of the Farm de Rietfontein, No. 14. A new shaft has been started, which, it is estimated, will be sunk to a depth of about 4000 ft., and should be completed in about four years. In the meantime, development is being pushed from the present mine into the new area, with a view to obtaining an early production of ore therefrom. The capacity of the reduction plant is to be immediately increased from 30,000 to 40,000 tons per month. Its eventual capacity is placed at 1,400,000 tons per annum. This, however, cannot come into operation for several years. At Modderfontein East, Ltd., which is still in the development stage, the comprehensive program for opening up the reef throughout the property is proceeding. At the end of September the two new shafts, Nos. 2 and 3, were, respectively, 898 ft. and 818 ft. in depth. The deep-level area is being rapidly developed from the Cloverfield shaft, and an exploratory drive has entered the outcrop section from Modderfontein B Mine.

Francois Cementation Process Used by Brakpan Company

At the Brakpan Mines the two new deep-level shafts, Nos. 3 and 4, in the extension of the property acquired in 1917, are being sunk. Their final depths are estimated at 4200 ft. and 4500 ft., respectively. Water in quantity has been encountered in No. 3 shaft, and the François cementation process is being employed to seal it off.

The new plant of the New Modderfontein Gold Mining Co., which increases the mill capacity to 100,000 tons per month, began operations in April, 1918, and is rapidly increasing its output to full production. The duty of the Nissen stamps in the new mill is 27 tons per day, with 0.28-in. screen aperture. The treatment plant includes many improvements on previous practice.

In July the extension of the reduction plant of the Modderfontein B, Ltd., to treat 60,000 tons per month, was completed. The delays in this work were due to the shortage of suitable labor. The Government Gold-Mining Areas brought up its capacity to 135,000 tons per month by the addition of five new tube mills and an extension to the Butters slime plant. Ten extra stamps and a new tube mill were added at the Van Ryn Deep on July 1.

The centralized control under the Transvaal Chamber of Mines of all mining supplies for all the mines has worked satisfactorily. The pooling system was originally restricted to gold, coal, and diamond mines, but in March, 1918, it was found advisable to include the base-metal mines to enable these to obtain supplies.

Introduction of Economies Has Helped To Make Operation Successful

Following on the enforced reduction of imports of mining supplies, the requirements of the mines have been met to a considerable extent by working up scrap and second-hand material locally. In this way economies have been introduced which should have a lasting effect. These include reshanking shoes, making cam shafts of broken stems, making up drill steel and rock-drill parts from scrap, shortening boiler shells to make further use of the tubes, and lining bins and repairing truck bodies with flattened-out railway sleepers.

Many mines now make their own tools from scrap material at a reduced cost. Owing to the necessity for restricting the use of glycerin in explosives to the lowest consumption possible, new compounds have been produced to take the place of gelignite. These include sengite, the ingredients of which are gun-cotton and nitrate of soda, and amatol, containing ammonium nitrate. The results from the use of these substitutes have been satisfactory.

Welfare Work Among Natives Effective

With regard to the health of the native workers on the mines, further experiments have been made with Dr. Lister's anti-pneumococcal vaccine, and the results have been extremely successful. At the Premier diamond mine the number of cases of pneumonia per 1000 natives employed during 1917 was 4.7, this being by far the lowest record obtained. The highest was 153 per 1000, in 1910. Experiments have also been continued at the Crown Mines, with the result that the number of cases has been considerably reduced. As the shortage of native labor is one of the greatest difficulties with which the mines now have to contend, it now rests with the government to recognize the success of this preventive of the disease, and to sanction a return to the employment of tropical natives.

TABLE III LABOR EMPLOYED IN TRANSVAAL GOLD MINES

	Whites	Natives	Native Death Rate per 1000
1910	25,376	191,784	35.72
1911	25,108	194,286	34.04
1912	24,334	206,121	28.83
1913	22,797	162,181	26.61
1914	21,834	177,291	18.35
1915	22,910	222,735	19.87
1916	23,074	206,852	17.17
1917	22,993	182,652	13.62
1918, January	22,921	185,864	13.49 (a)
March	23,097	195,042	
May	23,393	193,025	
August	23,422	189,295	

(a) For 12 months ended August 1918

In regard to miners' phthisis a Further Amendment Bill was passed in June, dealing chiefly with the extension of the period during which compensation is paid, and also with increases of pay to dependents. There are now four acts in existence dealing with this question, and it is proposed as soon as possible to bring in a final bill amalgamating them.

Industrial Relations Show Improvement

The year 1918 witnessed considerable improvement in the relations between employers and employed. The system of boards of reference, on which both sides are equally represented, has been extended to include all the men's unions. This advance is of the greatest importance, and is proving a satisfactory method of settling disputes. In July the mine mechanics asked for an increase in wages. They, however, have realized the necessity of adjusting their demands to the industrial position and the consequences involved in the closing of 16 of the low-grade mines, which is likely to take place if there is a further rise in costs.

DIAMONDS AND BASE METALS

The position of the diamond industry was well maintained in 1918. In the half year ended June 30, the Transvaal output was 446,411 carats, as against 491,410 carats for the first half of 1917. Of this total the Pretoria district produced 412,900 carats.

The iron-ore deposits near Pretoria and Ermelo were the object of much interest during 1918. Smelteries have been erected, and operations are being carried out on a small scale. The works erected to deal with the ores from the Pretoria district include a 50-ft. blast furnace capable of producing between 10 and 15 tons of pig iron per day. The ore from the Ermelo deposit is sent to the furnaces at Vereeniging, from which the production is sufficient to keep the greater part of the industry supplied with shoes and dies.

At the Rooiberg tin mine there was an improvement in results during the latter part of 1918. On the new property on Farm Blaauwbank payable ore is being opened up in several places, and the outlook appears promising. Better results have also been obtained at the Zaaiplaats tin mine, and in July a dividend of 30% was declared. The company has acquired on option from the Transvaal Consolidated Land Co. 27.75 acres of the adjoining farms Groenfontein and Roodepoort, which area contains a large quantity of high-grade alluvium. Tin smelting has begun on a small scale.

The development results of the Messina Copper Co. for 1918 have been disappointing, and the company has been greatly handicapped by the lack of labor and shipping facilities.

Australasia in 1918

By W. P. GEARY*

IN AUSTRALIA metalliferous mining was in a prosperous condition in 1918, and although it is not yet possible to obtain the output of the various metals accurately, the aggregate value of the mineral production during the year will closely approximate, if it does not exceed, that recorded for the previous year.

During the latter part of the year it was announced by the federal government that the exportable annual output of zinc concentrates, 300,000 tons, had been sold to the imperial authorities for the period of the war and 10 years afterward, and also that the exportable output of lead, about 175,000 tons per annum, had been sold to the British Ministry of Munitions, with the exception of lead for the markets of the East. It was also announced by the government that it would finance the copper producers for a period of three months from Jan. 1, 1919, if it should prove impossible to arrange an extension of the present contract with the British government to cover the output beyond the end of 1918. These considerations should prove important factors in maintaining the production of the industrial metals during 1919.

GOLD PRODUCTION

During the period under review every district in Australia showed a decline in the output of gold, and it is clear that unless fresh discoveries are made, the position of the industry will be unsatisfactory. To stimulate production the vital importance of granting a bonus of £1 ($5) per oz. on all gold produced within the empire, has been urged upon the imperial government, and also the suspension of all taxation on gold mining by the imperial and dominion governments.

Table 1 shows the gold yield of Australia for 1917 and 1918, the figures for 1918 being estimated from the production for the first 10 months of the year. Western Australia still maintains its position as the chief producer, but the yield indicates a falling off when compared with the year 1917.

In Victoria an important event was the completion of negotiations by the Bendigo A-1 Gold Mines, Ltd., with the Bendigo Amalgamated Co. to take over the Clarence United, New Argus, New Moon, and Suffolk United mines. The government has agreed to advance the company £10,000, which must be spent in actual development work, provided the company first expends a similar sum. It is expected that by persistent work a sufficient number of new shoots will be opened to permit of the tonnage being increased from 8000 to 8500 tons per fortnight. The last report available shows that 146,769 tons, averaging 5100 tons per fortnight, was treated, for a yield of 41,130 ounces.

TABLE 1. GOLD PRODUCED IN AUSTRALIA IN 1917 AND 1918

	Fine Oz., 1917	Fine Oz., 1918
Western Australia	970,317	887,966
Victoria	201,872	159,704
Queensland	179,305	136,629
New South Wales	82,171	84,137
Tasmania	14,496	13,500
South Australia	7,145	8,000
Totals	1,455,306	1,289,936 (a)

(a) Estimated.

The Mount Morgan Gold Mining Co., Queensland, for the year ended June 2, 1918, treated 214,989 tons of ore and produced 83,567 tons of concentrates. The smeltery and refinery made an output of 7619 tons of refined copper and 86,219 oz. of gold. The ore reserves at the date of the issuance of the report (June 2) were estimated at 3,825,685 tons, as compared with 3,942,029 tons on Nov. 25, 1917. The grade of the reserves is practically stationary at 2.58% copper.

In New South Wales it is expected that the total yield for 1918 will show a slight advance on that recorded for the preceding year. This is in a measure due to the resumption of milling operations by the Mount Boppy Gold Mining Co. at the end of January, 1918. The yield from this company's mine for the first three months of the year totaled 5369 oz. of gold, the ore reserves being estimated at 249,334 tons, which, without reckoning future developments, would give the mine, under favorable conditions, a further life of at least three and one-half years.

---

*Department of Mines, Sydney, N. S. W., Australia.

In Tasmania the Tasmanian Gold Mining Co. during the 12 months ended Mar. 25 treated 19,190 tons of concentrates and slimes, from which was recovered 5861 oz. of fine gold, valued at $123,825.

The mines in the Broken Hill field (N. S. W.) continued production on a satisfactory scale during 1918. The output for the first nine months of the year was as follows: Lead concentrates, 202,805 tons; zinc concentrates, 269,271 tons, and carbonate ore, 25,093 tons.

The North Broken Hill Co. during the half year ended June 30, 1918, raised 106,489 tons of ore, and the classification effected by the mills is given in Table II. The assets at the above date show a surplus over liabilities of $2,999,250.

TABLE II. NORTH BROKEN HILL PRODUCTION, JANUARY-JUNE, 1918

Product	Net Weight, Tons	Proportion, %	Assay Value Pb, %	Assay Value Ag, Oz.	Assay Value Zn, %
Concentrate	20,605	18.8	65.2	24.1	7.7
Quartzose tailing	15,800	14.5	2.7	2.6	8.0
Zinc tailing	57,778	52.9	3.3	3.5	16.2
Slime	15,017	13.8	6.3	4.9	15.8
Crude ore	109,200	100.0	15.3	7.5	13.4

The Broken Hill South Silver Mining Co. mined 127,745 tons of sulphide ore during the six months ended June 30, 1918. The working account shows mine production, $2,131,525, and a balance carried to profit and loss of $1,084,425. This, with $1,587,765 brought forward, and $51,715 interest and dividends, makes a total of $2,723,905.

The output of the Broken Hill Proprietary Co.'s mine for the half year ended May 31, 1918, was 79,348 tons, or an increase of 24,032 tons over the previous six months. The plants handled 70,843 tons of sulphide ore, which yielded 11,958 tons of lead concentrates, assaying 60.55% lead, 29.14 oz. silver per ton, and 13,608 tons of slimes. The zinc flotation plant dealt with 144,944 tons of tailings, as compared with 92,907 tons for the previous half year, the production of zinc concentrates amounting to 36,630 tons. The net profit for the half year was $1,798,530, as compared with $1,454,405 for the preceding six months. After providing for all outstanding liabilities, there remain liquid assets in cash, bullion, and convertible stocks representing a total value of $4,227,730.

The operations of the Zinc Corporation, Broken Hill, for 1917 show that the mine owned by this company produced 134,618 tons of ore, assaying 8.5% zinc, 2.8 oz. silver, and 14% lead. The yield is reported as follows:

	Tons	Zn., %	Ag. Oz.	Pb., %
Lead concentrates	24,829	6.6	10.2	64.4
Zinc middlings	40,576	16.6	1.9	4.7
Residue	69,213	4.4	0.6	1.4

The zinc concentrator treated 257,590 tons (215,640 tons being drawn from the dumps), of an average assay value of 14.6% zinc, 6.6 oz. silver, and 5.6% lead, which resulted as follows:

	Tons	Zn., %	Ag. Oz.	Pb., %
Zinc concentrates	63,700	47.7	10.9	6.9
Lead concentrates	7,164	15.6	30.2	56.7
Zinc slime	7,306	37.2	26.0	14.1
Residue	179,420	1.8	3.4	2.8

The net profit was $1,125,770, and the total available, after including the balance brought forward, was $1,255,625.

In the State of Queensland the value of the mineral production, other than gold, coal, and precious stones, for the first nine months of 1918, was $10,057,380, as against $9,438,670 for the similar period in 1917. The output of silver and lead was valued at $109,130. The quantity of silver-lead ore produced in Tasmania during the year 1917 was 9576 tons, valued at $760,610, and for the first six months of 1918 was 2516 tons, valued at $218,115.

PRODUCTION OF TIN

In New South Wales, the Vegetable Creek Tin Mining Co., Emmaville, continued working on rich wash in the dip workings, where, in the crosscut, there is a width of 36 in. which carries 200 lb. per fathom. The usual output of six tons of oxide per week is being maintained. The production for the year ended Apr. 24, 1918, was 204 tons, valued at $186,135. The Water Co., Emmaville, during the half year ended July 31, sluiced 296,300 cu.yd. of material, for a yield of 83 tons of black tin. Since the inception of operations, 12 years ago, the company has sluiced 4,695,000 cu.yd. of material, for a yield of 2384 tons of black tin, averaging 1.138 lb. per yard. For the first six months of 1918 it was estimated that the value of the yield from the Ardlethan field was approximately $200,000, of which the Bygooend had contributed $50,000.

The Mount Bischoff Tin Mining Co., Tasmania, for the half year ended June 30, treated 44,041 tons of ore, for a yield of 226 tons of concentrate. The ore reserves are about 1,185,000 tons, of an average assay content of 0.29% tin. At the smelting works 1859 tons was smelted, for a yield of 1269 tons of tin. The quantity treated on behalf of the company was 237 tons of oxide, which yielded 143 tons of tin, the remainder being on custom ore.

The Briseis Tin Mining Co., Tasmania, according to the last report, made a profit of $144,830 for the year 1917, as against $162,585 for 1916. The output of tin was 339 tons, as compared with 466 tons in the previous year. The Pioneer Tin Mining Co., Tasmania, including the Argonaut and South Pioneer properties, for the year ended June 30, 1918, treated 826,500 cu.yd. of material, for a recovery of 345 tons of stream tin. Since 1900 about 10,053,300 cu.yd. of material has been treated, yielding 7009 tons, or 1.562 lb. per cubic yard.

In the State of Queensland the output of tin for the first nine months of 1918 totaled 895 tons, valued at $953,615. In Western Australia, tin to the value of $185,535 was produced in 1917. The production of tin ore in Tasmania for the first six months of 1918 totaled 951 tons, valued at $1,030,355.

AUSTRALIAN COPPER PRODUCTION IN 1918

It may be expected that the copper production of the commonwealth for 1918 will approximate 32,500 long tons, which shows a slight falling off. Of this total, 50% will, as usual, be contributed by Queensland, and the remainder, with the exception of about 1000 tons which may be credited to Western Austraila and Papua, will be the production in about equal proportions by New South Wales, South Australia, and Tasmania.

Copper producers during 1918 had a difficult time. The price fixed for electrolytic, £108, and fire refined, £106, by the British Munitions Committee would have been entirely satisfactory had it been maintained for a year, but, on each occasion that the price was settled, it was done in such a way that producers had only a three months' tenure. This hampered financing operations seriously, and put the small producer practically out of action. At the time of writing those who have been able to make financial arrangements to continue, have no market for current production.

The British munitions contract expired Dec. 31, and, now that peace is in sight, there seems little prospect of a renewal unless the Allied governments realize that for economic reasons they must stand behind current production until the freedom of trade is mutually established again. The Australian production up to Sept. 30 is cared for; anything coming to the refinery after that date will not be in the refined state in time for inclusion in the British government contract. Consequently, the companies producing blister today are waiting to see what will be done for them in England. It would seem as if the peace discussion will relegate the question of copper production to obscurity for a while.

On this side of the world it is maintained that the Allied governments should finance the copper production during the peace discussion period, and take the copper for joint account. It could be sold in due course at cost price plus interest and charges to those governments which have caused the war.

Queensland has maintained in copper its premier position, largely through the production of Hampden Cloncurry and Mount Morgan. Of the Queensland mines it may be said that only these two have been able to make any showing against the adverse conditions referred to. Mount Elliott and Mount Cuthbert have at intervals had a short run, but the sum total is small. The old-established Wallaroo & Moonta, in South Australia, accounts for practically all that this state brings into the figures. In a labor sense Wallaroo & Moonta is well off. It is a settled town, and the company has been able to work amicably with its employees, whose wages vary with the price of the metal.

The Mount Lyell Co., the principal producer of Tasmania, has suffered principally through shortage of labor. Like Mount Morgan, in Queensland, it has adopted mechanical concentration, and at present is watching carefully the development of leaching in the United States.

Great Cobar and C. S. A. have been the principal producers of New South Wales. The latter has been given rail connection, and has entered upon a profitable career. Mount Hope, Ltd., another big proposition out in the west, has just been connected by rail. It has a future ahead of it, but during 1918 was twice compelled to cease mining, because of shortage of water. The trouble is not insurmountable, and the company is remedying the situation.

Papua continues to open up some promising basic deposits. It, however, adds little to total production, as work is mostly restricted to development. Western Australian operations have been mostly confined to the mining of shipping-grade ore, which has been sent to Port Kembla, the refinery in New South Wales, for smelting and refining. Whim Well, in the northwest, has been the largest producer. The West Australian production has been somewhat increased by the operations of the government smeltery at Phillips River.

Mica in 1918

Because of its wide range of utility in electrical equipment, mica was considered in 1918 as an essential war mineral. Restrictions imposed on the importation of mica on account of the lack of shipping caused some anxiety, because domestic production, so far, has not proved equal to consumption. Sheet mica, imported from India, is considered especially valuable because of its desirable physical properties.

The statement contained in *Mineral Resources* that the domestic production of sheet mica in 1917 was 1,216,816 lb., about 40% of the total consumption, gives no information as to its quality. The imports consist largely of clear sheets of good quality, whereas the domestic product includes several varieties. The prices of the larger sheets, 58c. per lb., were slightly lower than for the preceding two years, but an increase of 10 to 20% in price occurred in some of the smaller sizes.

During 1918 mica was imported chiefly from China, India, and England, with smaller quantities from Brazil, Peru, Guatemala, and Mexico. The more important domestic sources of production were North Carolina, New Hampshire and South Dakota, with varying quantities from Alabama, Georgia, Idaho, South Carolina, and Virginia. The total value of the domestic mica produced in 1917, according to the U. S. Geological Survey, was $757,346, and the value of the imported mica reached $1,430,048. The domestic production in 1918 increased proportionally to the total consumption. From foreign countries, only the sheet mica is exported. In the United States the chief domestic product is scrap.

A comparison of the quantity of crude and manufactured mica imported into the United States for the first nine months in 1917 and 1918, according to the Bureau of Foreign and Domestic Commerce, is given in the accompanying table.

U. S. IMPORTS OF CRUDE AND MANUFACTURED MICA, FOR NINE MONTHS OF 1917 AND 1918

	1917		1918	
	Imports, Lb.	Value	Imports, Lb.	Value
Unmanufactured	639,291	$318,653	557,556	$495,079
Cut, split and manufactured		804,625		753,023

Chinese Tungsten Ore Industry

The deposits of tungsten ore in South China, including Hongkong, have become one of the most important additions to the world's supply of this ore. The shipments of ore from Hongkong alone, in addition to those from Canton, Swatow, and other points made through Shanghai and other transshipment ports, during the first eight months of 1918, were valued at $1,010,405 gold. The number of Chinese interests involved in the collection of the ore from Kwangtung, Kwangsi, and Hunan has increased until there was a veritable boom in the business, says the *Ironmonger.* The ore is generally found in pockets scattered over a wide extent of territory. At present the greater part of it is purchased by middlemen from Chinese operators who manage the mining and deliver the ore.

Uncommon Ores and Metals

By H. C. MEYER*

NO DATA are available as to the total production of cerium, or cerium mixed, metal, as it is known to the trade, during 1918. This material, which is a complex alloy of cerium, lanthanum, didymium, and other metals of the cerium and yttrium group, is produced mainly from monazite sand residues by electrolytic methods. Its chief use is in the manufacture of ferrocerium, which is employed as a tinder in pocket cigar lighters, gas lighters, and to a large extent during the last three years for military purposes. The production of this alloy probably runs into 1000 to 2000 lb. per month. Prior to 1917, the alloy was manufactured under Austrian patents, but, following the seizure of these patent rights by the Alien Custodian, licenses were granted to several American manufacturers to produce the metal, and, as a result, the greatly inflated price took a severe drop. During 1916 the price was $25 per lb. but in the late spring of 1917 the market dropped to $18 or $20 for moderate-sized lots, with slightly lower figures for large quantities under contract. Ferrocerium is an alloy consisting of, approximately, 30% iron and 70% cerium, with lanthanum, didymium, and other ingredients.

Palladium

The active demands for palladium as a substitute for platinum increased greatly as the restrictions on platinum, except for Government work, became more and more severe. At the beginning of 1918 the price was about $135 per troy ounce, and by the middle of the year this price had advanced to as high as $165. It became apparent that it would be necessary to control the price of this metal as well as that of platinum and iridium, and the War Industries Board announced that the maximum price should not be in excess of $135 per troy ounce, and that trading in the metal, except for war purposes, could be conducted only under a license. After the signing of the armistice and the removal of Government control, the market advanced slightly, but only for a brief period; and before the close of the year, offerings were made of good-sized parcels for as low as $125 per troy ounce. It is interesting to note that, prior to 1914, palladium was used only in comparatively small quantities and considered a very rare metal. With the advent, however, of gold-palladium alloys for dental work and the manufacture of crucibles, the production of this precious metal showed a marked increase. In 1915 the total number of troy ounces sold amounted to only 958, whereas in 1917 the amount was over 3300. The probabilities are that the production for 1918 will show at least a 75% advance over that of the previous year. The uses of this metal have become so firmly established in certain trades that it is unlikely that a return will be made to the use of platinum, unless there is a marked drop in the price of the latter.

Selenium

The chief use of selenium during 1918 appears to have been as a decolorizer for glass as well as in the manufacture of ruby glass. The former use was developed through the shortage of suitable grades of manganese, which heretofore has been used to mask the green color imparted by the presence of iron. The demand of glass makers became so great that producers were not able to keep up with the consumption, and the price rose to as high as $3.25 per lb. and remained around this figure throughout the year. During the last quarter, however, there was a slight recession in price, and, at the close of 1918, black, powdered, amorphous selenium was offered for as low as $2.75 per pound.

Strontium Ore

The market for both celestite (the sulphate) and strontianite (the carbonate) was comparatively quiet. Large deposits of apparently high-grade carbonate were discovered at several points in the West and sold in carload lots at the rate of $60 to $80 per ton, depending on the purity of the ore. Nearly all the sulphate consumed was imported, as most of the mines in this country are situated in the Far West, and the high transcontinental freight rates made it impossible for domestic producers to compete with the high-grade imported ore which is laid down on the Atlantic seaboard at prices ranging from $16 to $18 per gross ton. The chief demand for strontium ore is in the manufacture of strontium nitrate, large quantities of which were used for military purposes, in signal rockets, star bombs, and similar apparatus. There was practically no fluctuation in the price of strontium nitrate—about 25c. per lb. throughout 1918.

Thorium Ore

The importations of thorium ore in the form of monazite sand from Brazil and India were practically normal during 1918. The Brazilian sand carries an average of 6% thorium oxide, and is preferred by certain manufacturers of thorium nitrate to the Indian sand, which carries an average of 8% thorium oxide. Prior to 1914 the Indian deposits as well as those of Brazil were practically controlled by German interests, and nearly all the thorium nitrate was manufactured in Germany and Austria. Under the control of the German syndicate the price of the nitrate was so regulated that French, English, and American independent manufacturers were practically driven out of business. The German syndicate had large mantle factories in all of the above-named countries, which served to further strengthen its strangle hold on the market. The war, however, put an end to all these conditions, and several independent manufacturers are now supplying consumers with thorium nitrate equal in quality to the best Austrian or German nitrate. There was little or no fluctuation in price in 1918. During the first half, the price ranged from $6 to $6.50 per lb., with lower prices for yearly contracts. Toward the end of the year, owing to keen bidding among nitrate manufacturers for the 1919 requirements of the mantle trade, the price dropped to $5 and $5.25 per lb., according to quantity. The world's consumption of thorium ore is approximately 3000 tons per annum. The consumption in all countries of incandescent mantles is about 300,000,000, and the average mantle contains the equivalent of about 1 gm. of thorium nitrate.

---

*Vice-president, Foote Mineral Co., Philadelphia, Pennsylvania

TITANIUM

Like many of the other war minerals, titanium ore was in great demand during 1918. The absence of any important domestic production of rutile, coupled with the inability to import this mineral from Norway, compelled manufacturers of ferrotitanium to resort to ilmenite, which, although carrying a lower titanium content than rutile, is just as suitable for the manufacture of the ferro-alloy as high-grade material. The beach deposits of ilmenite sand on the east coast of Florida supplied most of the demand, although a quantity of ilmenite ore was imported from Canada. Ilmenite sells for $12 to $20 per ton in carload lots, and generally carries from 35 to 45% titanium oxide. Little rutile was offered. The Norwegian grade was selling abroad for as much as $400 per ton during the first half of 1918. Later, owing to improvement in shipping conditions, the imported grade was offered in carload lots here for much lower figures. Prepared grades of titanium oxide, sold under the trade name of "titanellow," were in active demand for ceramic purposes. The price of "titanellow" ranged from 50c. per lb. for the lower grades, suitable only for pottery work, up to much higher figures for the highest grades used in porcelain teeth.

URANIUM

There was only a small production of carnotite during 1918, and ore carrying 1½% to 2% uranium oxide sold for $50 per unit, or $75 to $100 per ton, in carload lots. The black oxide, used principally in the manufacture of ferro-uranium and uranium salts, was quoted at from $3.25 to $3.60 per lb., depending on quantity. Sodium uranate, or, as is known in the trade, yellow oxide of uranium, ranged in price from $2.25 to $2.50 per lb. The great future for uranium apparently lies in its use as a steel-hardening agent. Although there has been much prejudice against ferro-uranium, the results obtained by many tool manufacturers and users of high-speed steel show that it has real merit; and it is probably only a question of time when it will be just as largely used as ferrotungsten and ferromolybdenum.

ZIRCONIUM

The year 1918 witnessed an unprecedented demand for zirkite—the commonly accepted trade name for native zirconium oxide. The total amount of zirkite imported during 1918 was approximately 1400 gross tons. This ore carries from 75% to 80% zirconium dioxide. During the first quarter the demand for the ore was mainly for refractory purposes, as it has been shown to be of great value for electric-furnace linings, as well as for other purposes where a refractory having a low coefficient of expansion, high melting point, and maximum resistance to slag corrosion is demanded. It had been known prior to our entry into the war that the Germans had developed remarkable zirconium steel, which was claimed to be superior to vanadium, chromium, molybdenum, tungsten or nickel steel. The demand for light armor plate on tanks, aeroplanes, and other equipment, compelled the Government to investigate the possibilities of all steel-hardening elements for such purposes, and it was ultimately decided that zirconium was the best suited for the requirements of the War Department. Owing to the absence of any authoritative technical data on the production and uses of ferrozirconium, many difficulties were encountered, but ultimately through the efforts of several large manufacturers of ferro-alloys, a ferrozirconium suitable for the production of zirconium steel was evolved. Ferrozirconium, as now offered to the trade, carries approximately 30% to 36% zirconium metal and sells for $4 to $4.50 per lb. of contained metal, depending on the quantity demanded. It is not to be supposed that ferrozirconium will supplant ferrotungsten, ferrochromium or ferrovanadium, but it seems evident that it will be largely in demand for certain purposes for which these other ferro-alloys are not entirely satisfactory.

Lump metallurgical zirkite sold for 5c. to 7c. and ground for 6c. to 8c. per lb., depending on quantity. Zirkite cement for chemical purposes and as a bond for zirkite refractories sold at 8c. to 10c. per lb., according to the quantity demanded.

The demand for zirkite bricks was active throughout 1918, increasing toward the closing months. All the standard brick shapes required by the trade are now available, and the use of this new basic refractory is well past the experimental stage. A standard 9-in. zirkite "straight" weighs approximately 12 lb. and sells in carload lots at prices comparing favorably with magnesite brick, when life and efficiency are considered.

Potash in 1918

Concerted efforts on the part of the Government and various producers in 1918 resulted in increasing the production of potash to only about 60,000 short tons, approximately of pure K_2O, the 1917 output having been 32,573 short tons, according to figures of various Government bureaus. With normal pre-war needs estimated at about 240,000 short tons, the output in 1918 thus rose to only 25% of this amount, from 13% in 1917.

The average selling price at point of shipment in 1917 was $4.26 a unit, or $426 a ton pure K_2O, according to figures reported to the U. S. Geological Survey by the 82 firms then producing, most of whom were small wood-ash leachers. At the beginning of 1918, the price was approximately $300 a ton, and at the end of the year about $1.50 a unit, or $150 a ton. During the latter half of 1918, it is understood that fertilizer men. the chief consumers of potash, were out of the market completely, being unwilling to pay the price asked, the prospects appearing good of obtaining foreign potash within a comparatively short time at a much lower figure.

The chief sources of the 1918 potash supply, briefly, according to A. W. Stockett, of the U. S. Bureau of Mines, were: Natural brines from Nebraska lakes, four companies operating; Searles Lake, California, two companies operating, namely, the American Trona Corporation and the Pacific Coast Borax Co. Solvay Process Co.; Salduro salt marsh, Utah, Solvay Process Co.; alunite deposits, Marysvale, Utah, chief producer being the Mineral Products Corporation; cement works, two companies producing at beginning of 1918; and California kelp, Hercules Powder Co., chief producer. Potash was also produced from glauconite at Jones Point, N. Y., and Stockertown, Penn., and from other minor sources.

Efforts of the U. S. Bureau of Mines to induce cement plants to undertake the recovery of potash were hindered by the curtailment of building operations and by transportation difficulties, which caused many companies to shut down or to reduce their scale of operations. On the other hand, the increased activity of blast furnaces made possible greater experimentation in the matter of the recovery of potash.

Blast-furnace dust was thought by some interested to be a possible source of potash, though there were no developments in this direction. It was expected that a dozen cement companies would have been producing potash by the end of 1918. The doubtful future and the uncertainty as to war-profits taxation probably retarded many projects. It was announced early in the year that the Du Pont Nitrate Co. had produced potash commercially from Chilean nitrate and had revealed its process to non-enemy competitors.

The first permit for leasing potash lands under the act of Oct. 2, 1917, was issued on Feb. 2, 1918, by the Secretary of the Interior, to cover 2560 acres in Inyo County, Calif. The production of potash was to have been stimulated, with that of other war minerals, by the War-Minerals Act., of Oct. 5, 1918. In October, the War Industries Board began a potash survey, with a view to meeting agricultural needs, there being no shortage for military needs. After the armistice was signed, the problem of increasing potash production in the United States was turned over to the Department of the Interior by the chemicals division of the War Industries Board.

Domestic potash produced at high cost would therefore seem to stand little chance in competition with the foreign product. Possible exceptions are such companies as may be operating in the Far West at moderate cost, and which can establish a near-by market.

Talc and Soapstone in 1918

The demand for talc in 1918 was greater than in previous years, owing to the shortage of French and Italian talcs, and, in some cases, to inability to procure English china clay, used to some extent as a substitute, although an added quantity of the domestic talc has supplanted that product which was formerly imported from Italy and France. A number of cotton-cloth manufacturers who formerly used nothing but an imported talc have found certain domestic grades satisfactory, and it is expected that many of them will continue their use even when importations resume their normal conditions and prices are low. Several large paper mills manufacturing fine grades of book and writing papers are using domestic talc, and it is expected that they will continue to do so regardless of the future importation of English china clay. The use of talc has increased in the manufacture of rubber and prepared roofing, and there is every indication that the demand for enlarged amounts will continue.

Owing to the fact that the talc industry is still in its infancy, many improvements have been made in separating the pulverized product, and it is because of this fact that paper and other manufacturers are becoming more interested in domestic talcs. Though no new processes of preparing talc for the market were developed in 1918, those already in vogue have been so standardized and refined that some producers have succeeded in obtaining a superior product, particularly during the last two years.

Labor conditions were generally unsatisfactory during 1918, but the shortage has not been such as to occasion protracted shut-downs among the talc manufacturers, although the irregularity of labor has at times seriously interfered with production, and in the early part of 1918 some of the mills were closed, owing chiefly to car shortage, which made it impossible for them to market their product.

It is expected that final production figures for 1918 will show an increase over those for 1917, which were 198,613 tons, valued at $1,889,672, or an average of $9.51 per ton. During 1918, the production of magnesia talc in New England was about 78,000 tons, an increase of 5% over figures previously reported and an increase of nearly 15% over the production in 1915.

Prices advanced in 1918 from 12 to 20% above those in 1917 and varied with the different grades. The highest average-priced grades ranged from $60 to $240 a ton and the lowest-priced material was sold as crude talc at prices ranging from $3.25 to $9.25 a ton, although the value of the latter was increased by grading according to quality, and averaged $10.50 per ton. Although prices of talc have advanced steadily since 1916, because of the high cost of labor and materials entering into the mining and milling of the product, it is interesting to note that the price of talc has advanced less than that of any of the other commodities entering into the manufacture of paper.

Talc imports in 1918 decreased, owing to the difficulties of ocean transportation. However, considerable activity was prevalent at Madoc, Ontario, and it is expected that final figures will show an increase of Canadian talc shipments to this country.

Few new developments are reported, although extensions of deposits now being worked have been disclosed. The Eastern Talc Co., at Rochester, Vt., is now developing a large body found by diamond drilling near the Williams mine.

The production of soapstone in New England declined in 1918, and in general, in the United States, the production of this material has been hampered by labor conditions and high freight rates. No actual figures are available on soapstone slabs, but the production of ground soapstone for 1918 was undoubtedly less than in 1917.

Depression in the Ukraine

The industrial conditions in the Ukraine seem to be going from bad to worse, says the *Ironmonger*. The iron industry is collapsing. All the 65 iron-smelting furnaces in the Ukraine, which formerly supplied 80% of the pig iron made in Russia, are idle. The coal output in the Donetz field is smaller than it has ever been, and the whole industrial life of the country is undermined. Trade restrictions and monopolies are encouraging speculation, and all business is handicapped by difficulties of transport. At a recent meeting of the Association of Trade and Agriculture held at Kieff, the Minister of Commerce declared that close relations with Russia were indispensable if industry in the Ukraine is to revive.

Mining Dividends

THE tables which follow show the dividends paid in 1917, 1918 and to date by the principal mining, metallurgical and holding companies of America that have paid dividends since 1913, except those which do not make public reports.

As most mines are commercial producers of two or more metals, no attempt is made to classify them as copper producers, lead producers, etc. Also, it is difficult to make a precise geographical distribution, and United States companies, such as the American Smelting and Refining, which have properties in two countries, are therefore, listed under United States for convenience.

Toward the end of 1917 many companies found it necessary to reduce or discontinue their payments, owing to war conditions and in 1918 the decrease continued, so that the total was $165,108,262, paid by 112 United States mining and metallurgical companies, compared with $245,337,018 in 1917.

Dividends paid by mining companies in Canada, Mexico, Central and South America also showed a decrease, as was to be expected, due to the same adverse conditions, and 1918 payments were $19,640,235, against $23,359,159 in 1917. Holding companies paid $1,983,732 in 1918 and $4,010,010 in the preceding year.

DIVIDENDS OF MINING AND METALLURGICAL COMPANIES IN THE UNITED STATES

				Dividends Paid						
				1917		1918			Latest	
Company Name	Situation	Shares Issued	Par Value	Per Share	Total	Per Share	Total	Total To Date	Date	Amount
Ahmeek, c	Mich.	200,000	$25	$16 00	$3,200,000	$10.00	$2,000,000	$11,250,000	Dec. '18	$2.00
Alaska Goldfields	Alas.	250,000	5	.10	25,000			428,250	Jan. '17	10
Alaska Mexican, g	Alas.	180,000	5					3,507,381	Nov. '15	10
Alaska Treadwell, g	Alas.	200,000	25					15,785,000	May '16	.50
Alaka United, g	Alaa.	180,200	5					2,045,270	Feb. '16	30
Allouez, c	Mich.	100,000	25	12 00	1,200,000	7.50	750,000	2,750,000	Dec. '18	1 50
Am. Mineral Prod	Wash.	1,500,000	1	20	30,000	.10	15,000	60,000	Nov. '18	.10
Am. Sm. & Ref., com	U. S.-Mex.	609,980	100	7.00	4,269,860	6.00	3,659,880	40,975,758	Dec. '18	1.50
Am. Sm & Ref., pf	U. S.-Mex.	500,000	100	7 00	3,500,000	7.00	3,500,000	65,296,386	Dec. '18	1.75
Am. Smelters, pf. A	U. S.	98,675	100	6 00	699,572	6.00	586,435	12,969,542	Oct. '18	1.50
Am. Smelters, pf. B	U. S.	35,395	100	5 00	513,094	5.00	173,088	17,696,182	Oct. '18	1.25
Am. Zinc, Lead & Sm	U. S.	193,120	25	2 00	386,240			1,495,060	May '17	1.00
Am. Zinc, Lead & Sm., pfd	U. S.	96,560	25	6.00	483,238	6.00	483,238	1,223,125	Nov. '18	1.50
Anaconda, c	Mont.	2,331,250	50	8.50	19,815,625	8.00	18,650,000	146,357,500	Nov. '18	2 00
Argonaut, g	Calif.	200,000	5	.35	70,000	.20	40,000	1,890,000	Dec. '18	05
Arizona Commercial, c	Ariz.	265,000	5	1.60	556,500	2.00	530,000	1,219,000	Oct. '18	.50
Arizona Copper, pf. (a)	Ariz.				119,221		119,221	2,486,728	Nov. '18	
Arizona Copper, com	Ariz.	1,519,896	1 20	1.14	1,754,339	78	1,300,338	21,432,164	Aug. '18	.36
Arizona United, c	Ariz.	2,500,000	1	.03	75,000			100,000	July '17	.01
Atolia, tung	Calif.	100,000	1	13.00	1,300,000	7.00	700,000	5,654,500	Dec. '18	.50
Barnes-King, g	Mont.	400,000	5	.10	40,000	.40	160,000	260,000	Nov. '18	.10
Big Creek Leasing, l. s	Ida.	5,000	10	2 00	10,000			12,500	Dec. '17	.50
Big Four Explor	Utah	400,000	1					50,000	June '16	.05
Bingham Mines, c	Utah	150,000	10	1.25	187,500	2 50	375,000	562,500	Dec. '18	.50
Bingham-New Haven, (c)	Utah	228,690	5					960,494	Dec. '15	.20
Boss, g	Nev.	408,500	1	.08	32,680	.03	12,255	93,955	Feb. '18	.03
Brunswick, g	Calif.	395,287	1					203,315	Sept. '15	.06
Bunker Hill, Con., g	Calif.	200,000	1					931,000	Sept. '16	.02½
Bunker Hill & Sull., l. s	Ida.	327,000	10	6 25	2,043,750	4 75	1,553,250	22,386,750	Dec. '18	.50
Butte-Alex. Scott, c	Mont.	79,311	10					1,054,019(*d*)	Apr. '16	10 50
Butte-Bullwhacker, c	Mont.	1,000,000	1	.02½	25,000			25,000	Oct. '17	.01
Butte & Superior, z	Mont.	290,184	10	6.65	1,929,804			16,940,258	Sept. '17	1 25
Caledonia, l. s	Ida.	2,605,000	1	.36	937,800	.36	937,800	3,761,256	Dec. '18	.03
Calumet & Arizona, c	Ariz.	642,480	10	11.00	7,067,041	8.00	5,139,840	41,132,601	Dec. '18	2.00
Calumet & Hecla, c	Mich.	100,000	25	85.00	8,500,000	55 00	5,500,000	150,750,000	Dec. '18	15.00
Camp Bird, g. s	Colo.	1,100,051	4 86					9,185,498	Nov. '15	24
Camp Bird, pfd	Colo.	649,625	4 86	.36	221,002	18	110,501	1,607,888	July '18	18
Cardiff, l. s	Utah	500,000	1	.25	125,000	20	100,000	725,000	Oct. '18	.20
Centennial, c	Mich.	90,000	25	1 00	90,000	2.00	180,000	360,000	Dec. '18	1.00
Centennial-Eur., l.s.g.c	Utah	100,000	5					4,150,000	Apr. '16	1 00
Center Creek, l. z	Mo.	100,000	10	.35	35,000	05	5,000	655,000	Apr. '18	.05
Cerro Gordo, z.l.s	Calif.	1,000,000	1	.22½	225,000	.05	50,000	299,375	Jan. '18	.05
Champion, c	Mich.	100,000	25	44.80	4,480,000	12.80	1,380,000	23,374,540	Aug. '18	6 40
Chief Con., s.g.l	Utah	884,228	1	.35	309,435	45	397,901	1,234,871	Nov. '18	.12½
Chino, c	N. M.	869,980	5	9.90	8,612,802	4.50	3,914,910	26,403,042	Dec. '18	1.00
Coahuila, l.z	Mo.	300,000	1	.20	60,000			150,000	Nov. '17	.05
Colo. Gold Dredging	Colo.	100,000	10					775,000(*e*)	Feb. '16	1 00
Commercial	Ore.	1,641,000	1	05	82,550			165,805	Nov. '17	.00½
Cons. Ariz. Smelting, c	Ariz.	1,663,000	5	.10	166,300	.20	332,600	498,900	Dec. '18	.05
Con. Interstate-Callahan, z	Ida.	298,303	10	2.00	929,980	1.25	688,717	6,966,082	Oct. '18	.75
Continental, z.l	Mo.	22,000	25	1.50	33,000	.50	11,000	638,000(*f*)	Jan. '18	.50
Copper Range, c	Mich.	395,000	25	10.00	3,943,912	6.00	2,366,394	25,420,704	Dec. '18	1 50
Cresson Cons., g	Colo.	1,220,000	1	1.20	1,464,000	1.20	1,464,000	7,271,162	Dec. '18	.10
Daly	Utah	150,000	20	.30	45,000	.40	60,000	3,030,000	Oct. '18	.10
Daly Judge, s.l. (*g*)	Utah	300,000	1					1,155,000	Dec. '15	35
Davis Daly, c	Mont.	600,000	10			.75	450,000	450,000	Dec. '18	.25
Derry Ranch, g	Colo.	1,000	100	25.00	25,000	35.00	35,000	235,000	Oct. '18	7 50
Dr. Jack Pot, g	Colo.	2,843,342	02½	.01	28,443			141,698	Jan. '17	.01
Dragon Con	Utah	1,875,000	1	.04	75,000	.04	75,000	150,000	Oct. '18	.01
Duluth & Utah Dev., l.s	Utah	50,000	20					10,000	Mar. '15	04
Dunkin, g	Colo.	200,000	1					55,000	Aug. '16	.07½
Eagle & Blue Bell, g.s.l	Utah	893,146	1	.40	357,258	.30	267,944	1,161,090	Sept. '18	10
East Butte, c	Mont.	420,731	10	2.00	831,731	1.50	631,097	1,462,828	Dec. '18	1 50
Eastern Talc	Vt.	69,690	10		41,220		31,301	97,319	Sept. '18	.15
Electric Point, l	Wash.	793,750	1	.20	166,687	.06	47,625	214,312	Sept. '18	.03
Elko Prince, g.s	Nev.	1,108,566	1	.03½	38,800	.11½	127,484	166,284	Apr. '18	05
Elkton Con., g	Colo.	2,500,000	1					3,579,465	May '15	.02
El Paso, g	Colo.	490,000	5					1,707,545	Feb. '14	10
Empire Copper	Utah	1,000,000	1	.20	200,000	.05	50,000	830,000	Jan. '18	05
Ernestine, g.s. (*h*)	N. M.	300,000	5					150,000	July '15	.10
Farncomb Hill Gold Dredg	Colo.	300,000	1.00	.16	48,000	.05	15,000	63,000	Oct. '18	03
Federal M. & Sm., pf	Ida.	119,861	100	7.00	839,027	7.00	839,027	14,764,358	Dec. '18	1 75
First Nat. Cop	Calif.	600,000	.5	40	240,000			390,000	Aug. '17	40
Fremont Con., g	Calif.	200,000	2 50					254,000	Oct. '14	02
Gemini, g.s	Utah	5,000	100	5 00	25,000			2,455,000	Mar. '17	5.00
Golconda, g	Ariz.	850,000	1					170,000	Dec. '15	.10
Gold King, g	Colo.	1,000,000	1					1,417,319	Nov. '15	.01
Golden Cycle, g	Colo.	1,500,000	1	.36	520,000	.36	520,000	8,698,500	Dec. '18	03
Goldfield Con., g	Nev.	3,559,148	10					28,999,832	Oct. '15	.10
Good Springs, Anchor, l.z	Nev.	550,000	1	07	83,500			169,285	Aug. '17	.01
Grand Central, g	Utah	500,000	1	.16	80,000	.09	45,000	1,780,250	Oct. '18	.04
Grand Gulch	Utah	239,845	10	15	35,977			67,157	Dec. '17	03

DIVIDENDS OF MINING AND METALLURGICAL COMPANIES IN THE UNITED STATES—Continued

Company Name	Situation	Shares Issued	Par Value	Dividends Paid 1917 Per Share	1917 Total	1918 Per Share	1918 Total	Total To Date	Latest Date	Latest Amount
Granite, g	Alas	430,000	1					17,200	May '16	02
Granite, g	Colo.	1,650,000	1	03	49,500	02	33,000	369,000	Mar. '18	01
Hamburg, g.s.l.	Nev	1,000		02	16,000			16,000	Apr. '17	01
Hecla, l.s	Ida	1,000,000	25	1 60	1,600,000	35	350,000	7,255,000	Dec. '18	.15
Homestake, g	S. D	251,160	100	7 80	1,959,048	6 00	1,506,960	41,417,704	Dec. '18	50
Horn Silver Min., s.c.z.l.	Utah	400,000	45					5,682,000	July '16	.05
Horn Silver Mines (i)	Utah	400,000	1	10	40,000	05	20,000	80,000	Dec. '18	.05
Inspiration, c	Ariz	1,181,967	20	8 25	9,751,228	8 00	9,455,736	25,391,081	Oct. '18	2 00
Inter'l Nickel, com	U. S.-Can	1,673,384	25	5 75	9,621,958	4 00	6,693,536	52,276,984	Dec. '18	1 00
Intern'l Nickel, pf	U. S.-Can.	89,126	100	6 00	534,756	6 00	534,756	6,951,714	Nov. '18	1.50
Iowa, g.s.l.	Colo.	1,666,667	1	03	50,000	.02	33,333	370,166	Aug. '18	.00½
Iowa-Tiger, g.s.l	Colo.	3,000	1					25,179	Dec. '15	1 00
Iron Blossom, s.l.g	Utah	1,000,000	10	25	250,000	07½	75,000	3,175,000	Oct. '18	02½
Iron Cap, c	Ariz.	144,908	10		322,794		543,310	887,823	Dec. '18	.25
Iron Cap, pfd., c	Ariz.	(o)		35	962			36,389	July '17	35
Iron Silver, s.l.g.	Colo.	500,000	20	20	100,000			5,250,000	Dec. '17	10
Isabella Mines, g.s	Colo.	2,528,331	1					742,500	Dec. '16	01
Isle Royale, c	Mich.	150,000	25	6 00	900,000	1.50	375,000	1,875,000	Dec. '18	50
Jamison, g	Calif	390,000	10					386,100	Dec. '15	01
Jerry Johnson, g	Colo	2,500,000	10					187,500	Nov. '14	00½
Jim Butler Tonopah, g.s.	Nev.	1,718,021	1	20	343,604	.17	292,063	1,151,074	Aug. '18	07
Joplin Ore & Spelter	Mo.	2,000,000	1					63,000	July '16	40½
Judge Min. & Sm.(m)	Utah	480,000	1	1 00	480,000	37½	180,000	2,250,000	Oct. '18	12½
Jumbo Ext., g.s.	Nev.	1,550,000	1					687,158	June '16	05
Kendall, g	Mont	500,000	5					(f) 1,555,000	Apr. '16	10
Kennecott Copper, c		2,786,953		5 70	15,885,643	4 00	11,151,071	42,356,997	Dec. '18	1 00
Kennecott Mines, c	Alas	250,000	10	(k)				5,000,000	Jan. '14	4 00
Knob Hill, g	Wash	993,834	1	01½	13,907			99,815	July '17	00½
Lake View, z	Utah	500,000	1					125,000	June '16	01
Liberty Bell, g	Colo.	133,560	5	15	200,327	.30	400,668	2,594,181	Sept. '18	05
Linden, z	Wis.	1,020	10					11,220	Dec. '15	3.00
Little Bell, l.s	Utah	300,000	1					90,000	Apr. '16	.05
Loon Lake, c	Wash.	1,461,685	25	.03	43,352			43,352	Sept. '17	.01
Lower Mammoth, g.s.c	Utah	1,000,000	1					67,000	Dec. '15	.01
Magma, c	Ariz.	240,000	5	2 10	504,000	1.50	360,000	1,584,000	Sept. '18	.50
Mammoth, g.s.c.	Utah	400,000	10	1.00	400,000			2,820,000	Nov. '17	.10
Mary McKinney, g	Colo.	1,309,252	1					1,182,398	Oct. '16	.01
Mary Murphy, g	Colo.	370,000	5					93,106	May '16	.07
Mass Con., c	Mich.	97,317	25	3 00	291,951			486,585	Nov. '17	1.00
May Day, g.s.l.	Utah	800,000	25					300,000	Dec. '16	.02
Mexican, s	Nev	201,600	1					171,360	Nov. '14	.75
Miami, c	Ariz.	747,114	5	8.75	6,537,247	4 50	3,362,013	19,595,044	Nov. '18	1 00
Mogollon Mines, g.s	N. M.	355,682	5	...				53,352	Oct. '15	.05
Mohawk, c	Mich.	100,000	25	20 50	2,050,000	10.00	1,000,000	8,625,000	Nov. '18	2.00
Moscow M. & M., g.s.c.z	Utah	900,000	1	.04½	40,500			108,000	Aug. '17	.02
Mountain King	Calif.	598,340	1					17,950	Apr. '16	.03
National Zinc and Lead, l.z	Mo.	500,000	1	.04	20,000			210,000	May '17	.02
Nevada Con., c	Nev	1,999,457	5	4 15	8,297,747	3.25	6,498,236	42,269,839	Dec. '18	1.00
Nevada Packard, g.	Nev	1,164,492	1			02½	29,700	87,000	Sept. '18	.02½
Nevada Wonder, g.s	Nev.	1,408,240	1	.20	281,680	.20	281,694	1,478,582	Nov. '18	.10
New Cornelia, c.	Ariz	1,404,900				25	351,225	351,225	Nov. '18	.25
New Idria, q	Calif.	100,000	5	3.00	300,000	1 50	150,000	2,680,000	Oct. '18	.50
New Jersey Zinc	U. S.	350,000	100	46 00	16,100,000	20 00	7,000,000	(s)	Nov. '18	4.00
North Butte, c.	Mont	430,000	15	2.50	1,075,000	1 00	430,000	14,657,000	Oct. '18	.25
North Star, g	Calif.	250,000	10	1 00	250,000	40	100,000	5,437,040	June '18	.40
Oaks Co., pfd.	N. M.	1,690	10	37½	465			634	Apr. '17	.17½
Old Dominion Co., c.	Ariz	297,071	25	8 00	2,376,262			13,216,976(g)	Dec. '17	1.00
Old Dominion M. & Sm., c (p).	Ariz.	162,000	25	...				8,424,000	Dec. '16	3.50
Ontario Silver Min.	Utah	150,000				1 00	150,000	(s)	Oct. '18	.50
Optimo, z	Wis	545	100					43,960	Sept. '15	10.00
Oroville Dredging, g	Calif	686,538	4 86	48	329,540	.36	247,155	2,683,920	Sept. '18	.12
Osceola, c.	Mich	96,150	25	20 00	1,923,000	8 00	769,200	17,179,475	Sept. '18	2.00
Pacific Gold.	Utah	400,000	10			02	8,000	16,000	Apr. '18	.01
Pacific Mines	Calif.	642,000	1					276,060	Dec. '16	.01
Parrot, c.	Mont.	229,850	10					7,871,839	July '15	1 63
Phelps Dodge	U. S.	450,000	100	32 00	14,400,000	22 00	9,900,000	84,596,000	Sept. '18	8.00
Pittsburgh-Idaho, l.	Ida	817,692	1	08	65,524			363,359	Apr. '17	.03
Pittsburg-Silver Peak, g	Nev	2,790,000	1					771,200	July '14	02
Plymouth, g	Calif	240,000	4 86	48	117,040	48	117,040	579,680	July '18	24
Portland, g.	Colo.	3,000,000	1	12	360,000	10	300,000	11,257,080	Oct. '18	.02
Prince Con., l.s	Utah	1,000,000	2	20	200,000			575,000	Nov. '17	02½
Quincy	Mich.	110,000	25	18 00	1,980,000	8 50	935,000	26,452,500	Dec. '18	2.00
Ray Con., c	Ariz	1,577,179	10	4 20	6,624,152	3 25	5,124,331	20,679,583	Dec. '18	.75
Reorg. Booth, g.	Nev	1,000,000	1					500,000	July '16	.10
Rescue Eula, g.s	Nev	1,478,910	1	02½	35,539			35,539	June '17	.02½
Rico-Wellington, l.z.c	Colo	1,000,000	10		39,600			39,600	July '17	...
Richmond	Ida	840,000	1	10	84,000	01	8,400	92,400	Oct. '18	.01
Rochester, g	Nev	2,000,000				04	80,000	80,000	Oct. '18	.02
St. Joseph, l	Mo	1,409,466	10	3 50	4,933,124	2 00	2,818,932	21,543,616	Dec. '18	.50
Seven Tr. Coalition, g	Nev	1,443,077	1					252,572	Apr. '16	.02½
Shannon, c	Ariz	300,000	10	1 25	525,000			1,425,000	Nov. '17	.25
Shattuck Arizona, c	Ariz	350,000	10	5 00	1,750,000	2 00	700,000	7,087,500	Oct. '18	.50
Silver King Coalition, l.s	Utah	1,250,000	5	60	729,660	15	182,415	15,198,560	Jan. '18	.15
Silver King Con., l.s	Utah	827,237	1	55	383,287	.10	70,000	1,562,705	Apr. '18	.10
Skidoo, g	Calif	1,000,000	5					365,000	Oct. '14	.01
Socorro, g	N. M	377,342	5					252,666	Oct. '16	.05
South Hecla	Ida	263,000	1					39,438	Aug. '16	.15
Stewart, s.l	Ida	1,238,262	1					2,012,314	Dec. '15	.05
Stratton's Ind., g	Colo	1,000,000	30					(s)	Jan. '16	.16
Success, z	Ida	1,500,000	1					1,125,000	July '16	.03
Superior & Pitts, c	Ariz	1,499,792	10					10,318,569	Dec. '15	.38
Superior, c	Mich	100,000	25	1 00	100,000			200,000	Apr. '17	1.00
Tamarack & Custer	Ida	1,776,288	1	06	124,340	12	266,439	461,830	Aug. '18	.06
Tennessee,	Tenn	200,000	25					5,206,250	Apr. '16	.75
Tennessee Cop. & Chem	Tenn	392,817				1 00	392,817	392,817	May '18	1 00
Tightner, g	Calif	100	1,000					160,000	Jan. '14	500 00
Tintic Standard, l.s	Utah	1,167,500	01	07	81,725	17	198,475	280,200	Sept. '18	.08
Tom Reed, g	Ariz	909,555	1			04	36,382	2,565,030	Dec. '18	.02
Tomboy, g.s	Colo	310,000	4 86	48	150,660	12	37,665	4,126,140	June '18	.12
Tonopah-Belmont, s.g	Nev	1,500,000	1	50	750,016	35	525,009	9,668,063	July '18	.10
Tonopah Ext., g.s	Nev	1,282,801	1	25	320,700	05	64,140	1,976,560	Sept. '18	.05
Tonopah Mining, g.s	Nev	1,000,000	1	55	550,000	37½	375,000	14,525,000	Oct. '18	.15
Trimountain, c	Mich	100,000	25			5 00	500,000	1,950,000	May '18	5 00
Union Con., s	Nev	200,000	1			20	40,000	40,000	July '18	.05
United (Crip. Ck.) g	Colo	4,000,000		01	40,000			520,385	Dec. '17	01
United Copper	Wash.	1,000,000	1	10	100,000			150,000	Oct. '17	.01
United Eastern, g	Ariz	1,363,000	1	30	408,900	62	845,060	1,253,960	Dec. '18	.07
United Globe, c	Ariz	23,000	100					4,255,000	Dec. '16	22 00
U. S. Sm., Ref. & Min	U. S.-Mex	351,115	50	5 00	1,755,575	5 00	1,755,575	10,365,733	Oct. '18	1.25

DIVIDENDS OF MINING AND METALLURGICAL COMPANIES IN THE UNITED STATES—Continued

Company Name	Situation	Shares Issued	Par Value	Dividends Paid 1917 Per Share	1917 Total	1918 Per Share	1918 Total	Total To Date	Latest Date	Latest Amount
U. S. Sm., Ref. & Min., pfd.	U. S.-Mex.	486,350	50	3.50	1,702,225	3.50	1,702,225	21,476,812	Oct. '18	87½
United Verde, c	Ariz.	300,000	10	17.25	5,175,000	18 50	5,550,000	(s)	July '18	1.50
United Verde Ext., c	Ariz.	1,050,000	.50	2 85	2,992,500	4 50	3,675,000	6,667,500	Nov. '18	75
Utah Apex, c	Utah	528,200	5	75	396,150	.50	464,100	1,122,425	Nov. '18	25
Utah Con., c	Utah	300,000	5	3 50	1,050,000	1.25	375,000	11,700,000	Sept. '18	25
Utah Copper, c	Utah	1,624,490	10	14 50	23,555,105	8.50	13,808,165	89,579,047	Dec. '18	2.00
Utah Leasing	Utah	250,000	.10	15	47,500	.09	22,500	95,000	Nov. '18	02
Utah Metal & Tunnel	Utah	691,588	1	80	553,262			895,734	Dec. '17	30
Vindicator Con., g	Colo.	1,500,000	1	12	180,000	.04	60,000	3,772,500	Oct. '18	01
Warrior Copper, pfd	Ariz.	68,000	10	70	47,600			47,600	Dec. '17	70
Wasp No. 2, g	S. D	500,000	1	03	15,000			664,466	Apr. '17	03
Wellington, g	Colo.	1,000,000	1	40	400,000	.20	200,000	1,850,000	May '18	10
West End Con., a	Nev.	1,788,486	1	.05	89,424	.20	357,698	1,073,092	Oct. '18	10
Western Development, pfd	Colo.	50,000	10			2.00	100,000	100,000	Dec. '18	.50
Western Utah, c	Utah	2,496,500	1			.07½	18,724	18,724	Feb. '18	.07½
White Pine, pfd., c	Mich.	24,000	25		126,051			126,051	Apr. '17	
Wilbert, l.s.	Utah	1,000,000	1	.05	50,000			100,000	Nov. '17	.01
Wolverine & Ariz., c	Ariz.	118,575	15			.25	29,668	83,072	July '18	.25
Wolverine, c	Mich.	60,000	25	13.50	810,000	4.00	240,000	10,170,000	Oct. '18	1.00
Yak, s.l.	Colo.	1,000,000	1	71	710,000			3,477,685	Sept. '17	.07
Yellow Aster, g.	Calif.	1,079,750	1	35	35,000			1,245,789	July '17	.05
Yellow Pine, z.l.s.	Nev.	1,000,000	1	36	360,000	.30	300,000	2,370,000	Dec. '18	12
Yosemite, g	Calif.	24,000	10					125,893	Dec. '14	.02
Yukon Gold, g	Alas.	3,500,000	5	.30	1,050,000	.05	175,000	9,858,110	June '18	.02½
Totals					$245,337,018		$165,108,262	$1,569,478,434		

CANADIAN, MEXICAN, SOUTH AND CENTRAL AMERICAN MINING COMPANIES

Company Name	Situation	Shares Issued	Par Value	1917 Per Share	1917 Total	1918 Per Share	1918 Total	Total To Date	Latest Date	Latest Amount
Aladdin Cobalt	Ont.	500,000	$4 86	$0 096	$48,000			$48,000	Feb. '17	$0 096
Amparo, g.s	Mex.	2,000,000	1	.16	320,000	15	300,000	2,952,176	Nov. '18	.04
Asbestos Corpn	Que.	30,000	100	4 00	160,000			160,000	Nov. '18	1 25
Beaver Con., a	Ont.	2,000,000	1					649,912	Apr. '16	.03
Blanca y Anexas, a	Mex.	140,000	10					1,943,000	Mar. '14	.90
Buena Tierra, s.l	Mex.	330,000	4 86					160,380	Feb. '15	24
Buffalo, s	Ont.	1,000,000	1					2,787,000	July '14	.05
Butters' Salvador, g	C. A.	150,000	4 86					4,138,050	Oct. '16	.24
Canadian Goldfields, g.s	Can.	600,000	.10					290,000	July '14	.01¼
Caribou Cobalt, s	Ont.	1,000,000	1	05	50,000			175,000	Apr. '17	.05
Casey Cobalt, s	Ont.	249,950	4 86					148,807	May '14	.12
Cerro de Pasco, c	Peru	898,224		5 75	4,009,470	5 00	4,393,353	11,069,487	Dec. '18	1 25
Chontalpan, g.s.l.z	Mex.	7,000	25					57,750	Apr. '14	.75
Coniagas, s	Ont.	800,000	5	62½	500,000	.62½	500,000	9,440,000	Nov. '18	25
Con. M. & S. of Can	B. C.	419,098	25	2 50	995,012	2 50	1,047,744	4,994,105	Oct. '18	62½
Crown Reserve, s	Ont.	1,768,814	1	05	88,440			6,190,849	Jan. '17	05
Dome Mines, s.	Ont.	400,000	10	75	300,000			1,500,000	June '17	.25
Encinas y Anexas	Mex.	3,000	10					30,105	Mar. '14	3.03½
El Favor, g	Mex.	3,500,000	1					210,000	Apr. '14	.01
El Oro, g.s	Mex.	1,147,500	4 86	.24	57,375			8,725,793	Oct. '17	.24
El Rayo, g.s	Mex.	260,020	2					967,223	Dec. '15	10
Esperanza, s.g	Mex.	455,000	4 86	.24	109,200	.48	218,400	12,435,798	Aug. '18	.24
Granby, s.l.c	B. C.	150,004	100	10 00	1,500,042	10.00	1,500,042	9,776,885	Nov. '18	2.50
Greene Cananea, c	Mex.	500,000	100	8.00	3,954,215	8 00	4,000,000	15,747,165	Nov. '18	2.00
Greene Con., (*n*)	Mex.	1,000,000	10	2 00	2,000,000			15,544,400	Apr. '17	1.00
Hedley Gold	B. C.	240,000	10	2 00	240,000	75	144,000	2,447,520	Dec. '18	15
Hollinger, g	Ont.	4,920,000	5	15	738,000	25	1,230,000	9,424,000	Dec. '18	.05
Howe Sound, c	B. C.	1,984,150	1			15	297,624	297,624	Oct. '18	.05
Kerr Lake, s	Ont.	600,000	5	1.15	690,000	1 00	600,000	8,010,000	Dec. '18	.25
Lake Shore, s	Ont.	2,000,000	1			05	100,000	100,000	Dec. '18	.02½
La Rose Mines, s (r).	Ont	1,500,000	1	20	320,000	02	30,000	7,505,410	Apr. '18	.02
Le Roi No. 2, g	B. C.	120,000	24 25	24	29,160			2,075,103	Mar. '17	.24
Lucky Tiger-Com., g	Mex.	715,337	10	.59	422,049	50	357,668	4,558,151	July '18	.05
McIntyre Porcupine, s	Ont.	3,610,283	1	15	541,542	10	361,028	1,083,084	Nov. '18	.05
McK.-Dar. Sav., s	Ont.	2,247,692	1	.12	269,724	12	269,724	5,415,947	Oct. '18	03
Mexico Mines of El Oro, g.s	Mex	180,000	4 86	5 28	934,700	3 36	612,360	5,166,143	Sept. '18	1 44
Min. Corp. of Can., a	Ont.	1,600,050	5	.93¾	1,556,297	81¼	1,333,792	4,238,839	Dec. '18	.18¾
N. Y. & Hond. Ros., s.g	C. A	200,000	10	2.00	400,000	2 00	400,000	4,990,000	Oct. '18	.50
Nipissing, a	Ont.	1,200,000	5	1 50	1,800,000	1.25	1,500,000	18,240,000	Oct. '18	.25
No. Am. Magnesite	Que.	1,866	100	10 00	18,660			69,042	Oct. '17	5.00
Peterson Lake, a	Ont.	2,401,820	1	01¾	42,032			504,382	Jan. '17	.01¾
Porcupine-Crown, g	Ont.	2,000,000	1	09	180,000			840,000	July '17	.03
Rambler-Cariboo, c	B. C.	1,750,000	1	02	35,000			432,500	Sept. '17	.01
Right of Way Mines, a	Ont.	1,685,500	1	02½	8,428			577,469	Mar. '17	.00½
San Rafael, g.s	Mex.	2,400	25					1,442,380	Jan. '14	.50
Santa Gertrudis, g.s	Mex	1,500,000	4 86	18	273,375	24	364,500	3,454,272	June '18	.24
Seneca-Superior, s	Ont.	478,884	1					1,579,817	Dec. '16	.05
Standard s.l	B. C.	2,000,000	1	.15	300,000			2,700,000	Oct. '17	.05
Temiskaming, s.	Ont.	2,500,000	1	12	300,000	03	75,000	2,059,156	Jan. '18	.03
Tem. & Hud. Bay, s	Ont.	7,761	1					1,940,250	Nov. '14	3.00
Tough-Oakes, g.	Ont.	531,500	5	12½	66,438			398,625	Jan. '17	.12½
Townsite Extension, s	Ont.	150,000	4 86	.12	18,000			18,000	Oct. '17	.12
Tretheway, a.	Ont.	1,000,000	1	05	50,000			1,161,998	Aug. '17	.05
Utica Mines, l.	B. C.	1,600,000	1	.04	64,000			64,000	Sept. '17	.02
Totals					$23,359,159		$19,640,235	$199,105,597		

HOLDING COMPANIES

Company Name	Situation	Shares Issued	Par Value	1917 Per Share	1917 Total	1918 Per Share	1918 Total	Total To Date	Latest Date	Latest Amount
Amalgamated, c	Mont.	1,538,879	$100					$103,444,983	Aug. '15	$3 71
California Expl		231,617	2 40	$0.24	$56,278			140,695	Oct. '17	.12
General Development	U. S.	120,000	25	7 00	840,000	2.75	330,000	4,853,917	Sept. '18	75
Guggenheim Expl	U. S.	833,732	25					34,036,783(*l*)	Apr. '16	11.85
Old Dominion (holding) (*q*)	Ariz.	293,353	25	(*q*)	(*q*)	(*q*)	(*q*)	(*q*)	Dec. '16	3.50
St. Mary's Min. Land	Mich.	160,000	25	14.00	2,240,000	5 00	800,000	11,360,000	Nov. '18	1 00
White Knob C. & D., pf		200,000	10	.30	60,000	20	40,000	310,000	Nov. '18	05
Yukon-Alaska Trust		203,433		4 00	813,732	4 00	813,732	2,237,763	Dec. '18	1 00
Totals					$4,010,010		$[illegible],732	$156,384,141		

(*a*) Two classes. (*c*) Taken over by Utah Metal and Tunnel Co. (*d*) Liquidation dividend of $10.50 per share in 1916 is included. (*e*) Includes return of capital; property sold to Tonopah Placers Co. (*f*) Includes liquidation payment. (*g*) Reorganized as Judge Mining and Smelting Co. (*h*) Absorbed by Mogollon Mines Co. in 1915. (*i*) Reorganization of Horn Silver Mining Co. (*k*) Reorganized as Kennecott Copper Corporation. (*l*) Liquidation payment of $11.85 per share in 1916 is included. (*m*) Successor of Daly-Judge Mining Co. (*n*) Taken over in 1917 by Greene Cananea. (*o*) Called for redemption Nov. 15, 1917. (p) Dissolved in Mar., 1917; succeeded by Old Dominion Co. (*q*) Old Dominion Co. (holding) is included in the list of operating companies beginning 1917, as it has absorbed the Old Dominion Copper Mining and Smelting Co. "Total dividends to date" include payments by the Old Dominion Co., before the absorption. (*r*) La Rose Consolidated was dissolved in 1918; assets transferred to La Rose Mines, Ltd. (*s*) Not reported.

Pyrites, Sulphur, and Sulphuric Acid

IN A REPORT to the Committee on Mines and Mining of the U. S. Senate on May 10, 1918, W. R. Ingalls made the following statement respecting pyrites, sulphur, and sulphuric acid:

> An increased requirement for sulphuric acid and a necessary reduction in the importation of pyrites from Spain have created a deficiency in the supply of this important material, but the tension in the situation is probably overestimated, and natural factors are applying the true correctives.
>
> In Louisiana and Texas we possess the greatest deposits of sulphur (brimstone) in the world, exploitation of which has heretofore been limited more by inability to market the product than anything else. Without any doubt, the supply can be increased immensely. The matter of sulphuric acid is perhaps the most complex of these problems. The United States possesses ample sources of sulphur, but the great resources are remote from the places where the sulphur is mainly needed, and both utilization and transportation difficulties stand in the way. Spanish pyrites comes cheaply to places where there are acid works and local channels of acid consumption. The utilization of the enormous quantity of sulphurous gas that is dispersed daily into the atmosphere at Anaconda, Mont., for example, would necessitate a stupendous outlay for manufacturing plant, for tank cars, and for transportation.
>
> The production of sulphuric acid in terms of monohydrate (H_2SO_4) in 1917 was about 4,300,000 tons, against about 3,900,000 in 1916. The Government estimates a requirement of 5,000,000 to 5,600,000 tons. We imported from Spain about 833,000 short tons of pyrites in 1917, which may be reckoned as making about 1,000,000 tons of sulphuric acid (monohydrate). If, therefore, we are to require as much acid as the Government's maximum estimate, stupendous though it be, and if we were not to import any pyrites from Spain, we should have to find raw material for about 2,300,000 tons of acid. Although that is a very large figure, the situation as to brimstone is of such a nature as to dispel any alarm. Moreover, importations of pyrites will not be checked entirely; for the domestic production of pyrites is increasing, and smelters are adding to their production of acid as a byproduct, wherefore it need not be assumed that new sources for 2,300,000 tons of acid must be found.
>
> In 1915-16, sulphuric acid of 60° B., which in pre-war times realized about $6 to $8 per ton, sold at $50 and $60 per ton. Before the end of 1916 the price had receded practically to the pre-war normal. Referring to this subject, the *Engineering and Mining Journal* remarked, Nov. 18, 1916, that:
>
> "One of the war commodities that has come down to earth again is sulphuric acid. In the acute period this fetched $50 and $60 per ton. Ordinarily tower acid is now down to about $7 and $8 per ton, which is only a trifle in excess of what it used to be in normal times. The explanation is increased production. The consumption is still very large."
>
> The price of $7 and $8 per ton at that time was undoubtedly subnormal, considering increased cost of production. At the beginning of 1917 the market was $12 and $13, and even that was regarded as low. It advanced during 1917 and was quoted at $22 and $25 at the close of the year. The recent price in the open market has been about $26, but the War Industries Board has arranged for Government requirements at $18.

The subsequent events of 1918 verified the above statements and opinions. During July the War Industries Board issued the statement that there was above ground, and had been all along, at the mines in Louisiana and Texas, over 1,000,000 tons of brimstone. According to W. G. Woolfolk, the consumption of brimstone at the middle of 1918 was approximately 120,000 tons a month; wherefore the existing stock was sufficient for eight months, even if production should be suspended entirely, which was scarcely conceivable. Mr. Woolfolk was, therefore, of the opinion that there had been no occasion for alarm over the alleged small supply of sulphur in this country.

In October, the War Industries Board issued a statement that the situation as to supply of sulphuric acid was easy, and citizens were warned against making further investments in pyrites mining. Later (in December) a report on the present sulphuric-acid capacity of plants in the United States and on the requirements for 1919 was made to the Chemical Alliance by Arthur E. Wells, who is one of the sulphuric-acid specialists of the War Industries Board. This report was as follows:

> On Jan. 1, 1918, the total manufacturing capacity of the country for acid was 5,124,000 tons (basis 100% H_2SO_4), or 8,200,000 tons per year (basis 50° B.), of which 29% was at contact acid plants.
>
> On Nov. 1, 1918, the total manufacturing capacity of the country was at the rate of 6,000,000 tons per year (basis 100% H_2SO_4), or 9,600,000 tons (basis 50° B.). Of this total capacity 40% was at contact acid plants.
>
> This capacity was divided among (1) Government, (2) explosives companies, (3) all others, including commercial manufacturers and byproduct manufacturers, as follows, in tons:

	100% H_2SO_4	50° B.
(1) At Government plants	648,000	1,040,000
(2) At plants of explosives manufacturers	696,000	1,120,000
(3) All others	4,656,000	7,440,000
Totals	6,000,000	9,600,000

The total capacity east of the Mississippi River, and also including the plant at Argentine, Kan., and the plants in Louisiana and Arkansas, is 5,448,000 tons per month as 100% H_2SO_4. The report continues:

> If it be assumed that the Government plants and the contact plants, which were built by the explosives companies primarily to supply acid for munitions explosives, are not operated in 1919, or, if operated at all, that the production will be utilized only for munitions, and thus will not be placed on the market, there remains a total capacity to be considered in the eastern part of the United States amounting to 4,380,000 tons (basis 100% H_2SO_4), or 7,000,000 tons per year (basis 50° B.).
>
> During the first nine months of 1918 the actual rate of production was only about 90% of the rated maximum capacity, although many plants were operating much above the rate capacities. Therefore, it is fair to conclude that the probable maximum output from these plants for 1919 cannot be greater than 90% of the rated capacity or, in other words, the maximum output could be only about 328,000 tons (basis 100% H_2SO_4), or 625,000 tons per month (basis 50° B.).

Not only was the requirement for sulphuric acid overestimated, and the supply *in esse* and *in posse* at all times ample, but also the Texas Gulf Sulphur Co. was pushing the completion of its plant for the exploitation of a large deposit of brimstone in Texas, from which it will be ready to produce early in 1919, and the question is now how to find a market for the prospective production of brimstone. The outlook is that this can be done only at the expense of pyrites, which, of course, means the sale of brimstone at a much lower price than heretofore, but the cost of production will permit that to be done.

On June 27, 1918, the War Industries Board fixed a maximum price of $18 per ton for 60° B. acid and $28 for 66° B., f.o.b. sellers' works. These prices were changed on Sept. 30 to $16 for 60° B. and $25 for 66° B.

Although the acid production in this country has increased largely during the last four years, manufacturers do not anticipate that any great difficulties will be experienced in readjusting themselves to new conditions. Many of those who under normal conditions produced acid as a byproduct, such as the Eastern zinc and copper smelters, found it desirable, in view of the enormous demand, to increase their output considerably by the use of brimstone. All such brimstone acid making can readily be discontinued. There were also numerous plants operated by the Government direct, and these too will undoubtedly be discontinued. It is not unlikely that many of the smaller producers who were attracted by the possibilities of the acid business for explosives, etc., during 1918, and who were able to operate successfully under the prevailing prices, will find themselves compelled gradually to curtail their production. In view of these factors, therefore, all of which operate toward a reduced production, and because of the further important fact that numerous uses for sulphuric acid, which bid fair to become increasingly important as time goes on, have grown up out of the war, there is a feeling that the acid market will soon adjust itself to a stable position.

Magnesite Industry in 1918

Changing market conditions and the unusual difficulties of transportation in 1918 brought about the closing of most of the smaller companies producing magnesite at the beginning of the year. This and a decrease in output of almost a third from that of 1917, together with the outdistancing of California, as a producer, by Washington, were the dominant features.

The production of magnesite in the United States during the first nine months of 1918 is given by R. W. Stone, of the U. S. Geological Survey, as 160,000 tons, of which 90,500 tons came from Washington and the rest from California. The total for the year is estimated at 225,000 tons, against 316,000 in 1917. Of the total in 1918 the Northwest Magnesite Co., operating at Chewelah, Wash., produced about 100,000 tons of crude magnesite, from which it made approximately 40,000 tons of dead-burned magnesite.

Washington produced its first magnesite in December, 1916, when less than a thousand tons was shipped. In 1917, the state yielded about 100,000 tons, which figure was exceeded in 1918. The utilization of dead-burned dolomite as a refractory, the freight embargo east of Chicago in the early part of the year, car shortage, and increased freight rates curtailed the 1918 production in both states, but California suffered more than Washington for two reasons: First, Washington crystalline magnesite has been found to make the better refractory, and, second, restrictions on building lessened the demand for the California mineral, which is lighter in color than the Washington magnesite and better suited for building purposes. Also, dolomite displaced California magnesite to some extent in the sulphite process for making wood-pulp.

Crude magnesite sold for $7 to $10 per ton during 1918, the demand being almost entirely local by calcining plants situated near deposits. Caustic and non-ferrous calcines sold for $32.50 to $40 per short ton, depending on quantity and length of contracts. Washington magnesite averaged about $37.50, with higher prices for ferromagnesite. Pacific Coast production of ferromagnesite was not large. Almost all calcined sold by local producers was shipped East and recalcined with addition of iron. Specifications for crude magnesite required that it should not exceed 3% SiO_2 and 2% lime; calcined not over 5 or 6% SiO_2 and 3 or 4% lime; caustic not over 6% CO_2; and dead burned not over 0.5% CO_2.

Imports of magnesite in the United States during the first eleven months of 1918, according to the Department of Foreign and Domestic Commerce, were: England, two tons; Scotland, 728; Canada 17,351; and Mexico, 1082; total, 19,163.

The importation of magnesite except by rail was prohibited by the War Shipping Control Board in its general embargo list issued in June, thus cutting off small shipments that were coming in from the Mediterranean, and preventing resumption of shipments from the island of Margarita, Venezuela. The War Trade Board in July amended this restriction so as to permit the mineral to be brought in as return cargo from Mediterranean ports and from ports where loading could be done without delay. Magnesite was one of the minerals covered in the War-Minerals Bill. It was removed from the Export Conservation List by order of the War Trade Board, effective Dec. 6.

In Margarita, the only two companies operating, the American Magnesite Co. and the Magnesite Products Corporation, both of New York, were closed through political influences. This threw 300 men out of work and injured American interests. About 3,200,000 tons of magnesite is estimated by C. F. Z. Caracristi to be available there. The most important property on the island, known as Estacia, was recently purchased by a New York company.

In Canada in 1918, as in previous years, production of magnesite was confined to the so-called Grenville district of Quebec, midway between Ottawa and Montreal and including the townships of Grenville and Harrington. This magnesite contains 5 to 10% of lime, the dead-burned material containing 15% of lime. The crude mineral was shipped throughout 1918 to cement works in Montreal and in Hull, near Ottawa, where it was ground and burned in the large rotary kilns, which otherwise would have lain unused, owing to the decreased activities in building. The average production of dead-burned magnesite from all works was about 150 tons a day throughout 1918.

Though there are large deposits of hydromagnesite of exceptional purity in British Columbia, remotely situated in the Atlin and Kamloops districts, there has been no production to date.

Producing companies in the United States in 1918 numbered 19 in California and 2 in Washington. The close of the year saw but 6 of California's 19 still in operation. The following list of 1918 producers has been furnished by the U. S. Geological Survey:

California: Clark & McDonald, Livermore, producers of crude; J. H. Plattner, Livermore, crude; Piedra Magnesite Co., Fresno, crude; Sinclair Bros. & Ferguson, Piedra, calcined; George W. Elder, St. Helena, crude; Bay Cities Water Co., Coyote, crude (owns property operated by lessees); Western Magnesite Development Co., 519 California St., San Francisco, crude and calcined; F. Albertz, Cloverdale, crude; Gustine Magnesite Co., Ingomar, crude; Red Mountain Magnesite Co., Marine Bldg., San Francisco, crude and calcined; Standard Magnesite Co. of California, 244 California St., San Francisco, crude; E. Duryee, 1205 Hollingsworth Bldg., Los Angeles, crude; H. T. Haden, Dinuba, crude. The following are believed to have been operating at the close of 1918: Frank R. Sweasy (White Rock mine), Humboldt Bank Bldg., San Francisco, crude and calcined; Wellman-Lewis Co., 901 Hibernian Bldg., Los Angeles, crude and calcined; Sonoma Magnesite Co., Humboldt Bank Bldg., San Francisco, crude and calcined; Tulare Mining Co., 310 Sansome St., San Francisco, crude and calcined; and Porterville Magnesite Co. of California, Porterville, crude and calcined.

Washington: American Mineral Production Co., 622 Insurance Exchange Bldg., Chicago, Ill., crude and calcined, operating; and Northwest Magnesite Co., Hutton Bldg., Spokane, crude and calcined, operating.

The Northwest Magnesite Co., by far the largest producer, and with a million-dollar plant erected since the war began, stated on Aug. 30 that it required 291 employees to operate.

The Southeastern Missouri Lead District

By H. A. Wheeler*

THE Southeastern lead district of Missouri produced about 168,000 tons of pig lead in 1918, of an approximate value of $25,000,000. This is the first year that the district has failed to show a substantial increase in its annual output in a period of steady growth extending over 50 years. The lead tonnage for 1918 is about 15% less than that of 1917, the latter year marking the crest in tonnage and value, 198,000 tons having been produced, of a value of about $35,000,000. The unusually high value of the 1917 output was due to the phenomenal conditions created by the war, when for a short period lead reached the unheard of price of 12c. per lb., which naturally stimulated a peak production.

The lead market in 1918 ranged from 7 to 8c. at St. Louis. Under normal conditions this would have meant large profits, but because of the high prices prevailing for labor and supplies, the margin of profit was not as large as the high lead prices would indicate. The district was prosperous during 1918, and the shrinkage in the tonnage was partly due to working lower-grade ores, to operating on five-sixths time in December, and, to a less extent, to the closing down of two minor producers. The influenza also curtailed work to an appreciable extent in the latter part of the year. Though labor was costly and difficult to hold to full time or efficiency, there was no pronounced shortage, despite the drafts made by the war.

Principal Output From St. Francois County

The output of 1918 was almost entirely derived from St. Francois County, as the Madison County production was much below normal and the small output from the gopher mines in the adjoining Washington, Jefferson and Franklin counties was less than usual, as the surface diggers flocked to "the big mines" in the Flat River district to enjoy the high wages.

The only entrance of new interests into the district occurred at Annapolis, in Iron County, where a St. Louis company carried out a large amount of diamond drilling in exploring a small, local limestone basin within the porphyry hills, on the main line of the Iron Mountain R.R. The area is six miles west of Madison County, and is the first deposit of disseminated lead that has been found in Iron County that promises to become of commercial importance. It resembles the Madison County deposits in general character, and though it is reported that some good cores were obtained, it is premature to estimate the probable size and richness of the deposit. Arrangements are now being made to sink a shaft upon the property, the lead ore occurring from 240 to 500 ft. in depth. The property was prospected by one of the Flat River companies four years ago, but the option was not exercised.

Although the lead market has receded considerably since the close of the war on Nov. 11, wages are still continuing on the abnormally high plane that has prevailed for over two years. An important step has been taken, however, that will render it easier to adjust the labor market with the lead market, by shutting down all the plants one day each week, thus reducing overproduction. At present, shovelers are paid $4.70 per shift of eight hours, miners $5 to $6 and common labor $4.

The soldiers who had been encamped in the district since the outbreak against the foreigners (mostly Hungarians) in 1917 were recently removed. Though at the outset there was more or less lawlessness and intimidation, to scare away the foreigners, it promptly subsided after a few days when the soldiers moved in. The continued presence of less than one company of troops has been sufficient to prevent any further trouble. That the outbreak was inspired and started by outsiders, if not by I. W. W. leaders, is now well known, and the fining or short imprisonment of some of the local participants in the trouble has completely cooled off the open antagonism to the Hungarians and Italians who largely do the heavy work or shoveling.

Mining and Milling in St. Francois County

The St. Joe Lead Co. continues to maintain its lead as the largest producer in the district, besides being the patriarch of the camp, as it is over a half-century old. The original pioneer mine at Bonne Terre, which has developed the largest orebody in the district, furnished through the No. 1 shaft a large tonnage that is concentrated at the local 2000-ton mill. The nucleus of the Bonne Terre mill was built in 1883 as a 500-ton plant, and as it has been operated continuously ever since, the removal of the tailings has become an important item, when the St. Louis demand for tailings fails. Though heavy tailing shipments are made to St. Louis for railroad ballast, concrete, and like purposes, the neighboring valleys have been largely filled up by rail haulage. As the dumping and spreading of the "chats" or tailings involves a large amount of labor, a "tailing-stacker," an endless-belt conveyor, has just been installed. This will do away with the costly train crew and chat gang, as has already been done at the other mills in the district. It will also eliminate the freezing of the tailings in the chat cars in cold weather. The No. 1 slime pond at Bonne Terre, into which all of the fine tailings and slimes are pumped, has effectively overcome the pollution of Big River, the general drainage stream of the district. The effluent that leaks through the retaining dam, which consists of a heavy bank of coarse tailings, is perfectly clear. Although the No. 1 settling pond covers over 20 acres, a second and much larger pond is under construction. It covers over 70 acres and will relieve the No. 1 pond when the latter is filled.

The 2000-ton mill at Leadwood, six miles southwest of Bonne Terre, was steadily operated in 1918 upon the output of the Leadwood mines, the most recent of the St. Joe shafts, opened about 15 years ago. The 4000-ton mill at Elvins, seven miles south of Bonne Terre, in the Flat River district, now treats the output of all the mines of the former Doe Run Co., which has been completely absorbed by the St. Joe Co., although the two companies were always closely related in ownership. Though this is the most recent of the St. Joe mills, being about six years in operation, its great capacity from the outset has resulted in the building up of a small mountain of tailings.

---

*Mining engineer, 408 Locust St., St. Louis, Missouri

The Cottrell electrostatic process for smoke and fume prevention is being installed at the smeltery at Herculaneum, where other extensive improvements have been made to reduce labor costs.

The Federal Lead Co. had a busy year in 1918 at its Flat River plants, and maintained its usual large output, only exceeded by that of the St. Joe Co. It operated No. 3 mill, of 4000 tons' capacity, and the new No. 4 mill, of 3000 tons' capacity, the latter being the latest and finest concentrator in the district. Five shafts were operated, including the No. 9 shaft in the southern end of the company's property. The Keystone shoveling machine was introduced underground, and proved so satisfactory that three of the machines are now in use, resulting in a marked saving in labor. As high as 250 tons per shift has been handled by a machine, and it does not require excessive head room. A filter and drying plant for flotation concentrates was completed in the No. 3 mill in 1918. The concentrates are shipped 80 miles to Alton, Ill., where the company owns a large smeltery.

The National Lead Co. had an active, successful year, and maintained its previous output in spite of labor shortage. The 3000-ton mill not only treated the output of its own three shafts, but also the output of the Baker Lead Co.'s shaft at Leadwood. The concentrates are shipped 75 miles to its smeltery at Collinsville, in the Illinois coal belt.

The Desloge Lead Co. has been busy trying to make as large an output as the unsatisfactory labor market, with the scarcity of men and loss of time through the influenza, would permit. Its efforts have been applied to production, rather than enlargements or alterations. A Lowden drier was added to the mill for the drying of the flotation concentrates.

The Baker Lead Co., of Boston, operated its one shaft on Big River, at Leadwood, throughout 1918, and made a satisfactory record. This property, formerly known as the Jake Day land, is not equipped with a mill, and ships its ore over the M. R. & B. T. R.R. to the mill of the National Lead Co. to be concentrated.

The Boston Elvins Lead Co.'s shaft at Elvins, on Flat River, was unwatered by a multi-stage vertical centrifugal pump in 1918, but after operating for a short time and producing a limited tonnage of lead, it was shut down, and the mine is again flooded. This has been a very wet shaft, and the presence of water gave much trouble and involved heavy outlay in the sinking. It is the most recent of the operating companies. Mining has been carried on for only two short periods since the shaft was completed in 1916. It has had an incessant fight with water. The company is controlled in Boston and owns a property of 40 acres that was formerly known as the Jones tract.

The historic Mine La Motte was closed down in 1918, and seems to be in serious financial trouble. The attempt to strip 50 to 150 ft. of solid limestone overburden from over the orebody, using steam shovels, has not been a financial success. A huge rock-breaker was installed to break everything down to picking size, and the lead-bearing rock was to be picked out as the broken material was conveyed away on traveling belts. Stripping the residual clay over the outcropping limestone with steam shovels and then washing it to recover some carbonate of lead resulted in a very low-grade product, mainly of sand carrying 5 to 8% lead.

The Missouri Cobalt Co. is now actively operating the mine of the North American Lead Co. at Fredericktown, and is recovering a small amount of lead as a byproduct in producing cobalt, nickel, and copper. Small amounts of siegenite, or the sulphide of nickel and cobalt, and copper pyrites occur, associated with the lead ore, throughout the disseminated-lead belt, but in St. Francois County the quantity is too slight to be commercial. In Madison County, where granite and porphyry occur in close proximity to the lead orebodies, the mixed sulphides often amount to 2 to 5%, and are rich enough to work. The present management of the Missouri Cobalt Co. has erected an entirely new plant for the extraction of cobalt, nickel, and copper by a process of its own. The former plant of the North American Co., which produced as high as five tons of ingot copper and from one to three tons of nickel and cobalt per day, has been scrapped by the present owners, who are Canadians with experience in the Cobalt camp of Canada.

The Catherine property, two miles north of Fredericktown, has not been operated since the lease was surrendered by the Federal Lead Co. over a year ago. "Chloriders" are scrapping over the dumps. It seems doubtful if the property will ever be reopened.

Zinc Mining in Wisconsin

By J. E. Kennedy*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in 1918 decreased 18% from that of 1917, as indicated in the accompanying table. The gross tonnage shipped from mines to smelteries and to separating plants decreased, in 1918, 24 per cent.

Ore prices in 1918 opened at $60 per ton base for premium grade of zinc ore, as against $75 per ton base for the opening week of 1917. High lead or Prime Western grade of zinc ore opened at $52 per ton base. By May 4 the base price of the premium grade had gradually declined to $50 base. During the week of May 11, and continuing up to the close of the year, the Government schedule of price for a limited quantity of premium-grade blende used in the manufacture of sheet zinc became effective in the Wisconsin district. The base price was fixed at $75 per ton for 60%-grade blende not in excess of 0.15% Pb, 0.5% CaO and 1.0% Fe. Upon this basis buyers generally made a base deduction of $5 for lime in excess of 2.0% and $10 for lime in excess of 2.5%, in addition to the regular deductions of $1 per unit for lime in excess of 0.5%, and $1 per unit variation of Zn and Fe, and approximately $25 deduction per 1.0% of Pb. The highest settlement price reported paid in the open market during the year was $76.90 per ton.

A total of 58 mills and 7 separating plants were in operation during 1918, as against 68 mills and 9 separating plants in 1917. Seven concentrating mills were built new or moved and reconstructed, viz. Lucky Six No. 2 (Linden), Connecting Link and Little Dick (Cuba City), Little Platte (Platteville), Dale Rundell (Livingston), Blewett (Galena), and Copeland (Shullsburg). At the close of 1918 the Zinc Hill Mining Co. was constructing a mill on the Harvey lease, Cuba City, and the Connecting Link Mining Co. was assembling material for another mill on the Coulthard tract, at Cuba City. At the year-end, W. W. Bonson, at Galena, was developing a separating process to extract the zinc content from roasted zinc tailings. The National Zinc Ore Separating Co. replaced its four Mathey roasting kilns with a multiple-hearth roaster of the Wedge type, having a capacity of 250 tons of raw ore in 24 hours. About July 15 the Government began the construction of two acid plants for the manufacture of 20% oleum. One, of 50 tons' daily capacity, at the Skinner roaster of the Wisconsin Zinc Co., was 50% completed, and the other, of 100 tons' capacity, at the National Separating plant, was 80% completed, when, in November, construction was ordered discontinued.

---

*Platteville, Wisconsin.

WISCONSIN ZINC ORE SHIPMENTS (a)

	Net to Smelteries		Gross from Mines	
	1917	1918	1917	1918
Highland	4,868	7,659	4,868	7,659
Linden	1,454	76	16,774	5,483
Mifflin	3,170	1,242	40,237	29,910
Mineral Point	35,075	34,429	958	368
Montfort	689	..	971	.
Platteville	4,953	2,781	8,301	3,203
Dodgeville	522	260	1,660	1,651
Cuba City	23,881	20,523	893	1,840
Benton-New Diggings	64,582	48,123	128,047	102,747
Hazel Green	614	....	11,868	6,070
Shullsburg	5,227	3,355	11,674	11,646
Potosi	1,978	..	2,812	164
Galena, Ill.	1,753	405	18,930	13,094
Totals	148,766	118,853(b)	247,993	183,835 (b)

(a) Short tons. (b) Totals to Dec 14, 1918.

Mining operations were seriously handicapped by shortage of labor up to the middle of December. The level of wages advanced over the high mark of the previous year. Experienced shovelers, at 10@12c. per can, under normal conditions, averaged $5@$6 per day. Underground drill men were paid $4@$6 per day wage and made as high as $8 on contract scale. Trammers generally received $3.50 @ $3.60 per day wage, hoistermen $4, grizzly-men $3@$3.50, crusher feeders $2.75@$3, and mill men $100@$150 per month.

Comparatively little prospecting was carried on throughout 1918. Shortage of labor was somewhat offset by the installation of more power shovels of the Thew and Keystone types. The year's production record was held by the Hoskins, the youngest producer of the Mineral Point Zinc Co.'s group, which made a shipment total of 15,371 tons blende, reported to Dec. 14. The Champion mine, of the Wisconsin Zinc Co., and the Yewdall mine, of the Vinegar Hill Zinc Co., were close behind.

German Supplies and Prices of Metals

According to the *Ironmonger*, all stocks of metals in the possession of manufacturers have been freed from control, but the supplies held by the War Metal Co. of copper, aluminum, nickel, spelter, tin, and lead are doled out in lots of not more than 25 kg. (½ cwt.), and only against an official permit. Every German manufacturer of finished articles, whether he belongs to a trade association or not, is entitled to a supply of the metal he requires representing a fixed percentage of his normal consumption. The prices per 100 kg., fixed by the State Demobilization Department, are as follows: Copper, 450 marks (equal to £225 per ton); tin, 1400 marks (£700); nickel, 1500 marks (£750); lead, 76 marks (£38); spelter, 130 marks (£65); refined zinc, (99.9), 158 marks (£79); antimony, 230 marks (£115); aluminum, 700 marks (£350); and platinum, 24 marks per gram. The selling prices will be adjusted as soon as possible to those ruling in the markets of the world and will be published from time to time. The allotment forms will also entitle the holders to import metals from abroad, instead of buying them from the War Metal Co. The metals supplied for war purposes by the War Metal Co., the Spelter Works' Association and the Association of German Zinc Rolling Works have hitherto been delivered to the manufacturers at less than the cost prices, but as they are henceforth to be supplied only for civil industry, the Demobilization Department has decided that there is no further need to sell them at less than their value. Hence, the owners will be charged with the difference between the preferential prices and the quotations that have now been fixed for all metal in stock on Nov. 13. Those who are unwilling to pay the difference may return the stock to the War Metal Company.

Uranium and Radium in 1918

Uranium is the chief source of radium, and is principally found as the mineral carnotite in southwestern Colorado, in San Miguel, Dolores, Montrose, and Mesa counties, and in Utah, in San Juan, Grand, and Emery counties. A new deposit is being developed in the State of Washington. The demand is so small that domestic production can easily be increased. The principal ores are carnotite, samarskite (or pitchblende), and uvanite. According to the testimony given at the hearing before the Committee on Mines and Mining of the U. S. Senate, 600 tons of ore are required to produce one gram of radium. The average uranium content of the Colorado and Utah ores varies from one-half of 1% to 2%. The total production of radium from 1908 to 1917 was only 25 gm. In 1917 the production was 12 gm. and the probable amount in 1918, 25 gm. Each gram is worth approximately $100,000.

Uranium is used industrially in the manufacture of ceramics, colored glazes, glass, gas mantles, as a chemical reagent for miscellaneous purposes and in the textile industry as a mordant in dyeing. The chief alloys of uranium are ferro-uranium and uranium carbide, which acts as a catalyst in the production of ammonia from nitrogen and hydrogen. The principal salts of uranium are the oxide, containing 95% U_3O_8 and selling for $5 per lb. per uranium content (previous to the war the price was $3.60); and uranate of soda, containing 80% U_3O_8, and selling for $4.50 per lb. Ferro-uranium, composed of 25 to 30% uranium, 21% silicon, and 4 to 5% carbon, has a market price of $7.50 per pound.

The industrial uses of radium include its application to the manufacture of luminous dials for compasses, watches, and clocks, gun sights and to instruments of precision that are part of the equipment of submarines, aëroplanes, and naval and other vessels.

Engineering and Mining Journal

January 18, 1919

Volume 107 *Number* 3

Rossiter W. Raymond

A MEMOIR BY W. R. INGALLS

AS LONG as 35 years ago Raymond was already a legendary character. There were not many mining engineers in this country at that time, and most of them were young men who had been graduated after the Centennial. There was a small number of men who had been schooled at Freiberg in the '60s. These were the revered seniors of the new profession, and among them Raymond was preëminent. His merits were distinguished. He had had a picturesque career. He had filled several public positions that had caused attention to be focused upon him. Long before that time he had become the most conspicuous among mining engineers. His colleagues admired him. The young fellows looked up to him as one standing on the heights. As one of those young fellows, I first met him at Leadville, in June, 1889, which was visited by the Institute in the course of its 54th meeting. The honor of an introduction to this famous man overwhelmed me, and I well remember the awe that I felt in entering his private car. It seems to me that during our subsequent acquaintance, and later friendship, of nearly 30 years, he never changed greatly in appearance from that day. He never seemed to grow very old in looks, and certainly in spirit he did not. At the particular time of my first meeting with him he was in the midst of a game of chess, and I do not think he relished the interruption, although he pretended it did not matter. However, it was my good fortune soon to come close to him when late in 1890 I came to New York to assist Rothwell on the *Journal*, and the latter, departing for a prolonged journey, enjoined upon me to look to Raymond as a guide, philosopher, and friend, and until I left the paper in 1892 we had such association.

Rossiter Worthington Raymond was born in Cincinnati in 1840, son of Robert Raikes Raymond, a descendant from Richard Raymond, who came from England to Salem, Mass., about 1632. His mother, Mary Ann Pratt before her marriage, came also from an old New England family. Rossiter was the eldest of a family of seven children. He received his early education in the public schools of Syracuse, N. Y., whither his parents had removed, and in 1857 entered the Brooklyn Polytechnic Institute, of which his uncle, Dr. John Raymond, was then the president. Graduating from that institution in 1858, at the head of his class, he set out for Europe to continue his studies, taking passage in the clipper ship "Great Western," of the Black Ball line. Before the long and disastrous voyage was over Raymond had become the third mate, and the crippled ship, with half a rig and half a crew, and on half allowance of water, finally crawled down through the Irish Channel to Liverpool, a surprise to her underwriters. That was a stirring experience for a lad of 18, who manifestly exhibited the stuff that was in him to be appointed an officer out of the passenger list.

Landing in Europe, Raymond entered upon studies at Heidelberg and Munich, but especially at the Royal Mining Academy at Freiberg, where he remained until he completed them; whereupon he returned to the United States in 1861, and in August of that year entered the Federal Army, serving as aide-de-camp,

FREIBERG, 1860-1861

THE "GREAT WESTERN," 1858

FEDERAL ARMY, 1861-1864

with the rank of captain, on the staff of Major-General Fremont. During the campaign in the Valley of Virginia he was officially commended for gallant and meritorious conduct.

Retiring from the Army in 1864, he entered upon the practice of his profession as mining and metallurgical engineer in New York. Whether he formed his association with Dr. Justus Adelberg at once, or a little while later, I do not know, but, anyway, it was not long before the firm of Adelberg & Raymond was organized and was doing a rushing business. This was almost coincident with the birth of the mining industry in the United States. Indeed, except for gold mining, mostly placer, in California, and lode-mining on the Comstock, which had been discovered in 1859, there was no extensive mining going on in the great region west of the Rocky Mountains. The prospecting that was to result in the discovery of the rich ore deposits of Eureka, Nevada, and the Cottonwood Canyons, in Utah, was just being begun in 1863-64, but the curtain of the stage of active mining was not to be raised for five years. Further east there was mining for copper in the Lake Superior region, and lead mining on a small scale in the Mississippi Valley. The St. Joseph Lead Co. and the Granby company, to mine for lead and zinc, respectively, in Missouri, were just being organized. Truly, Raymond entered upon the practice of his profession at a psychologic time. Equally so was the institution, in 1866, of the *Engineering and Mining Journal*, in which Raymond naturally became quickly interested. It will be best to carry on this part of the story of Raymond's professional career in his own words, quoting from some reminiscences that he contributed to the paper upon its 40th anniversary. The paper was known for a year or two as the *American Journal of Mining*. Raymond wrote:

> So far as I can recall, my own connection with the enterprise began with the contribution to the *American Journal of Mining* of a series of articles running from Apr. 27 to June 8, 1867, entitled "A Comprehensive View of the History and Present Standpoint of Geology. Being the Introduction to Prof. Bernard Cotta's New Work, 'Die Geologie der Gegenwart,' translated by Adelberg & Raymond, Mining Engineers."
>
> Dr. Justus Adelberg, my business partner at that time, was an accomplished chemist and technologist, who had also acquired by personal experience considerable knowledge of mining conditions on the Pacific Coast. I was a young beginner, with nothing but my education at Munich and Freiberg, and my service (occasionally in the line of engineering) in the Union Army to qualify me for serious professional work. Adelberg's advice was, of course, invaluable to me. It was at his suggestion that I made the translation from Cotta, mentioned above, and gave it to the *Journal*, partly to help that enterprise and partly (perhaps chiefly) to advertise our firm.
>
> Those were the days when mining experts were scarce and were eagerly employed. For some years Adelberg & Raymond did an immense business. Hermann Credner (afterward professor of geology in the University of Leipzig, and director of the Saxon Geological Survey), Anton Eilers (famous now on his own account as metallurgical authority and captain of industry), Chas. A. Stetefeldt, O. H. Hahn, and others who subsequently distinguished themselves in American mining and metallurgy, were first employed as assistants by the firm. For some time my personal work was largely that of superintending the labors and editing the reports of such men, with only occasional opportunity for professional field work of my own. My prospect of gaining such needed contact with actual conditions and practice was further diminished when, as the consequence of my published translation from Cotta, I was requested by Western & Co., the publishers of the *American Journal of Mining*, first to contribute anonymous editorial paragraphs and afterward to assume publicly the position of editor. I did not replace, or immediately succeed, Mr Dawson. There was an interregnum of one six-months' volume, during which Western & Co. were announced as "Editors and Publishers," and I did more or less editorial work for them
>
> My editorship of the *Journal*, which might have deprived me permanently of the benefit of actual practice, unexpectedly led to the contrary result. Certain articles of mine on the relations of the Federal Government to the mining industry on the public domain attracted the attention of some of the senators from the Pacific states; and in 1868, when Ross Browne was suddenly appointed U. S. Minister to China, I was invited to Washington, and, after a conference, was appointed to continue his work as U. S. Commissioner of Mining Statistics. Such an honor and opportunity could scarcely have come to a young man of 28 in any other way; and I have always regarded my connection with the *Journal* as a principal source of whatever subsequent professional knowledge and influence I was able to achieve.
>
> During the years which followed I practically edited the *Journal* with one hand, while discharging official duties and earning my living by professional work with the other. This was not altogether good for the *Journal*. I could have done better work there if I had not been forced to do so much elsewhere. On the other hand, the *Journal* could not support me, except as it gave me a prestige which commanded other income for its support as well as my own. First and last, it cost me about $30,000—all of which, in my judgment, my connection with it enabled me to earn otherwise—so that I considered the outlay fully justified. It was not until Mr. Rothwell took the business in hand that it began to be really profitable and to realize the conception which I had cherished concerning it, but for lack of time and money had always been unable to realize.
>
> It was Mr. Rothwell who, by urgent personal appeal, induced me to attend the famous Wilkes-Barre meeting of 1871, at which the American Institute of Mining Engineers was organized. Unknown to either of us, this was the "parting of the ways" in our business relations—though there was never such separation in our friendship. Curiously enough, he, who had been one of the founders of the Institute, devoted himself supremely in later years to the *Journal*, while I, who had assisted the infancy of the *Journal*, have given my life to the Institute. I feel sure that the *Journal* did not suffer by this exchange, and I am as heartily proud of its subsequent success as if I had had more to do with it.

Raymond did not overdraw the activity of this period of his life. Besides the two responsible positions that he was filling, and his interest in the Institute and private professional work, he accepted an appointment as lecturer on economic geology at Lafayette College, and occupied that chair until 1882, while for one year during that period he gave the entire course on mining engineering. In 1873 he was appointed U. S. Commissioner to the Vienna Exposition, and as such delivered at Vienna addresses in the German language at the International Convention on Patent Law, an address at the International Meeting of Geologists, and an address in English at the meeting of the Iron and Steel Institute, in Liège, Belgium. During this period, however, it was his work as U. S. Commissioner of Mining Statistics, recorded in eight classic volumes, 1869-76, that stands out most prominently. The technical library that possesses the complete set now deems itself fortunate. Respecting this work and this period generally I may be permitted to quote from an editorial in the *Journal* published following a memorable occasion:

> The celebration of Doctor Raymond's 70th birthday makes an appropriate occasion for the *Journal* to express its appreciation of the high services that in a professional career of nearly 50 years he has rendered to the mining industry of the world, its recognition of his help in advancing the standing of the profession of mining and metallurgical engineering, and finally its own respect that is due to him as a father, because, although he was not the first editor of the *Journal*, it was certainly he who shaped its editorial policy into that form which has come down as tradition and precedent. Raymond became editor of the *Journal* on July 13, 1867, and continued in that position until 1874, when the multiplication of his other duties necessitated his withdrawal from sole editorial control. He became, then, joint editor with R. P. Rothwell, this arrangement extending into the '80s, and finally a special contributor. Up to the present time no volume of the *Journal* has ever been published which has not contained some contribution by him.
>
> The major portion of Raymond's sole editorship of the *Journal* was contemporaneous with his filling of the position of U. S. Mining Commissioner, and during that time he produced those wonderful volumes upon the mineral resources west of the Rocky Mountains which are the admiration of everyone who has had

ROSSITER W. RAYMOND

occasion to study them. Respecting them, the present editor of the *Journal* can speak with peculiar appreciation, because of the minute examination of them that was necessary in connection with an historical investigation. No one better than he can praise the beauty of their style, their language always clear, incisive and easily flowing; the accuracy of the descriptions, the keenness of the perception manifested throughout, and the remarkable prophecies that had to await only a few years for their fulfillment. Written 40 years ago, when the Pacific railway had just been completed, and the Great American Desert was receiving the first strokes of development, especially as to its mining industry, these volumes can be read with almost as much interest today as when they were penned, and they may be read also with profit. No other country possesses such a chronicle of the development of its mining industry, and we may rightly esteem these volumes as classics of mining literature.

From 1875 to 1895 Raymond was associated, as consulting engineer, with the firm of Cooper, Hewitt & Co., owners of the New Jersey Steel and Iron Co., the Trenton Iron Co., and the Durham and the Ringwood Iron Works, as well as numerous mines of iron ore and coal. As president of the Alliance Coal Co., and director of the Lehigh & Wilkesbarre Coal Co., and as a personal friend of Franklin B. Gowan, he became acquainted with the inner history of the memorable campaign against the "Molly Maguires," and ever since has been known as a fearless opponent of all tyranny practiced in the name of labor. His articles on "Labor and Law," "Labor and Liberty," etc., published in the *Journal* at the time of the Homestead riots, attracted wide attention, and for these, as well as similarly frank discussions of the operations of the Western Federation of Miners in Montana, Idaho, and Colorado, he received special denunciations and threats from the labor unions thus criticized. He was threatened with hanging if he should ever dare show his face in Butte, but Raymond was not made of the stuff to be scared by any such talk. On the contrary, he often expressed himself gleefully about it, and he made a point of visiting Butte at the first opportunity. While connected with Cooper, Hewitt & Co., he also assisted Abram S. Hewitt in the management of Cooper Union, and for many years directed the Saturday Evening Free Popular Lectures on Science, etc., which constituted the beginning of what has since become a vast lecture system in the City of New York.

During the major part of this period Raymond continued to be a joint editor of the *Journal*, with Rothwell, but that arrangement between two forceful men, two men of remarkable individualism, proved gradually to be impossible. Without the least impairment of their friendship, which continued unshadowed until Rothwell's death in 1901, there were nevertheless bound to be differences regarding editorial policies. A great journal of character, tradition, and policy must necessarily be edited by one man who is solely responsible for it. Raymond tried to circumvent this by publishing on the editorial page that he was responsible only for those articles that were marked by an asterisk. Old readers of the paper will remember that custom and will also remember, no doubt, how much interest they experienced in discerning the difference in the views of the two men. But that arrangement was finally recognized to be unwise, and Raymond ceased to be an editor, appearing subsequently as "special contributor," all of his articles being thereafter signed with his name. A special contributor he continued to be until his death, though some years ago, in conformity with our policy of not publishing the names of editorial collaborators outside our immediate office, we discontinued the publishing of his name, with his own hearty approval.

In the meanwhile, Raymond's absorption in the American Institute of Mining Engineers had been steadily increasing. An original member of it, he had been vice-president in 1871, 1876, and 1877, president from 1872 to 1875, and in 1884 he became its secretary, which was equivalent to saying its administrator. Before reviewing his great work in that capacity, however, his outside work may well be mentioned, for he always had a great deal of that on hand.

From 1885 to 1889 he was one of the three New York State Commissioners of Electric Subways for the City of Brooklyn, and served as member and secretary of the board, preparing its final report, which was generally regarded as the best statement of the problem of municipal engineering and policy involved in the distribution of electric conductors. The president of one of the companies expressed a desire to honor him as "one of the first American electrical subway engineers." At the close of his official term as commissioner, he became consulting engineer to the New York & New Jersey Telephone Co., which position he retained for a great many years.

In 1898 Raymond was admitted to the bar of the Supreme Court of New York, and of the Federal District and Circuit courts, his practice being confined to cases involving either mining or patent law, in the former of which he was a leading authority. In 1903 he was lecturer on mining law at Columbia University. He delivered numerous addresses at other colleges and universities, including Yale, Cornell, Lehigh, Lafayette, Union, California, the Worcester Polytechnic, the Brooklyn Polytechnic, and the New York College of Physicians and Surgeons.

But from 1884 to 1912 Raymond's greatest work was as secretary, administrator, and editor of the American Institute of Mining Engineers. His early instincts and habits as an editor here reappeared. He regarded the Institute primarily and preëminently as an organization for the dissemination of professional knowledge. He was essentially a publicist. He stimulated contributions upon subjects that he deemed should be expounded for professional benefit; he accepted what was voluntarily offered if it measured up to his standards, and he put everything into the most beautiful, polished and lucid literary style. There are several types of editors. There is the editor who is a director of a general program, dismissing the execution of details to others. In the execution of details, especially in the handling of manuscripts, there are two methods. One is simply to scrutinize, clarify, condense perhaps, and, while correcting errors of grammar and syntax, let the author in the main express himself in his own language. Another method is to do all those things but the last, instead of which the author's expressions are polished and perhaps repolished—perhaps entirely rewritten. In technique Raymond's method was the latter. To him contributions were more or less raw material, hewed out by ax and adze. He was the joiner, carver, and polisher. The immense annual volumes of the "Transactions," for a long series of years were essentially his work, and few people appreciate the infinite pains he took with them. But let it not be thought for one moment that his mind was concentrated upon this delicate work to the exclusion of other thoughts of major character. He would work upon nothing but good material, and he made sure of its soundness before he put his hand to it at all. His immense erudition and extraordinary memory made him a keen and profound critic, and it was not often that anything imperfect passed his sieve. Nevertheless, he was human, and consequently not infallible.

Raymond not infrequently explained this style of editing. The president of a company, observing the publication of a paper in elegant diction over the signature of one of his superintendents, whom he knew to be rather awkward, if not exactly illiterate, remarked one day:

"Raymond, why are you trying to pull wool over our eyes? Bill never wrote that paper. He couldn't if he tried."

"No," replied Raymond, "Bill did not write it, but Bill did the work that the paper told about. It was good work, and information about it is important to the industry. It is my job to present such work in a way that it may be read easily and understandingly."

This epitomizes the philosophy of Raymond's editing. It was his aim to create a refined record of progress in the arts that concerned his professional colleagues and make it something of real use to them and those who should succeed them. In carrying out this ambitious idea he added to the archives of mining and metallurgy more than any other one man, not so much by his personal contributions, although they were important, always valuable, and always highly appreciated, but as the extractor and the producer of the records, views, and opinions of other men who had done things. The profession that witnessed and valued the results had perhaps but scant appreciation of the thoughtfulness and tireless energy that drew out these contributions and smoothed them into the clear and creditable essays and monographs of which the authors have been proud.

While on the subject of Raymond's editing, let reference be made to his own literary style in technical writing. This was as nearly perfect as anything could be. He was, indeed, the supreme master of us all. In the office of the *Journal* I made one standing order respecting Raymond's MSS. If they went to the composing room at all (almost always they did), they went just as he penned them, for it was certain that none of us could improve them even to the extent of one word, and it was equally certain that there were no errors to be corrected. Nor did he often desire to see a proof, but, if he did, there were rarely any alterations that he wanted to make. The characteristics of his style were incisiveness, crystalline lucidity, and wonderful fluency. He had a marvelous gift in choosing exactly the right word, for constructing ingenious and engaging phrases, and for producing perfectly balanced sentences, while his thought was developed in a logical array of consequential paragraphs. Raymond's technical essays were as nearly technical poems as anything technical can be.

Nearly all of Raymond's contributions to the *Journal,* which continued to the year of his death, and all of his private correspondence with me, which was often voluminous, was written by his own hand. His MSS. that were rarely typed were copies rather than dictations, for he did not like to dictate. Perhaps the excellence of his literary style had some connection with this. He wrote long, intimate letters in the old-fashioned way. His penmanship was graceful, and easily legible. Interlineations and corrections were uncommon. To compositors and to proof readers his "copy" was always a joy.

After 28 years of ministry as secretary of the American Institute of Mining Engineers, Raymond, in 1912, retired with the title of emeritus. He was then over 70 years of age, and, although he was as active and vigorous as ever, he failed to become fully conscious of new aspirations and new ideas among the membership, or perhaps he entertained different opinions respecting them. There was probably some of each of these explanations of his attitude. Anyhow, he preferred to let a younger hand take the helm and to direct his attention to special work that he particularly enjoyed, performing it in his old office at the Institute without having any worry about the day's routine of office details. He was well entitled to these last years of relative ease. However, he did not, even at 70 and later, seem to be old. Indeed, he used to say, himself, that he did not grow old; that he merely grew older.

I should be a poor biographer if I tried to depict Raymond as a man free from faults and foibles. He was very human, and, also, he was of a bold and strong character. Therefore it was not unnatural that he should be steadfast in his convictions; nor was it surprising that he should be sometimes opinionated and domineering; nor that he should exhibit considerable egotism. These traits often caused his younger associates to fear lest they should offend him. However, Raymond's was too open and generous a nature to take offense over any sincere, straightforward representation, even if it were a refusal of himself. I remember very well an incident between him and me. Soon after I had become editor of the *Journal* and he had sent me his best wishes in a very warm letter, he proposed a series of articles on a certain subject, which I accepted in principle. However, when I received the MS. I was considerably exercised over his treatment of the subject and was much disturbed over how to tell him just what I thought and felt I ought to do. But I made up my mind that the only thing was to be perfectly frank, so I wrote him that I did not think it wise either for the *Journal* or for himself to publish the articles, and, in short, I rejected them. To have to reject an article by Doctor Raymond was rather an appalling thought to me in my newness in the editorial chair, and I awaited his reply with a good deal of trepidation, really expecting something tart. I was immensely relieved when he wrote me that he thought I had done right. The flow of his usual contributions on his own good subjects kept right on.

Some years later Raymond said to me one day that he had to contribute a paper to the Pan-American Scientific Congress that was to assemble in Chile, that he was very much pressed by several things, and would not I do it in his stead? I told him that I also had my hands full and could not take over that task, but I would be glad to help him all I could, whereupon he proposed a collaboration. We spent an afternoon together, mapping out the paper, and agreed upon the parts that each would undertake. Having made our drafts, we met again and read each other's notes, after which Raymond said, "Your opening paragraph will make a good introduction" (or it may have been I who said that to him), and then we agreed that his first paragraph would appropriately fit in next, then my second and third, followed by his second, and thus we combined our productions. They dovetailed together with singular aptness, and not even was it necessary to write in more than a few connecting sentences in order to preserve the continuity of thought. Probably I am the only man who ever collaborated with Raymond in a technical paper; anyway in recent years.

But what of Raymond's professional work? Well, it was, first of all, as a publicist, as an educator, as has already been revealed in this sketch. But, besides that, he won high distinction as a professional specialist. From his early years in the field he had exhibited a predilection toward the science of economic geology, particularly ore deposits. He had early been associated with Credner (his first publication was on a geological subject), and during his commissionership he had devoted special attention to the nature and forms of mineral depositions. Along with this attraction he possessed a mind of analytical and deductive character—an essentially legal mind. The United States, in so far as its national lands were concerned, had been cursed with a singularly fatuous law governing the location of mineral claims. This law became known as the "Law of the Apex" in popular parlance, and it being soon found that Nature did not deposit valuable ores in so simple a way as the framers of the law thought, there developed litigation between claimants who held that each was entitled to the same deposit, wholly or in part. Obviously, it then became necessary to study, classify, and interpret the ore deposit, so as to ascertain whether the law did or did not apply to it, and, if it did, how, where, etc. Manifestly this required the services of mining and geological experts, and it was natural that Raymond should promptly be requisitioned. The first great case in which he appeared was the celebrated Eureka-Richmond, which is the most noted of the early cases. In summarizing what Raymond did in this case, everyone who knows will agree with the following words of William Scallon, one of his legal colleagues:

> The first great case in which he appeared was the famous Eureka-Richmond, which is also the most noted of the early reported cases. That suit involved questions of fundamental importance, the correct determination of which was vital to the successful operation of the United States Mining Statute. The decision rendered in it has been, ever since, a beacon light for lawyers and for courts. It was Judge Field who rendered the decision, but it may well be said that it was Doctor Raymond who induced it, and the great jurist himself gave credit to Doctor Raymond for his convincing exposition of the views which the Court adopted; indeed, he adopted also his very words in the statement of these views. There, Doctor Raymond successfully maintained that the law was made for the practical miner and the prospector, rather than for the geologist, and should be read in the light of practical experience and interpreted as practical mining men would understand it. The law is, even now, the occasion of so many uncertainties, that one can hardly imagine what condition would have ensued if Doctor Raymond had not, at that early day, succeeded in his advocacy of this beneficent rule. In the case referred to, it was as a witness that Doctor Raymond advanced his views, since then he has published many writings on the subject of the mining law. These have been the contributions of a publicist to the discussion of a subject of public interest. They have been no less influential in assisting and directing legal and judicial thought. Mr Curtiss Lindley, the author of a leading textbook on mining law, has made acknowledgment, in his preface, of the great value of Doctor Raymond's discussions and writings. For myself, it is with a sense of personal obligation that I speak of these works of Doctor Raymond, for, when I took up the study of Federal mining law, there were no treatises in existence, and his illuminating writings shed a gladsome light on the intricacies of the subject. I recall with ever-increasing pleasure that I had the good fortune of professional association with Doctor Raymond in the last great underground controversy in which he appeared in court. That was at Butte. With him, too, on the same side this time, was his brilliant antagonist of the Eureka case, the learned, lovable, and dearly remembered Clarence King, as well as Mr. Brunton, and other able and distinguished men. That they won goes without saying. It is worthy of mention that, as in his first case, so in his last, the Court paid Doctor Raymond the notable compliment of quoting his felicitous language in expressing its own conclusions. Thus, we see that Doctor Raymond has been a luminary of the jurisprudence of mining, as well as of its geological and technical departments.

Raymond's brilliant exposition in the Eureka-Richmond case created a great demand for his services, and his experiences in this branch of professional work were wide and varied. Generally he was on the victorious side, which of course was not at all a matter of luck, but purely of his judgment. In one case the opposing party surrendered before trial, after a conference between its expert and Raymond, in which the latter convinced the former. On another occasion, though not at that time a member of the bar, he was invited by the U. S. Supreme Court to address it on a point in mining law; and his exposition was accepted by the court in rendering its opinion.

But Raymond was in no wise a fomenter of mining litigation. On the contrary, he was a deprecator of the absurd law that fostered it, a law that has cost this country the ransom of an empire. In an essay on "The Law of the Apex" in 1883 he exposed its stupidity and its dangers, and he made it a part of his life-work to fight for the cancellation of that part of our mining law. In this campaign he was the pioneer. The law still stands unamended upon our statute books, owing to the ignorance and sluggishness of our legislators, who have been deaf to demands for its reform; but its evil has been greatly minimized by the tacit consent of people in the mining industry to disregard it and arrange things in their own sensible way.

This sketch has dealt mainly with Raymond's professional career, his working life. It has all been "shop," so to speak. There was another side of his life that his professional colleagues did not know so well, although, of course, we heard a good deal about it and had some insights into it. But surely we did not know all the things that Doctor Hillis told in his memorial address. Raymond from his youthful days was one of Brooklyn's foremost citizens and for 60 years he was a pillar of Plymouth Church. We knew him as "Doctor Raymond." In Brooklyn he was "Ros. Raymond," or "Uncle Ros." He had early become prominent in the affairs of the church, among other things conducting its Sunday School. When Henry Ward Beecher was called away from a service one Friday evening in March, 1887, to keep an engagement elsewhere, he called Raymond to the platform to take charge, and, turning to the audience, said: "You see I leave you in good hands." This proved to be Beecher's farewell, for before the next meeting he was stricken with his last illness. In this emergency the leaders of the church turned to Raymond. Doctor Hillis told this:

> When Thomas Shearman and S. V. White and others came to see me in Chicago just 20 years ago, they said that after Mr. Beecher's death they went together to Rossiter W. Raymond and asked him to give up his work as editor, lawyer and mining engineer and take the pastorate of Plymouth Church, to whom Dr.

> Raymond replied, as my old notes show, that the Providence of God, through his fathers, had lent him certain gifts ,and by His Providence guided him into an appointed path, and now that his life journey had been two-thirds fulfilled, he did not believe that the Lord was going to return to the beginning of that path and reverse Himself, and he would, therefore, follow the way appointed to the end thereof.

This report of a call of Raymond to the ministry is not so surprising a revelation of another of his many sides as some might think. Even at that time, Raymond had gone deeper into theology than most clergymen ever succeed in going. During the winter of 1885, while Mr. Beecher preached in the auditorium of Plymouth Church, Raymond lectured on the history of Israel, by Ewald, and upon Old Testament problems, as stated by Robertson Smith and Canon Driver. This was the time when the Presbyterian Church was in the throes of the heresy trial of Professor Briggs. While other churches were torn apart by the discussion of those questions, Plymouth Church went through the heated epoch without disturbance, upheaval, or fear. I am quoting Dr. Hillis.

Raymond initiated the custom 50 years ago of writing an annual Christmas story for the Sunday School of Plymouth Church, which he read about Christmas time. Never a year passed when he failed to make this contribution, which he caused to be printed as a little pamphlet for the benefit of his pupils and for his friends outside of the church circle. The latter always appreciated highly this Christmas remembrance from Raymond. His story-writing ability, which was exhibited in several novels and collections of short stories, and his poems, exemplified by his inspired ode on "The Grand Cañon," showed other facets of his many-sided ability.

Still another one was his skill as a chess player. I have mentioned already that the first time when I met him he was in the midst of a game of chess. At the dinner in honor of his 70th birthday, a silver service was presented to him. One of the pieces was engraved with the symbols of the game of chess, indicating this incidental accomplishment of Raymond's. In making the presidential address, Doctor Douglas said:

> I understand that Doctor Raymond once drew a hard-fought two-hour game with Steinitz; that he holds a gold medal as the winner of a chess tourney; and some of you remember how, in 1908, a confident group of chess players on the "Campania" challenged the chess players on the "Oceanic" to a game by wireless telegraph, and got the worst of it, because Doctor Raymond directed the defense.

A complete enumeration of Doctor Raymond's writings and honors must be left for the book that will surely be written about him by someone. Enumeration would be impossible in a sketch so brief as this. Some of his more important works were the following: "Die Leibgarde" (1863), a German translation of "The Story of the Guard" by Mrs. Jessie Benton Fremont (1863); "The Children's Week" (1871); "Brave Hearts" (1873); "The Man in the Moon and Other People" (1874); "The Book of Job" (1878); "The Merry-go-Round" (1880); "Camp and Cabin" (1880); "A Glossary of Mining and Metallurgical Terms" (1881); "Memorial of Alexander L. Holley" (1883); "The Law of the Apex and Other Essays on Mining Law" (1883-95); "Two Ghosts and Other Christmas Stories" (1887); "The Life of Peter Cooper" (1897); "Christus Consolator and Other Poems" (1916); various technical works and papers on mining law, as well as numerous addresses and magazine articles, and contributions to several American dictionaries and encyclopedias.

Throughout Raymond's distinguished career honors were showered upon him. He was made an honorary member of the American Philosophical Society, the Society of Civil Engineers of France, the Iron and Steel Institute, the Canadian Mining Institute, the Mining Society of Nova Scotia, and the Institution of Mining and Metallurgy of Great Britain, and numerous other technical and scientific organizations both at home and abroad. He received the degree of Ph.D. from Lafayette College in 1868, and that of LL.D. from Lehigh University in 1906. On the latter occasion, speaking as an adopted alumnus of the university, he delivered to the graduating classes an address on "Professional Ethics" which has been widely quoted and approved. In 1908 the Institution of Mining and Metallurgy awarded to him its gold medal.

In 1911, during the visit to Japan of a party of members and guests of the American Institute of Mining Engineers, Raymond received from the Mikado the distinction of Chevalier of the Order of the Rising Sun, fourth class, the highest ever given to foreigners not of royal blood, "for eminent services to the mining industry of Japan." These services consisted in advice and assistance rendered in America to Japanese engineers, students, and officials throughout a period of more than 25 years. In February, 1915, Raymond delivered the commemorative address on the 150th anniversary of the foundation of the University of Pittsburgh, and received its honorary degree of LL.D.

Raymond died very suddenly on the afternoon of the last day of 1918. He had been ailing a little for a few days previously, but the trouble did not seem to be of much consequence. On the previous Sunday morning he had read his fiftieth annual Christmas story in the Bible School of Plymouth Church, and on the previous Friday evening he had made a long address on the spiritual influences of the Great War. Doctor Hillis had asked him to speak on the forgiveness of enemies national. He began his address by saying that he much preferred to speak upon another theme, particularly because he found himself in full sympathy with the imprecatory psalms, and that as far as the forgiveness of our enemies who had butchered Belgium were concerned, there were moments when he understood how the chief of a cannibal tribe in the South Sea Islands felt. Asked by the missionary whether or not he was willing to forgive his enemies, the chief answered: "Certainly, certainly. Last week I ate them all up." "Then Doctor Raymond delivered one of the most brilliant addresses on what this war has done to the soul of the American people to which any of us had ever listened," said Doctor Hillis. "Never was he in finer form. Notwithstanding his nine and seventy years, his mind glowed and sparkled through 40 minutes. Never did he seem more lovable, more gentle. There was in his carriage always a certain note of chivalry. He seemed a Twentieth Century embodiment of the Knight Errants of Sir Thomas Mallory. Those of you who recall his youth think of him as a kind of Sir Galahad, and those who remember his age think of him as Sir Percival, who saw the Holy Grail because his heart was pure."

Raymond felt very deeply regarding the holiness of the cause of the Allies in the war, as readers of the *Journal* know from some of his contributions this year and last. I am reproducing his last contribution, which we published Sept. 14, 1918. When he sent it to me he suggested that it might not be suitable for an engineering paper. I replied that anything that helped the great cause was suitable for any kind of a paper, and this, his last contribution, well illustrates his wit:

> To engineers especially, the explanations offered by the German staff and the German press, to account for the successive defeats of the German army, are peculiarly amusing. The other day, we were told that Ludendorff had shown masterly ability in throwing enormous reserves into the Marne salient, so as to facilitate the retreat of the force already there—which reminds me of the story of the Irishman who was seen punching a greenback down between the boards of the Atlantic City boardwalk. His explanation was that he was not wasting the greenback at all—he had lost a nickel in that crack, and he was simply putting enough after it to make it worth his while to take up the planks.
>
> But the latest of these amusing *camouflages* is the pæan of triumph over "our victorious retreat," of which the following verses may perhaps be regarded as a sufficiently accurate echo:

AN INTERVIEW

"Wilhelm, what blacked your eagle eye?"
"O curious journalist!
It was this eye, now swollen high,
That smote old Foch's fist!"

"And, Wilhelm, 'seems to me you limp
And stumble as you go."
"'Tis true, I gave my leg a crimp
In stamping on the foe."

"O Wilhelm! whence, for goodness' sake,
That footprint on your seat?"
"That's where he failed to overtake
My masterly retreat!

"For I, when he came on apace,
With frenzy born of fear,
Strategically saved my face
Behind my conquering rear.

"Yes, even in battle's dread array
The leader still I'll be;
To hostile hosts I'll show the way,
And they shall follow me!

"Now let those brazen bands of mine
Strike up the usual tunes,
Beginning with *Die Wacht am Rhein*,
And ending, *Gott mit Uns!*"

Five or six years ago I began to tease Raymond to write his personal reminiscences, especially of the period from 1865 to 1880, and Arthur Dwight joined me in trying to persuade him to do so; but we did not succeed, although I am sure that we tempted him strongly. However, he had his heart set upon writing a history of the Institute (which perhaps might have come more or less to the same thing) and he wanted to devote his remaining years to that. We do not know how far along he got with it. One of the most beautiful things about Raymond's life was his devotion to his wife, whom he married in 1863, she being a daughter of William and Mary Dwight, of Brooklyn. In recent years, Mrs. Raymond's eyesight failed, and, to entertain her, the Doctor read to her a great deal and let his own interests go.

The American mining industry has lost during the last year three great men—Eilers, Douglas, and, lastly, Raymond. They were contemporaries, born at about the same time and dying within a narrow space. All three attained ripe years, and together they did more for our mining and metallurgy than any other three men. The association between Raymond and Eilers was one of beautiful, lifelong friendship. Eilers was born a year earlier and died a year earlier. He joined Raymond as an assistant about 1866, and continued with him through the years of the commissionship. Thereafter, when Eilers took up his residence in the West, his hospitable roof was always a home for Raymond, and, as the latter said, after more than half a century he could not recall a single occasion of even temporary and passing discord to mar that perfect friendship.

Raymond was one of the most remarkable cases of versatility that this country has ever known. Sailor, soldier, engineer, lawyer, orator, editor, novelist, story-teller, poet, Biblical critic, theologian, teacher, chess-player—he was superior in each capacity. In some he was superlative. In none was he mediocre. It was given to him to possess supreme powers in two ways—as a publicist and as a professional specialist. Almost any man deems himself distinguished if that can be said of him in one thing. Yet according to Raymond's own view he had not done the things he intended to do, but rather had unconsciously obeyed the maxim of Browning to "Get thy tools ready; God will find thee work." Rather than to work of creative and constructive leadership, Raymond, in his own words, gave his life and his strength to the vocation of an interpreter, chronicler, guide, and assistant to engineers. That is, I think, an approximate, but not an absolute, summary of his professional work. But even if there were no more, is not his own modest estimate enough to be satisfying? Raymond exalted his philosophy and his religion in these splendid words that he spoke at Eilers' funeral:

> And yet—and yet—can this be the end? Love says, No! and Science says, No! For the very existence of science demands the assumption of a rational universe. Nature must not tell us lies. Her evidence must be interpretable. And science, starting on that basis of faith in honest evidence, has discovered not only order but purpose in the evolution of the universe. We can read the progress of that purpose in ages past, from primordial slime through the ascending forms of life, to savage man, barbaric man, civilized man—through specific features to personality. Science confirms the poet who says, "An honest man's the noblest work of God." And science cannot receive with respect the conception of a Being who would spend aeons in careful, patient preparation to bring forth a man only to destroy him—a God blowing bubbles, and, just when such a radiant sphere has reached its brightest rainbow glory, dashing it into mist, in order to begin another with futile inflation. How childish, how absurd! No: we demand a reasonable universe and a respectable God—we students of science. We will not accept the notion that earthly death ends all. It is too ridiculous!

And as Raymond said to Eilers' spirit not farewell, but *a rivederci*, so said many friends over his own outworn body.

Nevada Wonder Mining Co.

The eleventh annual report of the Nevada Wonder Mining Co., operating at Wonder, Churchill Co., Nev., covering the year ended Dec. 31, 1917, shows that the development work done consisted of a total of 10,916 ft., a monthly average of 909 ft. The recovery of gold was 7512 oz., and of silver, 816,852 oz., from 55,800 tons of ore, carrying 0.141 oz. gold, and 16.65 oz. silver per ton. This indicates a recovery of 95.32% of the gold and 87.90% of the silver. The decrease in the recovery of silver was caused by a change, from the readily soluble silver minerals, in the ore found at depth in the mine. Four Senn concentrators are being installed and will be ready for service on Jan. 15, 1918.

Dividend disbursements during the period under review amounted to $281,694.80.

Dredging in 1918

GOLD dredging was seriously retarded in 1918 by the same conditions that impeded operations in vein and lode mining of gold ore. Indeed, the dredging industry, because of the very narrow margin of profit under normal conditions, has generally been placed in a worse position than has vein mining. When the complete reports for 1918 are available, few dredges will show any considerable profit. Most of them will show that they have been patriotically getting out every ounce of gold that they could while keeping their plants in good order and their well-trained crews together, hoping that relief might come from some source before the ground was all worked out. In most cases it has been more the hope of more favorable operating condition than patriotism that has kept the dredges working. Their operators have been between the devil and the deep sea. Continuance of operations meant production at a loss or with no profit. Cessation of operations meant deterioration of plant. So they faced loss in either direction. Yukon Gold passed its dividend, and others must defer dividend disbursements if they have not done so already.

Owing to the disadvantageous position held by gold dredging, little new work was started in 1918. In Alaska the Yukon Gold Co. continued its operations, but in a somewhat restricted manner, because of the shortage of labor and the high cost of supplies. The Canadian Klondike Co.'s dredges operated throughout the year, but the value of the ground worked was so low that, in spite of the employment of every possible economy, little profit resulted from the year's operation. No new work of any moment has been undertaken at Nome, and the reports so far received from this section concerning the year's operations are discouraging.

Few new boats have been put in commission in the California field, and several have almost finished the acreage on which they had been working. Under normal conditions such dredges would be ready to be dismantled and moved to new fields, but the present heavy cost of moving and rebuilding does not make this an attractive venture. The matter of resoiling has continued to occupy the attention of California operators, but successful resoiling, if it can ever be a success, requires rearrangement or practically rebuilding of the disposal end of the dredge, and the value of the redeemed land is usually too low to warrant the expense. When working deep ground, it is practically impossible to resoil, but when not digging more than 10 or 12 ft. some measure of success is possible.

Gold dredging in the Philippines has encountered setbacks, due to the fact that the Gumaos dredge, after five years' successful operation, had worked out all of its ground, and in attempting to move it some distance to a new piece of ground the dredge was wrecked and sank. The Mambulao dredge, which was put in operation two years ago, has also been unfortunate. Soon after beginning operation this dredge ran out of pay ground, and while attempting to move it to a new location it was overtaken by a typhoon and was sunk. However, it is expected that the dredge will be raised and put in operation again in the near future. Meantime, no new work has been undertaken in the Philippine Islands, and it will probably be some time before local capital can be induced to undertake new operations.

No new work has been undertaken in Colombia, and the one dredge that was shipped down in 1917 for the Lewisohn interests has not been completed, though their other dredge operated more or less during 1918 and recovered remarkable quantities of platinum. Colombia produced approximately 20,000 oz. of platinum in 1918, but most of this came from the small native hand workings in the various fields along the west coast. While speaking of dredging in Colombia it should be mentioned that this field has not been completely explored. There are extensive areas of possible ground tributary to the Magdalena River, and others are accessible from the west coast. Much of this ground is low and unhealthful, but as time passes more is being learned in respect to keeping a crew in health while working under tropical conditions. Transportation facilities show evidences of improving, and it is by no means impossible that future undertakings in Colombia may equal the highly satisfactory results of the Pato dredges.

Foreign Dredging Fields

No new installations have been undertaken in Russia, but at some points the older dredges have been kept in operation, notably the Orsk Goldfields Co.'s dredge on the Kolchan, which has operated continuously without interference from local governmental disturbances.

Korea opens up promising fields, and it was hoped that some further exploration work would be undertaken in that country in 1918, but little has been done along these lines so far. In the meantime, the Chiksan Mining Co.'s dredge in Korea, which was started up about a year ago, continued in successful operation throughout 1918.

In the Malay field, profits resulting from the operations of the tin dredges have been large, though the dredges have been rather crude affairs. This field offers interesting opportunities for dredge-constructing engineers backed by American capital.

The successful results of several dredging operations begun ten years or more ago have encouraged thorough prospecting of many widely scattered areas throughout the United States, but little promising ground, apparently, remains to be drilled, and scarcely any new areas were explored seriously in 1918. There are apparently greater opportunities for this work abroad than at home, and in the future, when dredging costs have returned to a pre-war basis, capital will undoubtedly be prepared to investigate foreign fields.

A review of the year's work in dredging would not be complete without mention of the publication of Bulletin 127 of the Bureau of Mines, "Gold Dredging in the United States," by Charles Janin. This paper discusses most lucidly the history, costs, and, in short, the whole field of dredging for precious metals, and the subjects are treated in a manner that should be of the greatest benefit to operators and engineers, bringing the subject up to the end of 1917, since which time little of importance with respect to dredging for gold has been brought to public notice.

Chrome Mining in Canada

BY ROBERT HARVIE*

THE year 1918 was the most successful in the history of chrome mining in Canada, the production coming mainly from the Black Lake and Richmond districts of Quebec Province, with a few hundred tons from British Columbia, which for the first time figures in the returns. The shipments, based on the returns for 11 months, will total 21,200 short tons, valued at $800,000, and consist of 6100 tons of concentrates, averaging 50%, and 15,100 tons of crude ore, averaging 36%. With the exception of about 2000 tons, the output was sold in the United States. Prices f.o.b. Black Lake, for short tons, ranged from $19 to $30 for 30%, from $25 to $43 for 40%, and from $45 to $80 for 50% ore.

From 1894 to 1908 a steady production was made by the Black Lake district, and from 1903 to 1907 it was sufficiently great to give Canada either third or fourth place among the world's producers of chromite. In 1909 production declined to zero, owing to the impossibility of meeting the competition from the larger, richer deposits in Rhodesia and New Caledonia. There was no production from 1909 to 1914. In 1915 the rising freight rates on ocean shipments of chrome ore reached such a level that the correspondingly rising prices offered for chrome ore attained a figure at which Canadian deposits could once more be profitably worked. The following table indicates the renewal of activity in what had been a dormant industry in Canada. Incidentally, the figures admirably illustrate the influence of increased prices in bringing out supplies and stimulating production.

CANADIAN CHROME SHIPMENTS, 1914-1918

	Short Tons	Total Value	Average Value per Ton
Total prior to 1914	62,334	$716,400	$11.29
From old stocks, 1914	136	1,210	8.90
Shipments for 1915	12,341	179,543	14 55
Shipments for 1916	15,412	312,901	20.35
Shipments for 1917	23,327	572,115	24 50
Shipments for 1918(a)	21,200	800,000	38 00

(a) Estimate based on shipments for 11 months

As compared with the monthly average of 1917, the first quarter of 1918 showed a distinct decrease in production in what should have been months of high production. The reason for this was an unduly conservative attitude on the part of the producers, who apparently could not believe that the exceptionally high prices of 1917 would last.

In March, 1918, at the request of the United States Government, the Canadian War Trade Board undertook to stimulate the production of chrome to meet an anticipated shortage due to restrictions then being placed on imports. I was already in charge of the work of the Geological Survey of Canada in the Black Lake district, and was appointed representative of the War Trade Board. The policy of this board has been to work in coöperation with the producers, and to improve existing facilities rather than overturn them, and direct assistance has been given in many ways. The speedy granting of export and import licenses on machinery and supplies, the waiving of express regulations to facilitate delivery of machinery, obtaining military exemptions for skilled employees, improvement of freight-car service, the securing of timber-cutting privileges, and an arrangement whereby the value of machinery was decided by arbitration were a few of the conditions secured by this coöperation.

During the second and third quarters, production improved, and an increase of about 25% over the corresponding period of the previous year was obtained. In September, however, the falling demand for chrome in the United States began to take effect on production, and during October and November the influenza epidemic, as well as unusually bad weather conditions, caused a drop in the production. This decline toward the end of the year is responsible for the total yearly tonnage being slightly less than for 1917.

No new deposits were discovered in 1918, but those producers who showed any energy in development were rewarded by large additions to their ore reserves. The most noteworthy deposit being operated is that crossing the Belanger-Mutual Chemical lots, from which the greatest production of chrome units during 1918 was made. This may be described as a zone or zones of disseminated ore, worked for 1400 ft. in length and to a depth of 100 ft. Besides the main zone, bodies of ore are found to either side, from one of which crude ore assaying more than 52% may be produced. One pit measuring roughly 50 ft. x 100 ft. is mining decomposed ore of good milling grade by merely pick and shovel. The Mutual Chemical Co. is opening its portion of the deposit by a shaft now sunk over 100 ft., with a first level at 90 ft. already in operation. Both the Belanger and Mutual Chemical mills were operated full time.

The Quebec Asbestos and Chrome Co., at Saint Cyr, near Richmond, operated to capacity during the year, and installed a 100-ton mill, as well as beginning underground operations. At one 200 ft. shaft over 500 ft. of drifting and crosscutting has been done on two levels. A second shaft is being sunk to a depth of 100 ft. The progressive policy which in 1917, the first year of operation, made this property the largest producer of chrome units for that year, is being continued with satisfactory results.

The property of the Black Lake Asbestos and Chrome Co. was worked in 1918 chiefly by small contractors, but in September a three-compartment shaft was started at the Caribou pit on company account. This property, which includes a great acreage of chrome-bearing lands and which during the former activity was the largest producer, has been robbed to the point of embarrassing future operations.

Although the Quebec operations were hard hit by the unexpected turn in the chrome situation in the latter part of 1918, it is probable that the above-named properties and mills can continue to be operated at a profit at even lower than the present prices. The mills have been built, and are probably already paid for out of profits, so that concentrates can now be produced without heavy charge for capital account. During early December, when all the mills were working full time, the output of concentrates was 60 tons per 24 hours, and it is thought that this rate can be maintained.

---

*Geological Survey, Ottawa, Canada.

The Miami District, Oklahoma

By A. E. Bendelari*

The Miami district includes the following camps: Commerce, Tar River, Century, Picher, Quapaw, Lincolnville, St. Louis, and Hockerville (all in Oklahoma); and Treece and Monarch (in Kansas, and for a distance of two miles north of the Oklahoma line into Kansas, and six miles east to Baxter Springs). The area is about twelve by six miles, and it now contains over 150 concentrating plants, varying in capacity from 150 to 700 tons per 10-hour day. In the newer fields a number of prospecting drill rigs are in operation.

All this activity has arisen during the last four years. In fact, it is just three years since the first mills were built in Picher and Tar River. The pioneer operators had to go back and forth as best they could through mud that was almost impassable, and machinery had to be hauled across the prairies, but now these mines are served by two railroads, and an interurban system gives the town of Picher, which is the hub of the district, a half-hourly service to Joplin.

During the year 1918, the total production of zinc concentrates from the Oklahoma-Kansas district was 523,514,000 lb., valued at $13,974,906, and 99,146,000 lb. of lead concentrates, valued at $4,595,500; making a total of $18,570,406, which is a wonderful showing, considering the time the field has been in operation.

The total represents the output of many individual operations; however, the greater portion of the production was made by the larger companies whose names are given in the table.

LARGE OPERATING COMPANIES IN THE MIAMI DISTRICT

	Mills
Commerce Mining and Royalty Co	8
Eagle-Picher Lead Co	8
Skelton Mining Co	6
Admiralty Zinc Co	6
Golden Rod M. & S. Co	6
The Lucky Companies	5
Bilharz Mining Co	4
Underwriters' Land Co	3
The U. S. Smelting Co	3
St. Louis S. & R. Co	2
Anna Beaver Mining Co	2

The price of the average grades of zinc ore for the year was unsatisfactory to the operators, whose production was based on war-time costs of labor and supplies. The price varied from $40, which was the bottom reached several times during 1918, to $57.50 per ton. Lead, however, was steady during the first six months of 1918, averaging $85 per ton. During the latter six months the price remained at $100 until early in December, when it dropped to $80.

The producers of high-grade zinc ore, which carried less than 0.20% lead, were more fortunate, and, through an agreement with the zinc smelters who make sheets, and with the approval of Washington, enjoyed a price of $75 per ton for the larger part of the year. Many producers were able to make part of their production high-grade, and received a weekly allocation, which helped the average selling price. In other cases, those who were not able to make the high-grade had a good percentage of lead, and were able to get the benefit of the high lead price. In this way they brought up the average selling price for their concentrates.

Reference made to Kansas relates to the new field adjacent to the Oklahoma line, the western end of which is three miles west of Picher. There are now about 15 mills in this vicinity, and, although the field is new, the orebodies already opened up seem to be especially rich and have indications of being extensive.

Farther east, toward Baxter Springs, the Chanute Spelter Co., a subsidiary of the American Metal Co., has a large acreage under lease, and a number of prospecting drills in operation. The finding of a number of extensive orebodies is reported, and one mill is already built, and, when the shafts are completed, will begin operation. Heavy water flows have delayed the work, but three Pomona pumps operating in 16-in. drill holes are now draining the ground.

In pre-war times the cost of mining and milling a ton of rock in the old Joplin-Webb City district was figured roughly at $1. For the last three years this has increased gradually, until there are few companies at present in either the Joplin or the Oklahoma-Kansas field which can produce for less than $2, and the average is probably higher. This has worked a great hardship on the old district, where the recoveries were small, and a number of mills that made the Joplin and Webb City district famous have been moved to Oklahoma, where the orebodies are richer.

As this district reached the producing stage since the beginning of the war, in 1914, one can but forecast its future when conditions become normal. With such demonstrated ore deposits as the district possesses, especially in the deeper levels, where they are very uniform, there can be no doubt, on account of the large mineralized area, that it will continue to be a heavy producer for years.

---

*Manager of mines, Eagle-Picher Lead Co., Picher, Oklahoma.

Quicksilver in Texas in 1918

By W. D. Burcham*

During 1918 quicksilver was produced in Texas by the same properties as in the previous year—the Chisos, Mariposa, and Big Bend mines in the Terlingua district, and the Ellis mine, about 40 miles further east. At this last-named mine the ore is treated in retorts designed by the mine superintendent. The retorts are placed on an incline, the ore moving through by gravity. At the other mines the metal has all been extracted by means of Scott furnaces, ranging in capacity from 10 to 50 tons.

The Mariposa mine, which at one time was one of the largest producers in the country, is unique among the mines of Texas in that practically its entire production has been obtained from the surface. The ore occurs in numerous outcropping fissure veins over a wide area. The present management is mining ores considered too low in grade by the original operators in the days of low prices. Prospecting at depth is being carried on. This mine, at the western end of the district, lies in formations that are 700 ft. deep at the Chisos mine, six miles further east, and supposedly about 1300 ft. deep at the Big Bend and Texas Almaden mines, six miles still further east at Study Butte, which is the eastern end of the district so far as developed.

The Texas Almaden is not producing, but both it and the Big Bend mine are being unwatered by joint operations between the lessees of the Texas Almaden Mining Co. and the Study Butte Mining Co., lessees of the Big

---

*Manager, Study Butte Mining Co., Terlingua, Texas.

Bend. These mines have a 50- and a 20-ton furnace, respectively. The ores occur in a series of fissures filled with calcite and cinnabar, and occasional impregnations in an intrusion of rhyolite. The intrusion is 500 ft. thick; it is flat lying and covered by 50 ft. of limestone shale, except at the southern extremity, where it turns sharply upward, extending 250 ft above the surface and making the Study Butte.

The only active prospect in the district is the property of the Rainbow Mining Co., adjacent to the Chisos mine. The company is sinking a shaft, which is to reach a depth of several hundred feet, before driving a crosscut toward a fault where ore is expected.

Although the price of quicksilver was uniformly high in 1918, on account of the demands caused by war uses, the production of the state fell off to less than two-thirds of the amount produced in 1917. This was due to the fact that quicksilver deposits are erratic, and each foot of stoping area necessitates a greater footage of development than probably any other kind of ore mined. The certainty of the present and the uncertainty of the future have caused the mine owners to concentrate their efforts for the last two years on mining the available ore and leaving much of the development and prospecting until such a time as there would be a reasonable expectancy of future prices that would justify the costs.

The mines of Spain, with ores averaging from 8 to 15% mercury, can produce and deliver quicksilver in New York for $35 per flask. This competition is entirely too severe for the American quicksilver miners, whose ores seldom run over one-half of 1% and whose costs of production amount to about $75 per flask. A conference between the United States Tariff Commission and the producers of quicksilver was held in San Francisco in June. It was the consensus of opinion that an import duty of $35 per flask, in addition to the present *ad valorem*, would be necessary to keep the mines operating after the coming of peace. Although vital in time of war, the industry is so small that there is apprehension that it will be entirely overlooked by the Government, and will therefore die a natural death. With such a duty, there is no doubt that the mines of Texas could produce for a number of years.

The principal peace uses of quicksilver are in the drug trade and in the manufacture of paint and ammunition. In war time it is an essential constituent of the fulminate used in detonators. For this purpose there is no satisfactory substitute, and although all hope and expect that the world has seen its last war, the fact still remains that, if the United States should have a war with a nation that could blockade American ports, the country would be at the mercy of its enemies if American quicksilver mines were closed. It would take a year or more to reopen the mines and do the necessary development for production.

Petroleum in California

The total production of petroleum in California in 1918, according to an estimate by the California State Mining Bureau, amounted to 100,000,000 bbl. This is in excess of the figures for any year except 1914. The total value of the 1918 production was about $123,000,000. Figures in the possession of the bureau show that during the last four years the acreage of proved oil lands has increased 20%, and now amounts to 87,280 acres. The number of producing wells increased in the same period by 10%. It is therefore obvious that a large margin of land remains undrilled. During the last nine years the total market value of oil at the well has amounted to $436,474,667. Dividends paid by producing and marketing concerns totaled $177,046,572.

The total capitalization of all refining and producing oil companies considered, numbering 294, is $292,314,595, and the dividends in 1917 were at the rate of 16.9%. The capitalization of the smaller producing companies is $123,433,008, and the 1917 dividend rate was 6.9%. The added profits attending marketing and refining are therefore considerable. The smaller companies which merely produce oil and sell it in a crude state, at the wells, have paid $48,309,177 in dividends since 1909, which is about 27% of the total dividends. These smaller companies at present produce about 28% of the total oil, and own or control about 35% of the proved acreage.

OWNERSHIP OF OIL LANDS IN CALIFORNIA

Operator	Per Cent of Total Oil	Proved Land Acres	Number of Wells
Associated Oil Co	9.1	7,347	1,048
Doheny (various companies)	7.3	4,286	379
General Petroleum Corp	4.3	2,584	400
Honolulu Cons. Oil Co	1.3	2,701	35
Atchison, Topeka & Santa Fe Ry (oil subsidiaries)	4.0	3,097	412
Shell Co. of California	6.8	2,442	236
Southern Pacific Co. (Fuel Oil Dept.)	8.5	18,267	681
Standard Oil Co	22.6	8,187	771
Union Oil Co. of California	8.1	8,198	427
All others	28.0	30,171	3381
Totals	100.0	87,280	7,770

Although it is true that the large companies are constantly enlarging their holdings by purchase from smaller concerns, there has also been a constant increase in the number of small companies paying dividends. In 1909 there were 65 such companies, and in 1917, 129. The average price of crude oil bears a fairly constant relation to the amounts paid out as dividends. From 1909 until 1917, inclusive, the average value of crude oil was slightly over 55c. per barrel, and the total dividends have averaged about 22c. per bbl. of total production. Prices have fluctuated throughout that period between the limits of 48c. and 91c., but the total dividends have, each year, been at a rate of about 33c. per barrel less than the average market price.

Comparison of the present ownership of proved oil lands in California with that of four years ago still shows that there is no monopoly, although 65% of the lands are held by only nine companies, and 72% of the oil is produced by them. The land ownership and percentage of the total oil production by the larger concerns is shown in the accompanying table.

The Skoda Works—The great Skoda armament works, of Pilsen, in Bohemia, have been the chief prop of the Austrian munition industry throughout the war, although the proprietors are of Czech origin. One of the first acts of the government of the new Bohemian Republic, says the *Ironmonger*, was to call before it Baron Skoda and some of his fellow directors and read the riot act to them. The baron was told that his action had been unpatriotic and that he must immediately come to terms with his Czech workmen. He appears to have promised to do anything that was asked of him, if only his property rights were guaranteed. Whereupon the Czechs told him to dismiss his German employees and to adopt the eight-hour day, raise wages, and introduce other reforms.

Graphite in 1918

DOMESTIC shipments of crystalline graphite of the grades known as No. 1 and No. 2 flake for the first nine months of 1918, according to the U. S. Geological Survey, were 3388 tons, the greater portion coming from Alabama and the remainder from New York and Pennsylvania, although small quantities came form California, Montana, and Texas. Shipment of these grades in 1917 totaled 3408 tons. The demand for domestic flake graphite early in 1918 was slight, owing to large stocks of the imported product and a decrease in the production of crucibles. Prices were lower than in 1917, and No. 1 domestic flake, with a carbon content of 90% or more, sold at 16@17c. per lb., f.o.b. mines, as against 17@19c. in 1917. Toward the latter part of 1918 there was a good demand for No. 1 flake of 85% carbon, which sold at about 15c. per lb. f.o.b. mines. The demand for 90% grade was not so good, but prices ranged up to 20c. per lb. Production of amorphous graphite, which has come principally from Rhode Island, has averaged about 5000 tons for the last three years. According to the Department of Commerce, imports of graphite for the first 10 months of 1918 totaled 18,062 tons and were valued at $2,988,295, and for the same period in 1917 they were 33,831, valued at $7,853,331.

POSITION OF DOMESTIC FLAKE IN CRUCIBLE MANUFACTURE

American consumers of crucible graphite, with one exception, maintain that American flake will not make a good crucible of itself, not having the proper physical formation, and that 25 to 30% of it is all that can be successfully used in mixture with the Ceylon product. The Bureau of Mines has been conducting a series of parallel tests with American and foreign graphites at the Ohio State University laboratories at Columbus, under the direction of R. S. Stull, to determine definitely how a crucible made of 100% American flake will compare with the crucible made from the foreign product.

Following a meeting of graphite producers, consumers, and importers with the Shipping Board at Washington in March, it was decided to stop imports of Ceylon graphite until July 1, after which time shipments would be restricted to 5000 tons for the remainder of the year. However, this allowance was exhausted previous to November, and since then certain importations have been allowed under permit.

ALABAMA GRAPHITE PRODUCTION

According to W. F. Prouty, who will review Alabama graphite in a subsequent issue, 30 plants were in operation in December, 1918. A schedule of prices, suggested by the Graphite Producers' Association, was approved by the Government, although no prices were fixed. These prices ranged from 20c. per lb. for No. 1 flake, containing 90% of carbon, to 10c. per lb. for No. 2, 80% carbon flake. Prices for graphite dust ranged from 1c. for 25@30% carbon to 12c. for 85@90% carbon. The production of flake graphite in Alabama in 1918 was about equal to that of 1917, though that of the lower grades of so-called dust graphite was less. The total production in 1917[1] was 6,223,095 pounds.

Through interviews and correspondence between the Graphite Producers' Association of Alabama and the different war boards, the Alabama producer was urged to develop, expand, and increase graphite production, and, to support this encouragement, an embargo was actually placed on foreign importation, and domestic consumers were ordered to use not less than 20% of domestic flake (which is to be interpreted as also including Canadian flake) in their crucible mixtures. But this did not produce a satisfactory demand for Alabama flake or a price in keeping with increased costs of production, which were from 60 to 65% above those of 1917.

IMPROVEMENT IN ORE-TREATMENT METHODS

There was a marked development in ore-treatment processes in 1918, and this would have been greater under more encouraging market and price conditions. The efforts of the Graphite Producers' Association of Alabama were strongly in the direction of improved methods of milling, with a view to higher recovery and lower costs of production, as well as toward the standardization of product. Experiments leading to several installations have been worked out with the Callow and Minerals Separation systems, as well as with classifiers and tables and the old-fashioned log washers with modifications. A number of new veins were opened in Alabama during 1918, showing, for the most part, good ore.

THREE PRODUCERS IN ADIRONDACK DISTRICT

The New York graphite industry was secondary to that of Alabama in the United States in 1918. According to D. H. Newland, who prepared a paper on New York graphite which appears in this issue, the actual production fell short of 5,000,000 lb., although considerable work was done in the enlargement and improvement of plants. There were three active producers in the Adirondack district, and some work was done by the Flake Graphite Co., near Saratoga Springs. The demand was steady, and good prices prevailed. At the mills there was a substitution of wet tables or dry jigs for the buddles that have been the standard for some time, and flotation was used to some extent, although this latter is only in the experimental stage as regards graphite treatment.

Pennsylvania graphite production in 1918 was active, and amounted to approximately 450 tons, according to the Geologic Survey of Pennsylvania. The deposits in Pennsylvania do not extend over as large an area as those of Alabama, but the rock quarried contains a higher percentage of graphite and the size of the finished flake is larger. The largest deposits are found in the valley of Pickering Creek, Chester County, and the operating companies form two groups, which are designated according to district—Byers or Chester Springs.

NEW MILLING PLANT IN ONTARIO

Ontario refined graphite production in 1918 was 3022 tons, as compared with 3173 tons in 1917. There were three operating companies, according to Thomas W. Gibson, who will review Ontario graphite in a subsequent issue, two concerns, the Black Donald Graphite Co., at Calabogie, and the Globe Graphite Mining and Refining Co., at Fort Elmsley, being old producers, and the Timmins Graphite Co. in North Burgess Township. At the latter, the vein has been stripped for some distance and the company is building a 200-ton mill, which will be placed in operation early in 1919. Flake graphite ranged in price from $140 to $320 per short ton, with little demand, and plumbago sold from $45 to $80 per ton, with an active demand until November.

---

[1] "Mineral Resources of the United States," 1917.

CEYLON INDUSTRY DULL IN 1918

During 1918, the graphite industry in Ceylon experienced a period of stagnation, according to Consul Walter A. Leonard. The chief reason for this was the decrease in the shipments to the United States, which was due not only to the War Trade Board's restriction on imports but to a lessened demand for the imported material. In 1917, the United States took over 81% of Ceylon's product, which amounted to 24,575 tons, with the best grades selling as high as $500 per ton, and in 1918 the amount and the prices were less than half. It is stated that with improved machinery for working at greater depths, Ceylon graphites can be mined at the rate of 30,000 tons a year. Ceylon graphite or plumbago is of the purest quality and is preferred by the crucible makers. According to Charles E. Pettinos, average prices for first quality Ceylon graphite have been as follows: During normal times, before the war, lump, 10c. per lb.; chip, 6c., and dust, 4c.; highest price during the war (which covers the period late in 1916 and early in 1917), lump, 30c.; chip, 22c. and dust 14c. Today lump sells at 18c., chip at 14c., and dust at 11c. per lb., f.o.b., New York. These prices include excess freight charges and war-risk insurance. The three grades of Ceylon graphite (lump, chip, and dust) contain, respectively, 90%, 80%, and 70% carbon content.

The production of flake graphite in Madagascar in 1917 was about 35,000 tons, of which 27,838 tons was exported to England and France, according to Consul James G. Carter. Early in 1918 prices slumped and dropped from about $140 to $96.50 per ton for flake graphite averaging 90% carbon. During the second quarter, importations from Madagascar to France were prohibited, and, later, shipments to the United States were forbidden, but this embargo was raised by the French government on December 28.

Graphite Mining in New York State

BY D. H. NEWLAND*

The Adirondack graphite industry exhibited some progress during 1918, but the district can hardly be compared in that respect with Alabama. The latter experienced a remarkable development under the stimulus of war conditions, and now has outdistanced the older field as a mining center. Operations were maintained throughout 1918 at three New York graphite mines, all of which were active in 1917. These included the American mine at Graphite (one of the holdings of the Joseph Dixon Crucible Co.), the Hooper Brothers' mine at Whitehall, and the mine of the Graphite Products Corporation at Saratoga Springs. Some work was performed by the Flake Graphite Co., the only other enterprise that was equipped for operation, with a mine and mill situated in the town of Greenfield, west of Saratoga Springs. No new projects were under development that may be expected to start production within the current season, although some interest has been shown in a number of other properties, including the Faxon, which adjoins the American mine; the Bly property, west of Ticonderoga, and the Smith prospect, which lies in the extreme northern part of Essex County.

With an estimated production of about 5,000,000 lb. of concentrates, the actual output was somewhat below that figure. Each of the operative companies carried out improvements and enlargements of installation that interfered with the normal running of the plants. Market conditions were practically on the same basis as in 1917, and a steady demand for the output and good prices obtained under the influence of the restrictions put upon importations. It would be difficult to give average figures of sales, as they varied for each mine according to size and purity of the products, in which respect there was some variation also between one shipment and another from the same mine. The mill concentrates comprised three grades, No. 1 flake, with 86-90% carbon; No. 2 flake, of finer size and with about 80% carbon; and dust containing 40-45% carbon. The last grade is practically a waste product for mines not equipped to put products in final finished forms.

In a technical way, the main event of 1918 in respect to the New York graphite industry was with regard to mill treatment—the final discarding of buddles as the one universal apparatus for separation of the graphite. Although the buddles were supplemented at some of the mills by wet tables or dry jigs, they had come to be regarded as indispensable for the bulk treatment of the ore and usually took the whole flow of the mill. Flotation was adopted as a substitute, but just how successful this process proved I am unable to state, as sufficient work has not been done as yet to afford the basis for an accurate estimate. There seems to be confidence among the operators that flotation represents an advance over the buddle in saving more of the graphite for the higher grades and in costs of operation. The loss of about 50% of the carbon content either in the tails or in the dust has been the usual experience of mills working on the Adirondack hard ores. There is thus much room for improvement.

A bulletin prepared by Harold L. Alling, and just issued by the State Geologist's office, gives a full account of the Adirondack deposits, with information as to the nature and tenor of the ores and other details of interest from the operating standpoint. It is not entirely apparent why the region should not have shared more fully in the recent expansion of the American industry, although the Alabama ores, no doubt, are easier to mine and to crush. On the other hand, the Adirondack rock carries 1 or 2% more graphite on the average and produces a cleaner, brighter flake. The general average of the mined rock is about 5%, as compared with 3%, estimated[1] for the Alabama ores.

Chief Consolidated Mining Co.—The earnings for the third quarter of 1918 show a reduction from the previous quarter, resulting from lowering in grade of the ore shipped and higher smelting and mining costs. Development costs were increased largely, owing to the sinking of a new shaft and exploration by diamond drilling. A dividend of 12½c. per share was paid on Nov. 1, 1918.

---

*Assistant state geologist, Albany, New York.

[1] B. L. Miller, Vol. 21, *Mineral Industry*.

Manganese Ore in East Tennessee

By Henry V. Maxwell*

As pointed out by the U. S. Geological Survey, and as evidenced by recent development, manganese exists in Tennessee on three distinct ranges, in a belt approximately 25 miles wide, and extending almost from Georgia to the Virginia line paralleling and a short distance to the west of the Ozark Mountains.

Production from East Tennessee has, until recently, amounted to only a trifling tonnage of manganese ore. This is due to rather low manganese and relatively high phosphorus content. Though known to exist for a long time, the deposits had been lying idle until war demands and high prices suddenly stimulated search and production, which became particularly active in the three eastern counties, Unicoi, Carter, and Johnson. A number of washing plants have been erected, and production, though relatively small, continued to increase until the armistice was signed.

The Southern Manganese Corporation, with electric-smelting furnaces at Anniston, Ala., is the largest operator, having had seven producing mines in the district. In March this company started work on its No. 1, No. 2 and No. 3 mines in Scotia Valley, Unicoi County, and built a fairly complete treatment plant for its No. 1 and No. 2 mines, the plant being provided with log washers, grizzlies, trommels, picking belt, and Harz jigs. No production was made until October, when 140 tons was shipped to Anniston. Here, as generally throughout the district, the manganese lies upon limestone beneath a decomposed quartzite, which is scraped off so that the ore may be removed from open pits.

Northward, at a distance of about four miles, on the northern slope of Little Mountain, in Carter County, the Max Mining Co., of Braemer, Tenn., has done some development on the Patton and Winters land. Here the ore, in the form of small grains to lumps weighing as much as 400 lb., is mixed with clay. It is estimated that there is about 15% of high-grade ore in the clay bed, which is approximately 40 ft. thick somewhat below the surface. The lateral extent of this bed has not yet been determined. Ore was followed on the surface for about a mile from the Patten development to the Winters mine, where a pit was sunk through 10 ft. of ore. A 30-ft. log washer was installed here, and a shipment of two cars made, the analyses of which have not yet been received. Two additional washers were purchased by the Max company, but were not installed before the market for ore ceased to exist.

At Valley Forge, five miles beyond the Max, A. D. Reynolds has installed four log washers and has shipped five cars of ore to the Bethlehem plant. The shipment ran over 40% manganese. On Pond Mountain, I installed a one-log washer and shipped 11 cars of ore. At Blue Springs, Carter County, W. S. Douglas built a two-log washer, and has shipped two cars of ore. At Butler, A. H. McQueen has mined and shipped between 25 and 30 cars of ore.

In the Mountain City district the Southern Corporation installed a two-log washer at the Doe Valley mine and shipped 360 tons of ore carrying 22 to 52% manganese concentrated from ore carrying about 6% of manganese. The same company has shipped 550 tons of ore from Taylors Valley, where it has had about 100 men at work. It has also shipped 550 tons from Shady Valley, where there had been installed a complete washing plant with a capacity of 35 tons per day. From the Neeley the corporation has shipped 63 tons of high-grade ore without washing.

The following table gives a summary of the shipments from the Eastern Tennessee district made during 1918, all of which was in the form of washed concentrates excepting that from the Neeley mine, which was hand-sorted ore.

EASTERN TENNESSEE MANGANESE SHIPMENTS, 1918

Locality	Shipment	Per Cent. Mn	Per Cent Fe	Per Cent. SiO_2	Per Cent. P
Scotia Valley...	140 tons	26.0	20.0	13.0	0.15
Winters Mine......	2 cars	.....	.....	.....	.....
Winters Mine boulders............	......	58.59	0.55	4.35	0.14
Valley Forge.....	5 cars	40.0	.....	.....	.....
Pond Mountain..	2 cars	47.83	7.97	4.50	.....
Pond Mountain..	9 cars	46.76	11.96	4.63	0.22
Blue Springs..	2 cars	45.0	.....	.....	.....
Butler.......	28 cars	45.0	.....	.....	.....
Doe Valley....	360 tons	22 to 52	2 to 14	2 to 25	.....
Taylors Valley..	550 tons	25 to 45	2 to 5	18 to 30	0.15
Shady Valley....	550 tons	25 to 46	6 to 12	6 to 15	0.20
Neeley Mine.......	63 tona	49.0	.....	.....	.....

Vanadium in 1918

The domestic production of vanadium previous to the war, compared with that of 1918, varied only a few tons, but the demand for ferrovanadium increased considerably. The greater part of the world's supply of vanadium comes from Peru. Colorado is the second largest producer. The annual importation of vanadium ore from Peru is approximately 3500 tons, which could be considerably increased but for lack of shipping facilities.

The chief producers of ferrovanadium are the American Vanadium Co., the Electro-Metallurgical Co., the Goldschmidt Thermit Co., and the Standard Chemical Co. Ferrovanadium contains from 30 to 35% of vanadium, and is made by reducing vanadium oxide with iron in a crucible by means of carbon. The prevailing price for ferrovanadium in 1917 was $3 per lb. of vanadium content, and during 1918 the price was $7.50. Vanadic acid, c.p., in 1918, sold for $11 per lb., and that containing but 85% V_2O_6 was only $1.20 per lb. The price of ammonium meta vanadate was $7.50 per lb., and the ferrovanadium containing 25% oxide was 90c. per lb., according to the quotations of the Foote Mineral Company.

During the last two years there was an increased development of vanadium deposits of Arizona and New Mexico. A new 50-ton mill was built by the United States Vanadium Development Co. at Kelvin, Ariz., to use the Bryan process of concentration. The American Vanadium Co. and the other Colorado producers operated their plants to the fullest capacity up to the signing of the armistice, when the market demand ceased, and they now have a large stock of material on hand.

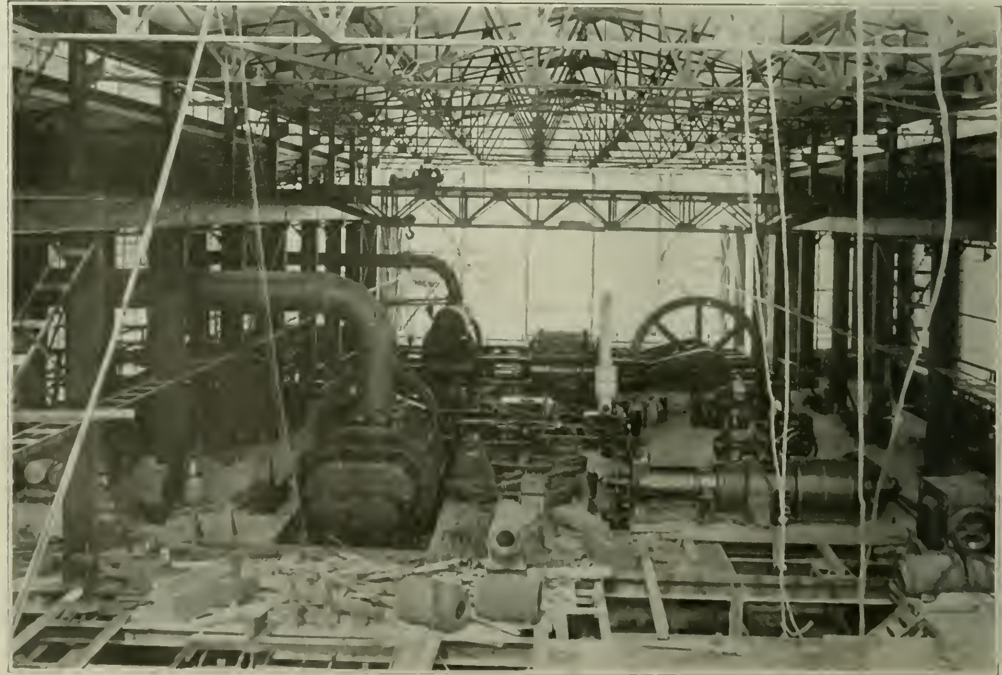
Vanadium acts as a cleanser and deoxidizer of molten steel, and a small percentage increases its tensile strength and toughness. The alloy with iron is used for high-speed tools and similar purposes, as the vanadium content increases the hardness of the cutting edges of the tools. Where used with chromium, in steel, it produces great resistance to repeated shock, making it especially suitable for steel springs, locomotive tires, and for military purposes where great resistance to shock is required.

---

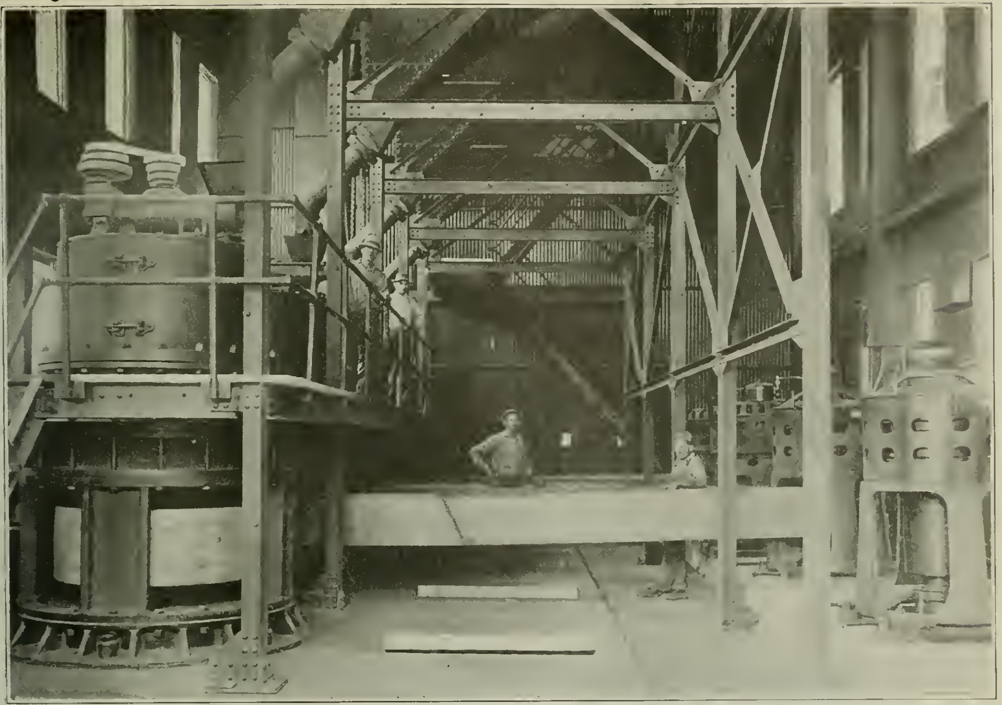
*Hampton, Tenn.

United Verde Extension Smeltery

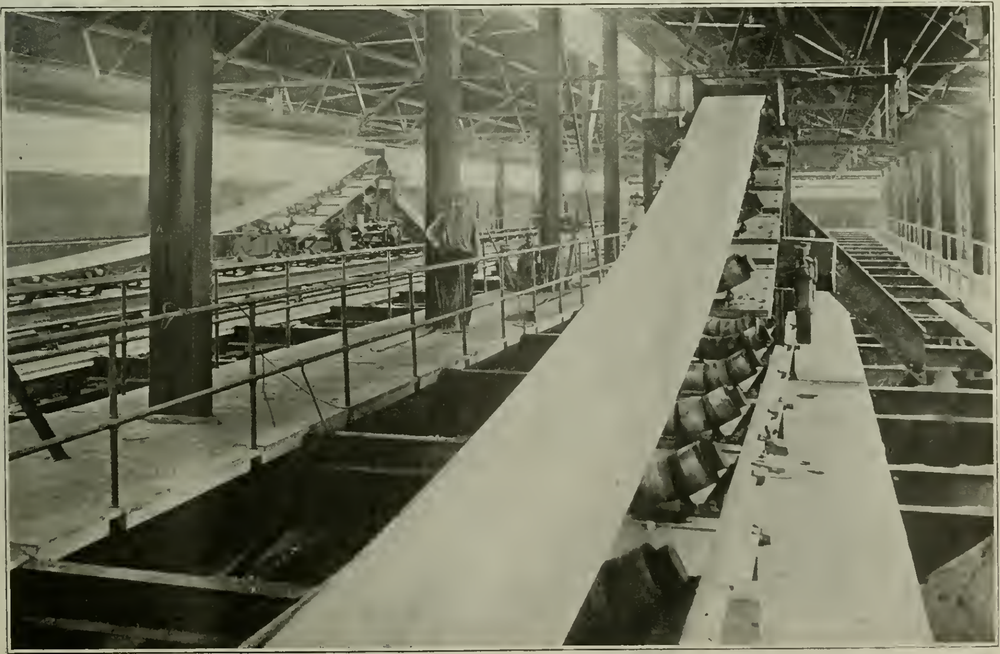
GENERAL VIEW FROM THE WEST OF UNITED VERDE EXTENSION SMELTERY AND CONVERTER PLANT



INTERIOR OF POWER HOUSE AT UNITED VERDE EXTENSION PLANT DURING CONSTRUCTION



BALL PULVERIZING MILLS IN COAL CRUSHING PLANT AT UNITED VERDE EXTENSION SMELTERY



BEDDING BIN CONVEYORS AT UNITED VERDE EXTENSION SMELTERY, CLARKDALE, ARIZONA

Mining in Colorado in 1918

BY GEORGE E. COLLINS*

THE last year of the war was probably the most disastrous which the mining industry of Colorado, as a whole, ever experienced. It seems certain that the artificial restrictions on prices, the increased wage scale and freight rates, and other economic conditions resulting from the war, bore more hardly on the small producers everywhere than on the larger ones, and Colorado is typically a district of small mines. But why small producers should have been more unfavorably affected in Colorado than elsewhere is not so easy to explain. In my opinion, the principal reasons were the following:

1. The majority of Colorado mines have for years been operating on an unduly narrow margin, which disappeared entirely in the face of unfavorable conditions.

2. The deposits being mostly fissure veins, or other ore occurrences of relatively small size and irregular distribution, increased cost of labor and explosives tended to raise operating costs to a greater degree than in other Rocky Mountain states.

3. The industry depends essentially on cheap smelting and freight rates, which are, in effect, a first charge on the proceeds. By the increase in these, a great quantity of low-grade ore became unprofitable, and much high-grade ore, which occurs as bunches together with the low-grade, was left unworked in consequence.

4. As to Colorado zinc ores, notwithstanding that the price of spelter remained high, the proportion of the spelter value paid to the producer of zinc ores and concentrates was less, so that the base price on which the miner was actually paid was no higher than before the war, though the average cost of mining increased more than 50%. Moreover, most Colorado zinc ores contain "residue" values in silver, gold, lead, or copper. Not only had these to bear the higher freight rate to the smelteries, in Oklahoma or Kansas, but the "residues" were saddled with a correspondingly higher freight rate back to Colorado, and the metals produced from them with an increased freight rate to the East. All these increases were borne by the miner, who therefore experienced the full benefit of Federal railroad operation.

5. In many of the more isolated districts, efficient labor was absolutely unobtainable. In no district did the cost of labor bear any relation to the wage paid, and at many properties there was an observable tendency for the efficiency of labor to lessen as the rate of wage increased. The special type of labor which was once the mainstay of Colorado mining is fast dying out, and owing to the high altitude and to the isolated character of most of the mines, the state is at a disadvantage when competing with other districts for its share of labor, when the total supply is insufficient.

CAR-LOADING REGULATIONS ILL-ADVISED

6. Ill-considered regulations for maximum loading of cars, and enforcement of prohibitive demurrage penalties for delays, which cannot be avoided by small, irregular producers in snowy, isolated districts, compelled many such to go out of business. These regulations were not only inapplicable to local conditions, but, as Colorado narrow-gage roads have a surplus of equipment which cannot be used on standard-gage tracks elsewhere, were entirely unnecessary. Later in the year, it was realized that the regulations were driving the small mines out of business, and the rules were tacitly relaxed, but the harm had already been done.

To illustrate the absurdity of these regulations, I will state that on one narrow-gage road the marked capacity is 25 tons, and 10% overload is permitted. If cars proved to be loaded with even a couple of hundred pounds less than the maximum permissible, including overload, letters would be sent out from the Federal Administration demanding an explanation; though, if the overload exceeded the maximum by an equal amount, another branch of the same administration would threaten dire penalties. There are no track scales in the district on which ore could be weighed, and much of the equipment will not stand loading to nominal capacity without breaking down.

7. The unwise and grossly unjust provisions of the Excess-Profits Act, which, as applied to leasing and prospecting, where one may expect only an occasional success to recoup the losses incurred in many failures, result practically in taking the lion's share of any profit, though not allowing for losses, discouraged this kind of mining, which was previously carried on extensively. It is not so much that the amounts actually collected were large, for in most cases there were no profits, excess or otherwise, as it was that enterprise was discouraged.

MANY PROPERTIES IN BAD FINANCIAL CONDITION

Whether or not I have correctly indicated the causes of the critical situation of Colorado mining, the fact is beyond question. The output, particularly of gold, fell off most seriously; that of base metals was largely unprofitable; and many properties which, two or three years ago, were generally regarded as permanent and financially solid, were on the verge of bankruptcy at the end of the year. Worst of all, a large proportion of the smaller mines and prospects went out of existence altogether.

Most of these conditions were foreseen and their effect was predicted. However, in the face of the extraordinary ineptitude or lack of concern shown by the various authorities to whom was intrusted the responsibility of guiding producing industries through the war period, warnings were useless, and it is poor consolation to be able to say afterward, "I told you so."

During the last three months of 1918 the influenza epidemic proved a most serious hindrance. The mortality from pneumonia is always much increased at high altitudes, and this, together with the scarcity of competent physicians and nurses, owing to so many of the more active and efficient having entered military service, resulted in a high death rate. At Silverton and Creede, the mortality for a short time was appalling. In many cases a strict quarantine, though a great burden on industry, was decidedly effective. At the time of writing, it seems that quarantine is of doubtful

---

*Mining engineer, Boston Bldg., Denver, Colorado.

benefit in the long run, for sooner or later the disease slips through, and the resulting epidemic, finding virgin soil, is just as severe as it was during its first outbreak elsewhere. The most efficient safeguard so far seems to be inoculation, which reduces both the percentage of cases and the severity of the disease.

The outlook for the immediate future, in my opinion, is discouraging. No revival of gold mining can be hoped for until either the cost of supplies and labor (the latter measured in terms of work accomplished) falls to at least pre-war figures, or the value of gold is adjusted, directly or indirectly, to correspond with the costs. Even then, the losses which the industry has suffered during the last two years are so serious that it will take a long time to respond to any stimulus.

GOLD AND ZINC MINING PROFITABLE IN FEW CASES

The situation as regards zinc is no more encouraging. For gold and zinc alike, profitable production under present conditions is possible only for a few exceptionally rich mines.

For lead producers a price around $7 should be sufficient; but, unfortunately, it seems that the state does not now contain many deposits which can produce lead profitably except at high prices. It is still true that Colorado has no copper mine of importance, although both at Red Mountain and in Gunnison County there are fair chances of developing copper mines.

As to silver, it is evident that no increased production can be expected until the increase in price is more than equivalent to the increase in mining costs. Dollar silver, with present costs, is unprofitable in Colorado, being merely the equivalent of 60-cent silver before the war. To stimulate silver production in the state, either the price must go up or the costs come down. I personally look for the latter in the near future. The improvement is to be expected, first of all, in increased efficiency of labor. Some evidence of this showed itself during December.

IMPORTANT DISTRICTS REVIEWED

I will now mention the more important districts in the state separately:

At Leadville, the closing down of the Leadville Unit operation of the United States company, which was started to unwater and develop in depth the Fryer Hill district, was a great blow. No ore was found on the "lower contact," as anticipated. The Iron Silver company closed its Moyer and Tucson properties, but continued its operation at the Mikado. Control of the Yak Tunnel enterprise was acquired by the American Smelting and Refining Co. The Down-Town Mines Co. extracted a large tonnage of ore through the Penrose shaft. The Greenback mine was operated for pyrite ore by the Western Chemical Co., of Denver. Considerable low-grade manganese ore was mined and shipped, but unfavorable market conditions reduced the production during the second half of 1918.

The Cripple Creek district, which produces nothing but gold, inevitably suffered as a result of labor scarcity and high costs, and the output fell off seriously. The Cresson continued to realize large profits, for the ore is rich enough to stand increased costs. But the other mines made little profit, and some closed down altogether. In the early summer, the Portland company closed down its mill at Colorado Springs, and, later, its Portland mill, above Victor, much of the equipment being used in enlarging the Independence mill. Such high-grade ore as was still being mined at the end of 1918, principally by lessees, was shipped to the Golden Cycle plant at Colorado Springs, which now affords the only outlet for the high-grade milling ores of the district. It is not, however, being supplied at anything like full capacity.

It was reported that ore of good grade was cut in the branch from the Roosevelt Tunnel, which is being driven to connect with the Portland No. 2 shaft, and also in the lower levels of the Vindicator. However, though it is probable that high-grade ore will be found at depth thoughout the district, no large bodies were discovered.

TELLURIDE ACTIVE AND PROSPEROUS

Of the various camps in the San Juan district, Telluride was by far the most active in 1918. In fact, it is now the only really prosperous mining town in the state. The Liberty Bell realized a fairly large profit, and was able to overcome the effect of the increased wage scale by adopting the contract system of mining. The Tomboy made fair profits, but had to draw on its reserves of broken ore. The Smuggler Union probably did little better than break even.

Owing to scarcity of labor, due to the influenza situation, the new operation of the Tonopah Belmont company in Alta Basin was closed down for the winter.

At Ouray, the Camp Bird deep-level tunnel intersected the vein early in the summer, but did not open up ore of commercial grade in quantity. Work is at present suspended, owing to a serious outbreak of influenza. The other mines in the district found it difficult to make both ends meet in the face of advancing costs, notwithstanding the increase in the price of silver.

At Silverton, the Sunnyside dominated the situation, and, by a successful application of differential flotation to its large bodies of low-grade complex ore, will probably achieve a success which may point the way to the successful operation of other mines of similar character. This mine was, however, greatly hampered by shortage of labor, which was not lessened by an ill-advised wage increase during the autumn, the only effect of which was to compel other mines and districts throughout the state to meet the advance, without in the least improving the supply of labor.

The production of the San Juan district was held back somewhat by conditions at the Durango plant of the American Smelting and Refining Co., which limited the tonnage that could be purchased, but most of all by labor scarcity and inefficiency. If it were possible to remove these hindrances, the output could certainly be increased.

At Creede, the American Smelting and Refining Co. undertook to reopen some of the principal mines along the Amethyst vein below the tunnel level. Interest was stimulated by the discovery by a leasing company of a large body of silver ore of shipping grade in the Monon, a property which had been unworked for years.

At Aspen, production was retarded by scarcity of labor, and for this reason the high prices of lead and silver did not result in increased enterprise, or in greater prosperity to the operating mines. The heavy fixed expenses for pumping and maintenance, with a lessened output, increased costs in proportion.

Rico suffered because of the virtual exhaustion of the copper orebodies of the Rico-Wellington mine, which was the principal shipper of the district a few years ago. The possibilities of silver production from this district are still considerable, but there is no probability of increased output in the immediate future.

Dredging Profitable Around Breckenridge

The gold dredges in the Breckenridge district were able to operate successfully in 1918, largely because this kind of mining depends more on cheap power than on labor. The Wellington mine also continued large and profitable production, but its output was considerably reduced by the prevailing labor conditions. Other probable zinc producers in this district were being developed at the year's end.

In outlying districts, such as Montezuma and the Gunnison County camps not near the railway, it was almost impossible to operate, miners being practically unobtainable; and conditions were nearly as bad in Park County.

Central City and Idaho Springs, with a more permanent and settled mining population, were able to keep some mines in operation, without competing with the extravagant wage scales current elsewhere. But both districts, especially the former, were short of men, and few, if any, mines in either district were able to meet expenses. Around Georgetown, work was resumed on several of the older properties, but without notably successful results as yet.

In Boulder County there was some increase of work in the silver-bearing properties, but in the tungsten field activity was greatly reduced, pending decision as to tariff protection. At the time of writing there seems to be no market for tungsten concentrates, and unless this condition improves in the immediate future most of the mines will close down.

The mines producing the rarer metals, such as tungsten, molybdenum and vanadium, were all affected by the uncertainty as to future demand and price. The Climax company and the Urad mine of the Primos Chemical Co. are in a position to maintain indefinitely a large production of molybdenite if market conditions warrant it.

As a whole, it may be stated that the problems of readjustment to pre-war conditions present features of exceptional difficulty in Colorado.

Mexico—Our Balkan Problem

It is growing increasingly evident that something must be done about Mexico. The tone of the press comment of the country is that it is a disagreeable task that has been held in abeyance, but must eventually be attended to, and attended to right, unless we want to have an army prepared for periodic junkets to the Rio Grande similar to the one that preceded by a few months our entrance into the Great War.

Going on the supposition that no news is good news, the country had begun to hope that Mexico, under Carranza, had become pacific and friendly, though the Zimmerman note and the Provisional President's birthday greeting to the Kaiser left a disagreeable memory. But the censorship appears to have slipped a couple of times of late, and news has become public of clashes on the border and an attack on an American naval guard in Vera Cruz. There is a suspicion that there have been other troubles that were kept quiet while our affair in Europe was being disposed of, and that the news of these clashes was finally let slip premeditatedly to prepare the country for the revelation that there is still a problem to be solved in our sister republic. As Colonel Roosevelt so aptly phrased it, "Mexico is our Balkan problem."

There would be much trouble and little glory in pacifying Mexico and establishing a stable government there, but it begins to look like our job, unless we can turn it over to the League of Nations for it to cut its teeth on.—New York *Tribune*.

There is nothing like a specific instance to illuminate a general theorem. Mexico, in the opinion of numerous Americans, is making war on the United States. It is a covert war, a war without a declaration or a trench line; but, in the estimation of its victims, at least, it is a war of spoliation hardly inferior in essential flagrancy, though of less sensational semblance, to the lootings by Germany in Belgium and northern France. Beyond question it is being waged by the Mexican government and not by irresponsible individuals.

Now, the interesting question that occurs to us is: What if the League of Nations be constituted as contemplated by President Wilson and, possibly, one or more European statesmen—what would be the effect upon the Mexican situation? Would the Government and people of the United States of America retain the right to demand and enforce redress of grievances against the Mexican government? Or would the League of Nations examine and adjudicate our claims?

Assuming that the decision were against Mexico, would the League make the United States its mandatory to enforce the decree? Or would it send a French or British or Brazilian or Japanese army into Mexico to enforce it? Or would it attempt to coerce Mexico by international boycott? Or, if the decision were against the United States, would the League compel the American people to accept cordially what they regarded as a wrong and to take the people inflicting the same to their hearts in mutual trade and in international social intercourse? If so, how would the compulsion be effected? With the armies and navies or by universal boycott?—New York *Sun*.

Bulletin on Mining Statutes Ready

The U. S. Bureau of Mines has issued the first of a series of bulletins containing the mining statutes of different states. This is Bulletin 161, entitled "California Mining Statutes Annotated," by J. W. Thompson. The purpose of the bulletin is to point out the laws and regulations best adapted to increase safety and efficiency in the mineral industry and to aid legislative bodies in framing uniform mining laws. The Bureau will follow this pamphlet with others that will contain complete collections of the mining statutes of the several states. This bulletin is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., for 20 cents.

Should the Government Own the Telegraphs?*

By CLARENCE H. MACKAY†

AN ARTICLE by the Postmaster General, Mr. Burleson, in the *American Review of Reviews* for December, 1918, strongly advocating Government ownership and operation of telegraphs, in accordance with his recommendation in his annual reports in the past as Postmaster General, raises the question very sharply, now that the Postmaster General has actually seized the telegraph lines under the war power of the Government, even though he has to return them when the treaty of peace is signed. Mr. Burleson's argument is cheapness of rates; any deficit to be paid by taxation. Is that argument sound?

USE OF TELEGRAPH LIMITED

The telegraph differs from every other public utility, in that the telegraph is not used by the great majority of people. Farmers use it very rarely. The laboring classes use it little, if at all. The clerical classes have little occasion to use it, and even the social use of the telegraph is negligible. One of the great telegraph companies states that only 3 or 4% of its entire telegraph business is from these classes. Over 70% of the entire telegraph business of the United States originates in 40 cities, these being the largest commercial cities of the country, the population of which represents 20% of the total population of the country. The fact is that the telegraph is a commercial agent, almost exclusively, and its expense is a part of the cost of the business of the banker, broker, manufacturing, and mercantile classes. Hence any attempt to give them cheap telegraph service at the expense of the taxpayer is unfair and discriminatory.

The sites of post offices are selected with a view to serving the whole population of each city, town, and locality, and in most cases are not so located as to serve that part of the public that uses the telegraph in its business; and Mr. Burleson's idea, that the public must come to the post office to transact telegraph business, no matter where the offices are situated, will not appeal to those who in the rush hours of the day must conserve their time and the time of their employees.

The banker, broker, manufacturer, or merchant wishes quick and accurate telegraph service, and does not want slow telegraph service or inaccurate service. He is willing to pay a fair price for his telegrams, and he considers the present telegraph rates as fair. He does not wish or expect to get cheap telegraph service at the expense of speed and accuracy, and especially so to get this cheap service at the expense of the taxpayer. He is not interested in this movement for Government ownership and operation. Neither is the taxpayer in its favor; nor are the great mass of people, who do not use the telegraph at all, and would not use it even if the charges were less. Hence I see no occasion for the Government interfering with the present competitive system.

In Europe the governments own and operate the telegraph systems, but instead of their telegraph rates being cheaper than the American rates, they are higher, to say nothing of the well-known inefficiency of the telegraph service throughout Europe. I have yet to learn of a business man who has traveled abroad and who does not hold this view. Telegraph rates in the United States are the cheapest in the world. This is not generally understood, because the published rate abroad seems cheap until one ascertains that every word in the address, signature, and in matter extraneous to the message proper, is charged for, as well as every word in the body of the message. In the United States only the words in the body of the message are charged for. Now, in the United States there are 14 words on the average in the address, signature and direction matter, in a telegram, in addition to the words in the body of the message. The following gives the comparative toll on telegrams of 10 text words: France, 29c.; Norway, 29c.; Sweden, 25c.; Great Britain, 30c.; Germany, 30c.; Italy, 29c.; Denmark, 30c.; Austria, 29c.; United States, 25 to 30 cents.

The above rate at 25 or 30c. for telegrams in the United States is between two points in the same state, the distance being about the same as between two points in any foreign country. When we come to telegrams in the United States for longer distances, the only comparison that can be made with European rates is telegrams in Europe between different countries, on account of the long distances traveled by the average long-distance telegram in the United States. For instance, from Paris to Vienna is about 650 miles, and the cost for a 10-word message, plus the address and signature charged for, is 96c., as against only 40c., address and signature free, for a similar distance in the United States. From Stockholm to Paris (1000 miles) the rate for a 10-word message, plus the address and signature charged for, is $1.20. From New York to Chicago, about the same distance, the rate for a 10-word message, address and signature free, is 50 cents.

CONVENIENCES DENIED IN EUROPE

In addition to the above there are other advantages of the American system. The American telegraph companies send messengers to collect and deliver telegrams and maintain call-box systems. The American companies keep open accounts for their customers and keep offices in hotels, apartment houses, and competitive offices in all parts of large cities. The European governments do nothing of this kind. There the telegram must be taken to the telegraph office; the sender cannot run up an account; he must prepay the charge, and may have to go a long distance before finding a main or branch office.

American business supremacy is based upon the dispatch and facility with which things are accomplished. The American business man will never consent to the substitution of European methods of handling telegraph correspondence as now proposed by the American Postmaster General. Here, the business man prepares a batch of telegrams and cablegrams, rings for a company's messenger by means of a convenient call box installed free of charge by the company, and dismisses

---

*From the New York *Times* of Dec. 22, 1918.
†President of the Postal Telegraph-Cable Company.

them from his mind. Competition insures their prompt transmission under a charge account. In Europe the business man must first reckon the cost of his messages, and send one of his employees to a post office with them or go himself. The postal clerk calculates the charge—when he finds time; one must purchase stamps and affix them, hand messages back to the postal clerk and trust to Providence that they will reach their destination in an intelligible manner. Complaints are met with a shrug of the shoulders.

CHEAPER RATES WOULD NOT INCREASE USE

Mr. Burleson thinks that cheap telegrams would increase their use by the great mass of the people. He gives no reason for thinking so. Nobody uses the telegraphs for transmitting communications unless those communications are more or less urgent, and a cheap telegraph service would not appeal to the great mass of people, because their communications are not of an urgent nature. They probably would not use the telegraphs to any greater extent at the 15c. rate than they do now at the 25c. rate. The telephone has displaced the local use of the telegraph; in other words, has displaced telegrams between towns not far distant.

The telegraph, in the course of trade, and by the competition of the telephone, has become more or less restricted to the use of the banker, broker, manufacturer, and merchant in carrying on commercial transactions, and they do not want the telegraph service injured by cheapness, slowness, or inaccuracy. The great mass of the public are not interested at all in the subject, excepting, of course, that they do not wish to have their taxes increased. Is the taxpayer to be ignored?

BRITISH GOVERNMENT'S FINANCIAL LOSS

In Great Britain about 40 years ago the British government bought the telegraphs and paid about $50,000,000 for them. For two years, namely, 1870 to 1871, the government made a small profit after charging interest on the debentures issued for the purchase, but since that time there has been an annual deficit after providing interest. In a speech in the House of Commons on Apr. 30, 1914, Postmaster General Hobhouse, of Great Britain, said that within the last 40 years the telegraph expenditure of the British government exceeded the telegraph receipts by $110,000,000, not including interest on the original purchase money nor interest on the annual losses, nor any provision for amortization. If these were included the loss would have been $200,000,000.

OVERHEAD CHARGES NEGLIGIBLE QUANTITY

Mr. Burleson states that at present the public pays overhead charges of the two telegraph companies, and also dividends on their capital stock. As to the dividends, they are reasonable, and the Government would have to pay the interest on the purchase price, and this would be a substitute for dividends. As to the overhead charges, the question at once rises whether the overhead charges of the two companies would compare for an instant with the increased operating expense if the Government should undertake the operation. The so-called overhead expense referred to by Mr. Burleson is the expense of supervision over the operations of a telegraph company, and this expense in the case of one of the largest telegraph companies is only about 2% of its receipts. Competent supervision by experienced managers whose salaries go to make up the overhead expense is more than offset by the economies effected by them in the cost of handling the traffic. No one who is familiar with the results of Government operation of anything will doubt for a moment that the overhead charges of the present two telegraph companies would be a drop of water as compared with the flood of increased operating expense if the Government ever acquired and operated the telegraph lines.

Furthermore, it is a well-known fact that the lines of the two telegraph companies are filled to capacity during the business hours of the day, and that the trunk lines are well occupied during the night, so that this disposes of any question of duplication of facilities.

After all, the main question is whether competition in telegraph service is wanted or not. Government ownership and operation means a monopoly. Continuation of the present two telegraph companies means competition. Competition means keen rivalry in service. It means efficiency. It means constant improvement of equipment. It means a greater desire to please, and more courteous treatment to the public.

If the American people prefer to take the chances of insufficient Government telegraph service, and the chances of getting a lower telegraph rate to be made up largely by taxation, and to take the chances of the telegraph systems being turned into a political machine for the benefit of the party which may happen to be in power, then Government ownership and operation of telegraphs will come. If, on the other hand, the public comes to realize that the telegraph service differs from every other kind of public utility, in that telegraph service is a commercial instrument practically for commerce alone, and is not used, and would not be used even under Government ownership, by the great mass of the people, and that any reduction in telegraph rates would be followed by taxation to make up the deficiency, and that the telegraph systems would certainly become political machines, and that the service itself would inevitably deteriorate in speed and accuracy under Government management, then there is little probability of Mr. Burleson's idea being adopted by the American people.

DANGERS OF POLITICAL CONTROL

The American public is keenly suspicious of political influences controlling the wires for partisan purposes, and one of the most disastrous things that could threaten our free institutions, and which would aim at the very foundations of the Government itself, would be to allow the channels of communication, whether telegraph, telephone, or cable, to be brought under political control. Without a free telegraph you cannot have a free press, because the telegraph is the feeder of the press. Any proposal, therefore, that the Government take over the telegraphs might just as well embody a proposal to have the press controlled by the Government.

Where there are two separate and distinct companies, with absolutely no union of interest, fiercely competing for the telegraph business of the country, this danger of political control is removed, a condition far superior and far more desirable, from the standpoint of the national welfare, than a Government-owned telegraph system under the domination of a political administration.

Engineers Honor Herbert C. Hoover*

ALMOST coincident with the news that Herbert C. Hoover has assumed the direction of the distribution of food supplies to the neutral and enemy people of Europe, comes the announcement that American engineers have recognized the services rendered to humanity by their fellow engineer by making him the first recipient of the Washington Award.

Two years ago, John W. Alvord, of Chicago, made a gift to the Western Society of Engineers to establish a prize which is to be given annually to some engineer, "on account of accomplishments which have preëminently promoted the happiness, comfort, and wellbeing of humanity." "Almost all engineers serve the public directly or indirectly," said Mr. Alvord, "and it is one of the most important duties of engineering societies to point out to their membership and to the public such instances of engineering and administrative skill as seem to have unusual merit, in order that honor may be properly accorded where it is due." The award of this prize is made by a board of 17 engineers, of whom nine are chosen by the Western Society of Engineers and two by each of the four national societies.

In the whole history of engineering one will search in vain to find a man who has rendered a greater service than has Herbert C. Hoover. The story of how he organized the work of feeding the millions of people in Belgium and Northern France during the early years of the war is fresh in the memory of everyone. The marvelous efficiency with which he carried out this great trust led President Wilson, when the United States entered the war, to select Mr. Hoover to head the great work of organizing food production and food conservation in the United States.

Now comes a task far surpassing in magnitude and difficulty either of these. Substantially all Eastern Europe beyond the former German and Austrian battle lines is in peril of starvation. The work of husbanding the supplies these people already possess, and supplementing them with what can be brought overseas from the Americas, Asia, and Australia, is one of the most difficult tasks ever undertaken; yet all agree that upon its accomplishment depends the chance of checking the flood of Bolshevism and anarchy now rolling westward.

Mr. Hoover has been in Europe for several weeks coöperating with the officials of the Allied nations in an investigation of European food supplies and needs. On Jan. 3 it was announced at Paris that the Allied governments had requested the United States to take a predominating part in the organization of relief measures in all enemy and neutral countries, and that President Wilson had named Mr. Hoover to be director-general of the international commission which is to carry on this important work.

The countries liberated from the dominion of the Central Powers contain probably 125,000,000 persons, and the populations of Germany, Austria, Bulgaria, and Turkey doubtless make a total of more than 250,000,000, with whose food necessities this commission will have to deal.

At this time, when it is being rightly insisted that larger responsibilities should be given to the engineer in dealing with broad questions of public welfare, it is well for the profession to emphasize its appreciation of Mr. Hoover's great work. It should make the fact more widely known that he is an engineer, and one who had by his technical ability risen to the highest position among his professional brethren before he became an international figure.

The story has been told—but will bear retelling—of Mr. Hoover's notable career. He was born on an Iowa farm, worked his way through Leland Stanford University, graduating with high honors in 1895. He then followed his profession of a mining engineer, first in New Mexico and California and then in West Australia. In 1898 he was made chief engineer of the Chinese government's Bureau of Mines, but the Boxer rebellion of 1900 put an end to this work. He helped to organize the defense of Tientsin, and when the rebellion was over he found work for a few months in rebuilding Chinese railways and harbor works.

In 1901 he went to London, and, as a partner in the firm of Bewick, Moreing & Co., became a prominent figure in the organization of mining industry, first in Western Australia and later in other parts of the Orient. That it was his technical knowledge as well as his abilities as an executive and a financier which won him advancement is attested by the engineering treatises which he found time to write, the most important of which was "Principles of Mining," published in 1908, and which is a standard textbook on this subject.

The translation of Agricola's "De Re Metallica," which was published in 1912, was of itself a remarkable achievement. Agricola's treaties, which was perhaps the first mining and metallurgical treatise published, was originally written in Latin. The translation involved elaborate research of collateral literature. Many German works were consulted. The result of the painstaking work of Hoover and his wife was a book of absorbing interest.

Everyone knows with what suddenness the Great War broke out in the summer of 1914. Another man than Hoover might have reasoned that his interests in the mining industry needed all his time and attention at such a period of chaos; but it is characteristic of him that he threw himself heart and soul into the work of a hastily organized American committee which undertook the task of rescuing the 100,000 or so Americans who were caught unaware by the war's outbreak and were panic-stricken over the difficulties of getting home.

Hoover's ability and public spirit were so well known in the American colony in London that when the task of organizing relief for the Belgians was undertaken, the late Ambassador Page was in no doubt where to turn to find a man equal to the need. Mr. Hoover has since been devoting his time and ability to works of public service, and without compensation other than the consciousness of duty well performed.

Engineers have long been insistent that the members of their profession were capable of performing great things if given the opportunity. Mr. Hoover's recent work is remarkable and striking proof of the soundness of the claim.

---

*Abstracted from *Engineering News-Record*, Jan. 9, 1919.

Mining Stocks in 1918

THE stock market of 1918 was characterized by few extreme fluctuations, and in spite of war conditions there was considerable steadiness. The curtailment of credit undoubtedly acted to prevent excessive speculation. Toward the close of the year there was a sharp drop, from which the principal stocks quickly recovered. The uncertainty marking the closing events of the war undoubtedly produced a softness to the stock market in general.

The accompanying tables show the quotations and transactions on the New York and Boston Stock Exchanges and those of the more important stocks on the New York Curb, the latter being from the records of the Curb Quotation Co. of New York.

With reference to the table of Curb quotations, it should be noted that these are not official, although they are probably as reliable as can be obtained. On the New York Stock Exchange every precaution is taken to insure that quotations are authentic; on the Curb, however, there are no restrictions whatever, and anyone can make prices and have them recorded in the published lists. It is, therefore, impossible to vouch for the trustworthiness of the prices, and they are printed merely as a matter of record.

MINING STOCKS ON THE NEW YORK STOCK EXCHANGE

	1915		1916		1917		Range Year 1918						Total
Company	High	Low	High	Low	High	Low	First	High	Date	Low	Date	Last	Sales
Alaska Gold Mines (d)	40½	21¼	26½	10¾	11⅛	1	1¾	5⅞	Nov 6	1¼	Apr. 27	3⅛	354,125
Alaska Juneau Gold Mining (d).	13½	9¾	10¼	6¾	8⅜	1⅞	2¾	3½	Jan. 11	1½	Apr. 1	1⅞	558,550
Amer. Smelt. and Ref. Co	108⅞	56	123¼	88½	112⅝	67⅞	80	94¾	Oct. 18	73	May 28	76½	2,186,194
Amer. Smelt. and Ref. Co pf	113	100	118⅜	109¼	117⅞ (h)	99½	104⅜	110¼	Nov. 12	103	Sept. 25	103¾	20,062
American Smelters pf. A	92	86	102	91¼	102¼	90½	93⅛	96	Nov. 15	89	May 25	95	4,760
American Smelters pf. B	85¼	78	97¼	84½	99¼	90⅞					..		.
Amer. Zinc, Lead and Smelt (b)	71½	67¼	97¼	29⅞	41⅞	10½	14	21⅞	July 3	11	Dec. 30	11¼	175,800
Amer. Zinc, Lead & Smelt. pf (b)	71½	67¼	87	59½	72½	39½	41	53¼	July 1	38¾	Dec. 30	43	16,665
Anaconda Copper Mining Co. (a)	91¾	49½	105⅞	77	87	51⅛	62	74⅛	Oct. 18	59	Dec. 30	60⅞	2,672,520
Batopilas Mining (c).	4½	½	3¾	¾	2⅛	⅞	1⅛	2⅞	Nov. 14	1	Jan. 4	1½	96,450
Bethlehem Steel Co	600	46¼	700	415	515	66¼	76¼	96	May 16	60	Dec. 30	61⅞	73,135
Bethlehem Steel, Class B, com.					156 (h)	66⅛	75¼	94	May 16	59⅛	Nov. 12	61⅝	4,976,410
Bethlehem Steel Co. pf.	184	91	186	126	135	84	90	94	Sept. 23	84	Dec. 28	89¼	5,600
Bethlehem Steel, 8% pf			.		101½	93	98½	106⅞	Apr. 29	96½	Jan. 15	104⅞	127,015
Butte & Superior (d)	79¾	53	105¼	41⅜	52¼	12⅞	16⅞	33½	May 14	16⅛	Jan. 2	17⅞	381,750
Butte Copper & Zinc (e)				.		...	10½	12⅞	July 10	5⅜	Dec. 30	5⅞	133,580
Calumet & Arizona (d).							65	71	May 15	61	Dec. 30	61	11,600
Cerro de Pasco. (g)				..	41	25	30½	39	Nov. 12	29⅛	Mar. 6	33	127,952
Chile Copper (b)	26⅞	23⅞	39¼	19⅞	27⅞	11¼	17	24	Oct. 18	14½	Apr. 4	18	451,390
Chino Copper (e)	57⅞	32⅞	74	46⅜	63¾	35½	42⅞	47⅛	May 16	31⅞	Dec. 28	33⅛	310,710
Colorado Fuel and Iron	66½	21⅞	63¼	38⅛	58	29¾	36½	54½	May 24	34¼	Jan. 29	36⅞	385,540
Con. Inter Callahan (d).	...	.	28⅞	18	21	7	8	13	June 21	7½	Sept. 23	8¼	18,700
Dome Mines (d)	30¼	16	29½	18	24¾	6½	8⅞	15	Nov. 1	6	June 19	11⅞	211,615
Federal Min. and Smelt	60	8	35	12⅛	26½	8¼	13¼	15	Oct. 1	9	Dec. 30	9⅛	9,070
Federal Min and Smelt pf	65	20	57½	35½	54¾	28	35⅞	44½	Oct. 18	27	Jan. 10	37⅛	33,918
General Chemical Co	360	165	350	285	250	153	175	185	Aug. 12	165	Jan. 26	168½	4,034
General Chemical Co., pf	116	106	117	113½	113	100	103⅞	103⅞	Jan. 24	99¼	June 24	103	3,275
Granby Consolidated	91	79⅛	120	80	92⅞	65	78⅛	86	Oct. 23	74	Jan. 25	78½	41,715
Great Northern, ctfs. for ore prop.	54	25¼	50⅞	32	38⅛	22⅞	27½	34½	Nov. 14	25¼	Jan. 15	31¼	751,665
Greene Cananea	52⅞	37	56½	34	47	34	39⅛	58⅛	Nov. 6	38½	Jan. 17	44	112,189
Homestake Mining	124	116	135½	126½	131½ (h)	89	89	95	Nov. 13	68	June 28	95	3,095
Inspiration Con. Cop. (e)	47½	16⅞	74⅛	42⅞	66½	38	47¼	58½	Oct. 18	41¼	Dec. 26	46⅞	1,141,740
International Nickel v. tr ctfs. (f)	223½	179⅞	56⅛	38⅛	47⅞	24½	30½	35	Nov. 7	27	Jan. 15	32½	564,772
Internat Nickel pf. (f)	110	105½	111⅞	105	108	92	98	98	Mar. 15	88½	May 2	96⅛	2,236
Kennecott Copper (g)	59½	25	64¼	40	50⅛	26	32½	41⅛	Nov. 12	29	Mar. 25	31⅛	837,065
Lackawanna Steel Co	94⅞	28	107	64	103¼	68	77⅞	91⅞	May 16	65⅞	Dec. 30	67	331,999
Miami Copper (e)	36⅞	17½	49⅞	33	43⅛	25	29¼	33⅛	Jan. 31	22¼	Dec. 31	22⅛	208,520
National Lead Co	70⅞	44	74⅞	57	63⅛	37⅞	47¼	69¾	Dec. 11	43⅛	Jan 7	66	67,850
National Lead Co, pf	115	104¾	117⅛	111½	114	99	104	105½	May 18	99¾	Mar. 2	104¼	4,540
Nevada Con Copper Co. (e)	17	11¾	34⅛	15	26⅞	16	18⅞	21¼	May 16	16½	Dec. 30	17	171,750
Ontario Silver Mining	12⅞	2	11⅞	5¾	7⅞	3⅞	5¼	13	June 17	4¼	Jan 22	7¼	266,067
Pittsburgh Steel pf	102½	74	106	93½	102	87	95	98	Jan 10	90	Apr. 2	90	3,135
Quicksilver	5⅞	¼	6	2	3	½							
Quicksilver pf	6¼	⅞	8¾	3½	4⅛	⅞							
Ray Consolidated Copper (d)	27½	15¼	37	20	32⅛	19½	23⅛	26⅛	May 16	19¼	Dec 26	20⅛	319,896
Republic Iron and Steel Co	57⅛	19	93	42	94½	60	79½	96	May 16	72⅞	Jan 15	75⅛	1,421,950
Republic Iron and Steel Co, pf	112⅞	72	117	101	105¼	89	92⅞	102½	Sept 17	92⅞	Jan 2	97	24,830
Shattuck Arizona Copper (d)	38	18⅛	40¼	22	29⅞	15	16½	18⅞	Feb 19	11	Dec 31	13	42,120
Sloss-Sheffield Steel and Iron	66¼	24	93½	37	74⅛	33½	40	71⅛	May 24	39	Jan 24	50	99,525
Sloss-Sheffield Steel and Iron pf	102	85	103½	91½	99	88⅛	81	93⅛	July 29	81	Feb 28	90	1,950
Tennessee Cop & Chem (f)			19½	15¼	19½	11	12¼	21	July 6	12¾	Dec 28	13	328,165
United Alloy Steel (g)					49⅞	34½	37	44½	May 10	36⅛	Oct 31	38⅛	100,550
U S Smelt, Ref & Min (a)			81½	57	67⅞	40	45⅛	50¼	Oct 19	36	Apr 13	45⅛	98,400
U S Smelt, Ref & Min pf (a)			53⅛	50	52⅞	43⅞	45	47¾	Dec 13	42⅞	Apr 12	47⅞	6,970
U S Steel Corporation	89½	38	129¾	79¾	136⅞	79½	91⅞	116½	Aug 28	86½	Mar 25	95	31,853,040
U S Steel Corporation pf	117	102	123	115	121⅛	102⅞	109	113⅞	Dec 31	108	Mar 25	113⅞	152,206
Utah Copper (d)	81⅞	48½	130	74⅛	118⅞	70⅛	81⅛	93	Oct 19	71⅞	Dec 26	73⅞	634,820
Vulcan Detinning	19	5	10½	7	10⅛	6	8⅛	10½	Dec 26	7⅛	Apr 3	10½	838
Vulcan Detinning pf	43	21	26½	20½	24½	20	25	42	Sept 5	25	Mar 11	42	700

Highest and lowest prices of the year are based usually on sales of 100 shares. (a) Par $50. (b) Par $25 (c) Par $20 (d) Par $10. (e) Par $5. (f) Par value of common stock reduced from $100 to $25 in 1916, in 1917, voting trust certificates were exchanged for stock. (g) No par value. (h) Ex-dividend

MINING STOCKS ON THE NEW YORK CURB—1918

Sales	Company	Open	High	Low	Last	Sales	Company	Open	High	Low	Last
412925	American Tin and Tungsten	¾	⅞	¼	¼	283800	Consolidated Arizona Smelting	1¼	2³⁄₁₆	1¹⁄₁₆	1⁵⁄₁₆
74300	Arizona Binghampton Copper	5⅛	6	3⅛	4	321650	Consolidated Copper Mines	6⅛	7¾	4½	6⅛
62700	Aurora Silver Mines	2	6⅛	2½	5	229450	Cresson Gold	4¼	6	4⅛	5
1141678	Big Ledge Copper	1⅛	1½	⅞	⅞	700	Davis Daly	5⅞	5⅞	5⅞	5⅞
3514150	Boston Montana	†45	96	38	53	96685	Denbigh Mine	2	2⅛	½	⁹⁄₁₆
90020	Bradshaw Copper	1½	1⅞	⁷⁄₁₆	½	7440	Dome Extension	†12	14	12	14
4600	Buffalo Mines	½	1⅞	⅞	1	20715	Dundee Arizona Copper	1⅛	1³⁄₁₆	⁹⁄₁₆	1⅛
1055200	Butte-Detroit	⁷⁄₁₆	⅞	†2	2½	800	East Butte	10⅛	10½	9⅞	10
21075	Butte-New York	¾	1⅛	½	⅞	480732	El Salvador Silver	†55	1¼	†55	1⅛
66200	Butte Copper and Zinc	6⅛	10½	6¼	11	1196445	Emma Copper	⁹⁄₁₆	⁹⁄₁₆	†11	12
1700350	Caledonia Mining	†46	56	23	29	3121	First National Copper	2⅛	2½	1½	2
1044400	Calumet & Jerome	1⁵⁄₁₆	1½	⅞	⁷⁄₁₆	279800	Goldfield Consolidated	⁵⁄₁₆	⅜	†17	23
206900	Canada Copper	2	2⅛	1½	2³⁄₁₆	407800	Gold Merger	†3½	11	1½	6
423300	Candelaria Silver	†37	53	37	53	9500	Great Verde Extension Copper	⁵⁄₁₆	1	⁵⁄₁₆	1
1482700	Cashboy	†4	19	3	8	219637	Hecla Mining	4⅛	6³⁄₁₆	2¾	4⅞
509200	Cerbat S. M. and M	†46	1¼	†42	1⅛	8030	Howe Sound, w. i	4⅛	4⅞	3¾	4
9400	Cerro Gordo Mining	1½	1⅛	½	1	1014000	Hypotheek Mining and Milling	†16	35	12	17

Sales	Company	Open	High	Low	Last
57670	Iron Blossom	½	11/16	7/16	9/16
243650	Jerome Verde	⅝	⅞	⅜	½
603875	Jim Butler	†78	90	32	35
87460	Josevig-Kennecott	3/16	7/16	3/16	5/16
343650	Jumbo Extension	†15	24	8½	13
14225	Kerr Lake	5	6	5	5⅛
262550	Kewanas	† 6	10½	1½	7
112450	La Rose Consolidated	¼	11/16	¼	¼
145900	Louisiana Consolidated	½	⅝	⅜	⅜
8400	MacNamara Mining	33	34	32	33
126900	McKinley-Darragh	55	60	38	48
113730	Magma Chief	7/16	½	¼	5/16
58085	Magma Copper	42	42	23	26
420000	Marsh Mining	† 6	8½	2½	4½
81070	Mason Valley	5½	6¼	2¼	2¾
2900	Mines of America	1½	1½	¾	¾
22100	Mogul Mining	†35	35	10	15
47700	Mohican Copper	¾	⅞	½	⅞
1611800	Mother Lode	†27	56	25	35
691800	National Zinc and Lead	†28	38	7	11
83050	New Cornelia	15½	19⅝	15½	18
3300	New York & Honduras Rosario Mining	12½	14	11r	12
52300	Nipissing	8⅜	9¼	8	9¼
141495	Nixon Nevada	15/16	1 5/16	+31	+43
496800	Ohio Copper, new, w. i.	15/16	1 3/16	⅝	¾
934280	Onondaga Mines	2	6	1⅞	4¼
638600	Pacific Tungsten	1¼	2⅛	13/16	1⅛
106800	Portland Consolidated Copper	†33	34	30	32
163300	Ray Hercules	3¾	4⅞	3	3⅛
2500	Red Hill Florence	4½	4½	4	4
76150	Red Warrior Mining	½	⅞	⅛	⅛
333200	Rex Consolidated Mining	†10½	15	7½	8
704200	Rochester Mines	†30	54	27	27
8800	Santa Fe Copper	¾	¼	¾	1¼
48600	Seneca Copper Corporation	7½	16	7½	15½
122450	Senorito Copper	¼	1	¼	½
210680	Standard Silver Lead	7/16	13/16	3/16	¼
676700	Stewart	¼	¼	†10	16
607400	Success Mining	† 9	16	7	7½
26545	Superior Copper	2	3½	2	3
19695	Tonopah Belmont	3	3⅛	2	2 9/16
1700	Tonopah Divide	1 15/16	2 1/16	1 15/16	2
349075	Tonopah Extension	1¼	2⅝	1	2 1/16
10235	Tonopah Mining	4	4	2 5/16	3
70520	Tri-Bullion	¼	7/16	⅛	⅛
230011	Troy-Arizona	†15	29	8	10
5000	Tintic Mining	¼	½	¼	7/16
20225	United Eastern	4	5¼	3	4⅜
635605	U. S. Zinc and Lead	† 9	60	6	9
65700	United Verde Extension	36⅜	42	32	39
31500	Utica Mines	†11	12	9	10
1500	Verde Combination Copper	¾	¾	⅝	13/16
498800	West End Consolidated	†69	1½	†65	1¼
974640	White Caps Manhattan	†12	⅞	† 8½	10½
162400	White Caps Extension	†10	18	1½	2
105900	Wilbert Copper	†17	17	4	5
18100	Yukon Gold Mines	1¾	2	⅞	1⅛

† Cents per share.

MINING STOCKS ON BOSTON EXCHANGE, 1918

	High	Date	Low	Date	Last
Adventure	1¾	Jan. 25	½	June 27	60c.
Ahmeek	86	Nov. 12	69	Dec. 27	70
Algomah	45c.	May 13	15c.	July 11	20c.
Allouez	54	Feb. 27	41¼	Dec. 31	41¼
Arizona Commercial	16¼	Aug. 24	11	Jan. 5	12½
Butte Ballaklava	48c.	Nov. 22	20c.	Oct. 21	30c.
Calumet & Arizona	73½	May 16	61	Dec. 27	61
Calumet & Hecla	470	Dec. 4	425	Dec. 26	430
Centennial	14½	Feb. 19	10¾	June 27	13
Copper Range	51½	Nov. 12	40	Dec. 26	41½
Daly West	3	Sept. 30	1½	Apr. 10	2⅝
Davis Daly	6⅞	Mar. 8	4¾	Dec. 23	5
East Butte	12	Nov. 12	8½	Mar. 25	9⅜
Franklin	6	Feb. 18	3	June 21	3½
Hancock	10⅝	Jan. 2	4¾	Dec. 31	5
Indiana	1	Jan. 3	40c.	July 23	60c.
Island Creek	70	May 15	45½	Dec. 27	46
Island Creek, pfd	84	Feb. 18	79½	Oct. 1	79¾
Isle Royale	29	July 3	19½	Jan. 14	24
Kerr Lake	6½	Oct. 18	5	Jan. 2	5¼
Keweenaw	1⅛	May 15	80c.	Sept. 11	95c.
Lake	8⅛	May 14	4½	Dec. 27	4½
La Salle	3¼	Mar. 5	2	Jan. 2	3
Mason Valley	6	Feb. 13	2¾	Dec. 27	2¼
Mass Consolidated	7	Jan. 2	3¾	Sept. 17	4⅛
Mayflower-Old Colony	4½	Nov. 4	65c.	Mar. 26	2⅛
Michigan	4¼	Oct. 29	40c.	June 28	2¼
Mohawk	66½	May 16	51	Dec. 26	52
New Arcadian	2½	July 1	1¼	Aug. 29	1½
New Idria	17¼	Mar. 7	9¾	Dec. 27	10
Nipissing	9⅞	Apr. 11	8 3/16	Jan. 11	9
North Butte	17⅜	May 16	10½	Dec. 30	10⅝
North Lake	95c.	Mar. 19	¼	Feb. 14	55c.
Ojibway	1⅝	Dec. 10	½	June 21	1⅝
Old Dominion	45½	Jan. 3	33	Dec. 24	35
Osceola	65	Jan. 9	46½	June 11	48
Quincy	78	May 16	59	Dec. 27	60
St. Mary's	57	Jan. 2	38	Dec. 27	40
Santa Fe	1¼	Feb. 21	¼	Dec. 12	32c.
Shannon	5¼	Jan. 2	3	Apr. 10	3
South Lake	2	Jan. 3	½	Sept. 30	1¾
So. Utah M. & S.	20c.	Jan. 8	10c.	Dec. 30	10c.
Superior	8⅞	Nov. 20	4	Feb. 19	5¾
Superior & Boston	4¾	Sept. 27	1¼	Aug. 13	3
Trinity	4½	Feb. 13	2½	Sept. 23	2½
Tuolumne	1 13/16	Aug. 20	73c.	Dec. 27	77c.
Utah Apex	4⅛	Nov. 18	1¼	May 31	2 1/16
Utah Consolidated	12	Jan. 16	7½	Dec. 27	8
Utah Metal and Tunnel	3 1/16	Apr. 8	1	Dec. 9	1⅛
Victoria	3	Jan. 3	1⅝	Dec. 30	2
Winona	2	Jan. 3	½	Nov. 21	85c.
Wolverine	36	Jan. 3	18	Dec. 16	18⅛
Wyandot	1 1/16	Mar. 7	40c.	May 19	50c.

Bonds on New York Stock Exchange

	1917		1918			Sales in
	High	Low	High	Low	Last	$1000
Alaska Gold M., 6% conv., '25, Series A.	85	14	39	18	32½	188
Alaska Gold M., 6% conv., '26, Series B.	84⅞	14	36	18	32	305
Am. Sm. & Ref., 1st 30-yr. 5's, Series A, 1947	92⅝	84	95⅜	84⅞	92	1,682
Beth. Steel, 1st ext. 5's, 1926	104	93⅞	99	92	95½	317
Beth. Steel, 1st and ref. 5's, 1942	102	86½	93½	86	87½	480
Braden Copper, coll. tr. 6's, 1931	98	89	96¼	89⅞	96	892
Cerro de Pasco, 10-yr. conv. 6's, 1925	118	100½	(a)	(a)	(a)	(a)
Chile Copper, conv. 7's, 1923	132	96¼	118½	102⅜	108	1,643½
Chile Copper, conv. 6's, 1932	101	70	89⅛	77	84	468
Chile Copper, conv. 6's, 1932 full paid	100⅜	80	.	.		
Chile Copper, coll. tr. 6's, 1932	..	..	89½	73	83	853½
Granby Consol., conv. 6's, '28	109½	94¼	100	91	98	88
Granby Consol., stamped	109¾	96½	97	91	97	107
Colo. Fuel & Iron, gen. s.f.g., 5's, 1948	97½	81⅜	86¾	83	86¾	54
Illinois Steel, deb. 4½'s, 1940	94	81	86½	81	83⅛	506
Indiana Steel, 1st mtg., 5's, 1952	103½	94⅝	99	92	97¼	487
Lacka. Steel, 1st conv. 5's, 1923	101⅝	95	97	94¼	96	358
Lacka. Steel, 1st conv. mtg. 5's, Series A. 1950	107¼	83⅞	96½	83½	84½	688
Mex. Petrol, 1st and ref. conv. 10-yr. s.f. 6's, series A, 1921	111	100	181½	105¾	165	57
Mex. Petrol, 1st and ref. conv. 10-yr. s.f. 6's, series C, 1921	110½	100	175	106	163¾	126
Nat'l Tube, 1st mtge. 5's, 1952	103	94½	97½	93	95½	76
Republic I. & S. 10-30-yr. s. f. 5's, 1940	101¼	93⅛	98¼	91	91	452
Tenn. C. I. & R.R., 1st 5's, 1951	103⅛	95	97½	92⅛	95¼	101
Tenn. Copper, 1st conv. 6's, 1925	101¼	87½	95½	88	91	82
U. S. Sm., Ref. & M., conv., 6's, 1926	109	94¾	100	92⅛	99½	397
U. S. Steel, 10-60 yr., s. f. 1963	107⅛	93¼	101	96	99¼	8,038
U. S. Steel, 10-60 yr., s. f. 5's, 1963, registered	107	92¼	100⅝	96	98½	78
Va. Iron C. & C., 1st 5's, 1949	90	85	86⅞	83	86⅞	61

(a) Entire issue called for redemption, May, 1 1918.

Hoover Talks Bluntly

Hoover's friends know how deeply he feels and how straightforwardly he speaks. They can readily appreciate his attitude when recently the Baron von der Lancken and Dr. Reith, who were prominent in the German administration of Belgium, telegraphed from Berlin to Walter Lyman Brown, Director of the Commission for Relief in Belgium, at Rotterdam, that they had been appointed by the German government to negotiate with Hoover for food supplies, and that they desired Mr. Hoover to advise them as to when and where he would meet them.

In answer to the request for a conference, Mr. Hoover sent this message to Mr. Brown:

"You can describe two and a half years of arrogance toward ourselves and cruelty to the Belgians in any language you may select, and tell the pair personally to go to hell, with my compliments. If I have to deal with Germans, it will not be with that pair."

It was to Baron von der Lancken that Brand Whitlock, American Minister to Belgium, vainly appealed to intercede for Miss Edith Cavell, the English nurse who was executed by the Germans on the charge of "treachery." The designation of that pair by the Berlin government to negotiate with Hoover shows that, whether autocratic or democratic, it is unable to appreciate the fitness of things.

Industrial News from Washington

By Paul Wooton, Special Correspondent

New War-Minerals Bill Introduced

Bills authorizing the Secretary of the Interior "to determine, adjust, and pay losses sustained by investment preparatory to production of war minerals" have been introduced in Congress. The Senate bill was introduced by Senator Henderson. Identical bills have been introduced by several members of the lower house.

The bill provides that the cost of the investigation of the subject and the payment of claims are to be taken from the money appropriated by the War-Minerals Act, and, "that said funds and appropriations shall continue to be available for said purposes until such time as the Secretary shall have fully exercised the authority hereby granted and has performed and completed the duties hereby provided and imposed."

The Secretary is directed to determine the losses sustained in efforts to produce war minerals "to supply the urgent, published and evident needs of the Nation during the war." The bill allows a wide range to claimants, as it covers "money heretofore invested or contracted to be invested and obligations incurred by any and all persons and investors for producing, or for the purpose of producing or preparing for producing or acquiring property for producing," the war minerals within the United States.

The action of the Secretary is to be final. He is instructed to consider claims having a basis on moral, equitable, and just grounds. The full text of the bill follows:

A bill to supplement an act of Congress approved Oct. 5, 1918, (public numbered 220), and to authorize the Secretary of the Interior, from the funds appropriated by said act, to determine, adjust, and pay losses sustained by investments preparatory to production of war minerals mentioned in said act.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior be, and hereby is, authorized and directed to ascertain and determine the amount or amounts of money heretofore invested or contracted to be invested and obligations incurred by any and all persons and investors for producing, or for the purpose of producing or preparing for producing or acquiring property for producing, within the United States, to supply the urgent, published, and evident needs of the Nation during the war, any ores, metals, minerals, or mineral substances mentioned and enumerated in an act of Congress approved Oct. 5, 1918 (public numbered 220), entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply"; and that said Secretary ascertain, determine, adjust, liquidate, and out of the moneys provided and appropriated by said act, pay to the parties entitled thereto the amount of such losses and damages as he, the said Secretary, shall find and determine have been sustained and suffered or are likely to be sustained and suffered, by reason of having made such investments for said purposes or having produced surplus stocks of such materials; and that in each case he shall make such determination, provision, settlement, advancement, or final payment, and by agreement with owners and claimants make such other adjustment or take such other action as he shall find and determine to be just, equitable, reasonable, and expedient; and that he make such provisions as he may deem necessary, advisable, and reasonable to prevent further losses pending final decision, settlement, and disposition in any case or cases; that the payments herein authorized be made to the claimant or claimants the said Secretary shall find to be morally, equitably, and justly entitled thereto that in ascertaining and determining the losses and damages sustained or to be sustained, and the adjustments, settlements, payments, and provisions to be made, the said Secretary shall consider the prices and conditions existing at the time of each investment and the prices and conditions existing prior to the war, as well as those existing at the time of such determination, adjustment, and settlement, together with all of the circumstances and conditions of each case; that the final determination, decision, provision, disposition, and action of said Secretary in each case shall be conclusive and final; that all payments shall be made and all expenses incurred by the Secretary paid from the funds and appropriations provided and appropriated by said act of Oct. 5, 1918 (public numbered 220), and that said funds and appropriations shall continue to be available for said purposes until such time as the said Secretary shall have fully exercised the authority hereby granted and performed and completed the duties hereby provided and imposed.

Sec. 2. That a report of all operations under this act, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

Sec. 3. That nothing in this act shall be construed to confer jurisdiction upon any court to entertain a suit against the United States.

Bastin Heads Reorganized Division

An important reorganization of the mineral-resources division of the U. S. Geological Survey is in progress. Edson S. Bastin has been appointed to take charge of a reformed and extended division. In explaining the need for the change, Director George Otis Smith said:

> The pre-war activities of the Survey now must be expanded so as to include: the collection of more complete statistics bearing upon domestic consumption, supplementing the figures that show domestic production with more data regarding stocks and imports and exports; the quarterly and monthly publication of statistical returns, thus making the current statistics valuable as industrial guides as well as historical records; the study of the international movement of mineral raw materials, as bearing upon the domestic industry; and the investigation of the extent of the world supply of minerals, the world view being essential to the home industry, for it is no longer enough to know simply what are the mineral resources of the United States. Full development of all these lines of inquiry will necessitate complete coöperation with other bureaus and departments and larger utilization of the Survey's own resources of scientific personnel.

The division will include four sections—metals, nonmetals other than fuels, mineral fuels, and foreign reserves. G. F. Laughlin will be the geologist in charge of the metal section; R. W. Stone the geologist in charge of the non-metals section; C. E. Lesher the geologist in charge of the mineral-fuels section, and J. B. Umpleby the geologist in charge of the foreign-reserves section.

H. D. McCaskey, who has had charge of the division of mineral resources for many years, continued that administrative work at considerable personal sacrifice during the war, but declined to ask for relief until the emergency had passed. In the future, he will devote his time to the study of special phases of mineral resources which he has not been able to undertake comprehensively, owing to the burden of administrative work.

Mr. Bastin, the new chief of the division, was born in Chicago in 1878. He was graduated from the University of Michigan in 1902 and received his technical training at the University of Chicago. He began his work with the Geological Survey in 1904. In 1913 and in 1914, however, he returned to the University of Chicago as lecturer on economic geology. He then again took up his work with the Survey. His field work on economic geology has been confined largely to the Breckenridge, Gilpin County, Boulder County, Clearfield County, Ouray, Telluride, Red Mountain, San Juan and Aspen districts of Colorado; Patagonia, Pierce, Wickenburg, Kingman, and Chloride districts in Arizona; and the Tonopah and Virginia City regions in Nevada. In September, 1916, Mr. Bastin went to Chile to make a special geological report on the mines of the Braden Copper Co. This occupied a year. On his return, he was retained for several months as lecturer on mining geology at the Massachusetts Institute of Technology. Since the beginning of the war, he has acted as secretary of the departmental committee on war minerals and their derivatives. Up to the close of 1918, he was in charge of the mineral bureau of the War Trade Board.

May Delay War-Minerals Relief

Pending the outcome of the present controversy, which deals chiefly with War Department agreements and contracts, it is not probable that the Henderson bill providing for the relief of producers of war minerals will be pushed. After the Senate had given some evidences of regarding the Hitchcock bill with favor, the measure apparently has received its quietus at the hands of Benedict Crowell, the Assistant Secretary of War. In a communication to Senator Fletcher, Secretary Crowell said:

> The Hitchcock bill provides for the establishment of an Adjustment Commission of three members, who shall decide all cases of cancellation of existing valid contracts or orders of the War Department, and also all cases in which a contract was not made or signed as provided by law.
>
> The War Department is strongly convinced that the enactment of this bill would cause great and unjustifiable delay in settling the proper claims of contractors and would most unjustly throw hundreds of contractors into bankruptcy.
>
> It would first be necessary for the President to appoint the members of the commission. The Senate must then confirm the appointments. Thereafter the board must organize and familiarize itself with its duties. If regional boards of examiners are appointed, their membership must be selected and their machinery started.
>
> These various steps will necessarily take time. After they have been performed, the board will find itself confronted with a situation which will absolutely prevent prompt settlements. This situation will result both from the magnitude of the task and from the almost total lack of assistance provided for the board in the bill.
>
> Incomplete figures show that the total number of settlements which would come before the board would exceed 25,000. That this is an impossible task for three men in one year is, of course, obvious.
>
> Your attention is invited to the fact that the entire appropriation provided by the bill is only $50,000; that $35,000 of this amount will be used to pay the salaries of the three members of the board and the secretary; and that only $15,000 will be left for the accountants, investigators, clerical assistance and office expenses of the central board and the entire expenses of all such boards of examiners as may be appointed. Comment on the utter inadequacy of such an appropriation is unnecessary. At the very outset, the board would be choked with work, and this condition would become hopelessly more aggravated each succeeding week.
>
> In addition to being utterly unable to do its work, the Adjustment Board provided by S. 5261 is entirely unnecessary, for the reason that the War Department already has established and at work a machinery adequate to handle efficiently and promptly all settlements. Without now going into the details, the department has a central board of contract review in each of the eight supply bureaus in Washington; also a total of 24 local or district boards in various sections of the country making settlements for the Ordnance Department and the former Quartermaster Corps. The department has also established in Washington a Board of Contract Adjustment to which the Secretary of War refers for decision all cases in which the contractor and the contracting officer are unable to agree. Furthermore, several thousand contracting officers, accountants, investigators and other assistants are now at work helping the boards to make prompt settlements. On the enactment of the legislation which the War Department has requested, this machinery is prepared to start immediately on the cases in which contracts were not made or signed as provided by law.
>
> The War Department feels very earnestly that the good faith of the Government is pledged to a prompt settlement and payment of all just claims of contractors. The department stands fully ready to make such settlements, and is already doing so where the contracts were made and signed as provided by law.
>
> The Dent bill, as amended by the House Committee on Military Affairs, will meet the requirements of the situation if amended in a few further respects as suggested by the War Department and will enable the department to utilize its existing boards and its existing personnel to make prompt settlements of all formal and informal contracts.

Cannot Import Potash for Months

Edward N. Hurley's statement given to the press in Paris that all returning American ships would carry potash from Alsace caused domestic producers to protest strongly. This led Senator Hitchcock, of Nebraska, to investigate the matter. His comment on the subject made on the floor of the Senate is in part as follows:

> For the present, it is the intention of the War Trade Board not to allow the importation of potash until the peace treaty is signed, for the reason that the potash industry has been encouraged by Government agents during the war to go to an extraordinary expense in the development and production of potash, and a large supply of potash is now on hand. The fertilizer companies are refusing to buy this potash in the hope of being able to import potash from Europe to put into fertilizers during the present season. This is utterly impossible. During this season it is holding out a false hope to the agriculturists who are depending on fertilizers; potash cannot be imported for months yet to come. The order of the War Trade Board still stands, and the War Trade Board has taken occasion to send to Mr. Hurley information that that order still holds good. It would be, in effect, a breach of faith on the part of the Government, after encouraging the potash men, as a war industry, to produce the potash at this time and at great expense, now to make it impossible for the companies to market their product. I think that the fertilizer companies which are depending upon securing potash from Europe at this season for their fertilizers will find that they are anticipating something that is impossible.
>
> I wish to say in this connection that I have introduced, and there is still upon the table of the Senate, a resolution which I may ask later to have considered, directing the Federal Trade Commission to inquire whether the fertilizer companies of this country have entered into a combination to refuse to buy this potash, whether those fertilizer companies have large interests in European potash mines, and whether or not European potash companies, notably those of Germany, have interests in the American fertilizer companies. I think that this is susceptible of some proof. There seems to be a combination at the present time of fertilizer companies to refuse to buy the American potash that has been produced at the urgent request and under the stimulation of the Government urging.

Platinum Supply To Remain Scant

Practically no platinum is in the hands of Russian banks, according to information reaching Washington. There is some in the hands of individuals in Russia, but this, it is believed, does not exceed 50,000 oz. All operations in Russia have ceased, and it is believed that two years must elapse before there can be any hope of enough production for it to be a factor.

Any decided easing off of the stringency in the metal is not expected by officials here. There is to be no scrapping of sulphuric-acid plants, so that little of the platinum being used as a catalyzer will be released. Some platinum has been allocated to plants not yet built, but that surplus and more probably will be demanded for nitric-acid plants. There is every reason to believe that the Government will carry out its plans for the production of nitrates.

Molybdenite in Norway

There are a number of deposits of molybdenite in Norway, the principal ones being situated near Flekkefjord, in the southern section of the Stavanger Amt, and the working of these deposits is the only mining of any importance carried on in this district, says *Commerce Reports*. New mines are being opened and companies formed to exploit them. As yet there are no plants in Norway where the product molybdenite (MoS_2) can be converted into ferromolybdenum, and a market must be found abroad. Small quantities go to Sweden. To prevent molybdenite from reaching the Central Powers, where, it was reported, it is used extensively to manufacture quality steel, the British government made contracts for the purchase of almost the entire output of 1917. The price paid was high, $4.25 per lb., and caused much activity in the mining and reduction industry.

A company was formed to undertake the production of ferromolybdenum and other products of molybdenum. The plant is to be at Flekkefjord or Sandnes, where the raw material is convenient and water power obtainable. It is said that the company has acquired the patent rights for a process by which ferromolybdenum can be produced without the usual waste, which is from 20 to 30% of the molybdenite with ordinary processes. It is not known when the plant will be completed and ready for operation.

The Siberian Mines

Latest news from Russia, according to the *Statist*, is to the effect that the Siberian government is becoming stronger. Men of tried ability and honesty who refused to be connected with previous governments have now joined. All the properties of the group are free from Bolshevik influence, and preliminary resumption of operations is reported, in particular coal mining and production of lead, for both of which a good market exists in Siberia. Resumption of copper production on a large scale depends upon ability to obtain stores and materials, and upon improvement in transport conditions. Until the Bolshevik influence vanishes from Western Russia, and the railway outlets therefrom are available, big-scale operation under normal conditions can hardly be looked for.

No real damage has apparently been done to the Irtysh properties, and the managing director has recently telegraphed that the position is promising. In regard to Kyshtim, it has not been possible to prepare the accounts of the Russian companies for 1916-17, but the blister copper output is known to have been about 5000 tons in the latter year, against 6392 tons in the former. The Tanalyk's production of blister copper is placed at about 700 tons for 1917, against 687 tons in 1916. The plants have been shut down since the beginning of 1918.

Mining in German East Africa

The principal mining group in the protectorate of German East Africa, according to extracts from the British *Board of Trade Journal*, printed in *Commerce Reports* of Jan. 2, consisted of the Centralafrikanische Seen Gesellschaft (Central African Lakes Co.), the Centralafrikanische Bergwerks Gesellschaft, the Kironda Goldminen Gesellschaft, and the Irangi Syndikat. The second company was an offspring of the first named and the third an offspring of the second. The Irangi Syndikat was founded in 1896 by the Diskonto Gesellschaft and the Norddeutsche Bank of Hamburg.

The parent mining company, the Central African Lakes, founded in Berlin in 1902, was itself chiefly concerned with the salt works at Gothorp, and from 1910 onward paid a steady 8% dividend. The Lakes company's gold mining claims were represented by an interest in the subsidiary Bergwerks Company (1905), which, in its turn, made over its rights in the Schenkwe gold fields to the Kironda Gold Mining Co. The original holding of the Lakes company in the Bergwerks concern was one-half, but the proportion appears to have been since reduced.

The Bergwerks and the Irangi Syndikat each held a one-fifth interest in the Kironda company, founded in 1908, of which the capital was 1,250,000 marks. The Kironda company produced nearly 1,000,000 marks' worth of gold in 1911 and made 224,000 marks' profit but afterward did less well. Gold mining in the protectorate was upon a very small scale in comparison with the industry in British South Africa.

Resume the Gold Standard

The London cables announce that the committee on financial facilities for after-war trade has completed its preliminary report. It recommends the resumption as soon as possible of the gold standard and reducing inflation caused by short-time government borrowing of the banks. Resumption of the gold standard in England means exactly what it means in the United States, says the *Tribune*. It does not mean that there has ever been in England during the war any definite gold premium or depreciated paper currency, any more than there has been any gold premium or depreciated currency in the United States. Both countries, while remaining nominally upon a gold basis, had actually stopped free payments in gold, and were therefore actually upon a paper basis. The paper in England was treasury notes, bank notes and bank credits. The paper in the United States was chiefly Federal Reserve notes and bank credits. England proposes now to "resume" by annulling her embargo upon gold exports. The United States should do the same, promptly and without further hesitation.

A Plea for Common Honesty

The *Wall Street Journal* says: "Let it be supposed that a private company, the U. S. Steel Corporation, for example, should, because of inefficient bookkeeping, neglect to pay wages for several months. In such an altogether impossible contingency everyone knows what the result would be. The company, in fact, could not hold up wages even for a few hours without risking a strike.

"But the U. S. Government is doing exactly that thing with the soldier. Not only are his wages in arrears, but those dependent upon him have not received punctually, to put it mildly, what was guaranteed when the soldier was drafted. He has not the recourse of the

Steel employee, because he cannot strike. But is it common honesty to subject him to a privation so serious as this?

"There is a growing and dangerous feeling in Washington that the U. S. Government can be guilty of acts of tyranny, neglect, and flat dishonesty which would not be tolerated in private corporations and would be personally abhorrent to members of Congress who are willing, by indifference or even pernicious activity, to encourage such government. Is there anything recorded in the relation of corporations to those whom they serve more shamelessly dishonest than that of the postoffice to the railroads in the transmission of mail? The abuse of the contract is notorious, and the politician thinks it upon the whole rather clever to cheat the property holder in railroads out of his just due for service performed."

How Is Germany Going To Pay?

How to get blood out of the German stone is the question that is worrying not a few of our Allies, remarks the *Evening Post*. An even more startling problem is how to take wealth from Germany without ruining ourselves by it. Sir Eric Geddes, First Lord of the British Admiralty, says that a German indemnity must be paid in gold, goods, or labor. But Germany has no gold; and "if we received the indemnity in goods it would stagnate our production and labor market." And thus Mr. Lloyd George: "Germany ought to pay; she must pay as far as she can, but we are not going to allow her to pay in such a way as to wreck our industries." And if Germany is made to pay, it might unduly stimulate her manufactures and export trade! Horrible predicament!

A way out is suggested by Sidney Low in a letter to the London *Times*. Goods and labor are not Germany's only assets. She has immense natural resources. "Her iron fields and coal mines, even after the cessation of French Lorraine, will still be among the richest in Europe; she has copper, lead, zinc, and silver; and potash deposits of unique importance." Authoritative estimates place the gross value of Germany's mineral resources as high as 1000 billion dollars, and even more; and the Ruhr basin mines alone are said to be worth 225 billions. Mr. Low's proposal is that the Allied governments require Germany to surrender to them the usance of such of her mines and mineral deposits as would yield from 500 to 1000 millions annually for the next 30, 40, or 50 years. It is a gorgeous proposal.

Bulletin Discusses Gold Situation

WASHINGTON CORRESPONDENCE

The forthcoming issue of the Federal Reserve Board's bulletin will contain a discussion of the present gold situation of the world. It is pointed out that the restoration of the free gold market under proper conditions at as early a date as may be feasible is strongly to be desired. Some of the problems in this connection are discussed. During the month ended Dec. 10, gold imports, it is stated, amounted to $2,412,000, coming largely from Mexico, Canada, and Portuguese Africa. Gold exports during the same period totaled $1,132,000. The latter were consigned chiefly to Chile and to Mexico. The gain in the nation's stock of gold since Aug. 1, 1914, is shown by the following table:

GOLD IMPORTS AND EXPORTS
(000 omitted)

	Imports	Exports	Excess Imports Over Exports
Aug. 1 to Dec. 31, 1914	$23,253	$104,972	(1) $81,719
Jan. 1 to Dec. 31, 1915	451,955	31,426	420,529
Jan. 1 to Dec. 31, 1916	685,745	155,793	529,952
Jan. 1 to Dec. 31, 1917	553,713	373,171	181,542
Jan. 1 to Dec. 10, 1918	61,066	39,701	21,342
Totals	$1,775,732	$704,063	$1,071,669

(1) Excess of exports over imports.

Only a portion of the information to be contained in the article was allowed to become available. It will include elaborate tabulations, showing the present gold position of the world.

Mining Congress Forms New Division

The war-minerals division of the American Mining Congress has been formally organized and the following executive committee elected: A. J. Edwards, Batesville, Ark., chairman (manganese); Howard F. Wierum, Valley, Wash., vice-chairman (magnesite); Nelson Franklin, Denver, Colo. (chrome); W. L. Gazzam, Seattle, Wash. (chrome); Courtney DeKalb, San Francisco (chrome); Nathaniel P. Pratt, Atlanta, Ga. (pyrites); J. J. Jensen, Salt Lake City, Utah (pyrites); W. W. Pettis, Phillipsburg, Mont. (manganese); and John T. Burns, Washington, D. C., secretary. All producers interested in the minerals and metals named in the War-Minerals Bill have been asked to join the new division of the congress.

Miners Built Good Bridges

The boys of the 27th proved that mining furnishes a good all-around experience for nearly every kind of engineering work. So stated Lieut. Col. O. B. Perry in a recent letter, in which he described the work the regiment had accomplished. "After they got going," he said, "they handled the bridge work as creditably as any organization could have done that was specially trained for the work. They also proved their ability in dugout construction and had officers coming from all around to see how the work should be done."

In referring to the Comfort Fund, Colonel Perry said, "I have seen men go without food, and work for 24 hours straight, or longer, in the rain and cold, without a grumble; and the same men will get grouchy and dissatisfied if they do not have tobacco or sugar for their coffee."

Contributions are still arriving for the Fund, the last one coming from Alaska, and the one before it from Chile. Geography has cut no figure where the mining regiment was concerned.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$19,653.56
W. E. Defty	10.00
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
Interest to Jan. 1, 1919	105.30
Total	$19,888.36

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.

Editorials

What About Copper?

FROM Dec. 1 to 31 no copper was sold by producers, who were in agreement among themselves not to sell any for less than 26c., which nobody would pay. Just before the end of the year it was signified that 23c. would be the export price, and it was intimated that the same would be asked for domestic business. On Jan. 2 some of the small producers began to sell copper at 21@20c. Their total sales up to date have been probably not more than 15,000,000 lb., which is a mere bagatelle in comparison with what has to be sold ordinarily in order to dispose of the American output. The large producers have made no unqualified sales. Last week they said they would sell at 23c. and guarantee that price against themselves, i.e. if A. B. sold copper to C. D. at 23c. and before delivery was made he should sell E. F. at 20c., then C. D.'s copper would be billed to him at 20c., not 23c.; but the sale of copper by other producers would not modify A. B.'s contracts. We believe that the above is a correct statement of facts so far as things have yet developed. We may add, however, that the British government is offering its accumulation of electrolytic copper at £105, to meet which price producers would have to sell here at an equivalent that is variously reckoned at 18½@19c. Furthermore, that standard copper is quoted in London at a considerably lower price.

Before passing into the field of opinion, we may mention, also, that the foreign governments have put obstacles in the way of the transportation of metals to their countries, and American producers temporarily are deprived of a European outlet. This is true not only of copper but also of zinc and lead. Sellers who have tried to feel those markets have run up against a blind wall, which they cannot describe exactly, but respecting the existence of which they have no doubt. In the meanwhile, American consumers have professed an absence of interest. The few who really needed a little copper could get it from sellers at 20 cent.

With the situation that has thus developed there cannot be said to be any copper market in the major sense, for an average of one million pounds per day does not cut much of a figure in comparison with the eight million that ought to be sold daily. Nor is there any free offering, any general effort to make a market. It can neither be said that copper is offered in volume at 20c., nor that consumers could obtain it at that price if they wanted to buy it liberally. Indications of any such desire on their part would probably cause the small producers to raise their prices. The dominant feature is that there is no real market, owing to the big producers being out of it. We do not think the big producers are holding aloof with intention of enforcing an arbitrary price nor that they are acting in collusion. They are probably swayed, however, by a reluctance to force copper in a market wherein but few buyers are yet intimating any interest.

Aid for War-Minerals Producers

ON DEC. 15 Senator Henderson introduced a bill in the Senate for the relief of mines and miners who have suffered through the production or contemplated production of the so-called war minerals. This bill appears in full upon another page of this issue.

We have two particular criticisms to make of the proposed measure. If its enaction is necessary or strongly advisable, its provisions should be broad enough to cover all other producers who have suffered through our participation in the war, not yet provided for by previous legislation. The amendment in its present form should have a title reading somewhat as follows: "A bill to create endless work for the Interior Department, and a cemetery for the blasted hopes of those who, at one time, classed themselves as patriots."

There have been losses among miners who can ill afford them, and there will be discomfort and perhaps suffering in their families owing to the fact that the war unexpectedly came to an end on Nov. 11. But miners of the metals and substances mentioned in the original bill to which this is an amendment are no greater sufferers than the thousands of others who were producing or attempting to produce raw and manufactured articles needed during the war period. Producers of food, such as the farmer and the gardener, have been fully protected by the law of supply and demand, now acting strongly in their favor. The farmer was further protected by the Government guarantee on his wheat. Manufacturers with Government contracts were also fairly well protected, but the millions of their employees and the dependents of those employees—the actual producers of the guns, ammunition, and clothing—are as keen sufferers as those who have put their small capital into mines or plants which are now idle. "Every man for himself and the devil take the hindmost" may be accepted as a good business maxim in some quarters, but if the miners can "put one over" on the rest of the people that circumstance will not in any degree indicate a desire to conform to or to promote correct business principles. As a matter of fact it is not good business, because it is not honest. We are not any harder hit than thousands who are not miners; we did not go into the business with the understanding that the Government was going to make good our losses if we failed. Few of us went into the business for patriotic reasons. We went after manganese and chrome ores because the prices for these ores were high, and we believed that we could get in and make money. We were certainly led to believe that the prices were going to stay high for a time through the information given out by the Government in respect to stocks, demands, and importation; and, had the war continued, some of us would have made good, though many would not have done so.

The Government certainly stimulated production, but it did so because it gave out all the information it possessed, not through misrepresentation. Because ore resources somewhat exceeded expectations, and because the war came to an end before profits had equalled expenses, it is scarcely a square deal to the rest of the people who have to pay the bill to ask the Government to meet the losses.

There is another way of looking at this question of miners' losses. Let us honestly ask ourselves the question as to how much longer we would have liked this war to have gone on. There is not one good American —not one with real red blood in his veins ready to spill if demanded of him—but would say that he was glad to see it stop the day it did. What suffering may have resulted from its continuance we cannot guess, but the money equivalent, presuming that it could be measured in such terms, certainly would have reached many times that indicated by the cost of a manganese log washer. Our dose of medicine has been small compared with that accepted by those who have lost relatives dearer than life itself. Let us live up to our reputation of being men, and take our losses like men who play the game for what there is in it, and ask no favors at the table except that the cards be dealt fairly.

When it comes to the administration of the proposed law, the line of justice will be most difficult to discern, because all the wolves will be dressed in lambs' clothing. We do not wonder at Secretary Lane hesitating to take action with the authority of powers already delegated to him; and he and his department have our sincere sympathy if he is ultimately required to administer justice under the proposed amendment.

Some Views of Labor

It is important always to get many views. The New York *Sun* recently sent a representative to ascertain and report respecting the conditions in the important manufacturing and munitioning city of Bridgeport. He submitted an illuminating report. Among other things he mentioned a conversation with Sam Lavitt, business agent of the machinists' union.

"Cancellation of war contracts," said Mr. Lavitt, "has practically closed the small shops, which laid off a majority of their men two or three weeks ago. These men can get other jobs, but won't take 'em."

"Why not?" the *Sun* reporter asked.

"Because the war standard of wages must be maintained," said Mr. Lavitt. "The manufacturers want to pay 65c. an hour to toolmakers who have been getting from 80 to 90c., and 45 or 50c. an hour to machinists who have been getting from 60 to 80c. The manufacturers are trying to break down the standard, and the men won't stand for it.

"We have a program that would prevent both wage cuts and lay-offs. That is, let the manufacturers continue to pay the same wages they have been paying and if necessary reduce the number of hours so that everybody could keep working at the old wages until we get adjusted to peace production and the hours could be increased. Suppose a factory has 1000 men and now has work for only 500. Instead of laying off 500 let it cut the working day from eight to four hours, and keep on that way until business picks up."

Mr. Lavitt's ideas reflected, of course, the ancient fallacy respecting the advantage of breaking window panes in order to make work for the glaziers. The general adoption of such ideas would turn civilization backward on the road leading from the condition when men lived in caves, wore the skins of animals and lived by trapping and fishing; from which state the civilized world has progressed slowly and painfully.

The people of the country paid the ransom demanded by the railroad brotherhoods. Mr. McAdoo, after he became Director-General of Railways, advanced wages some more, and then all around. It has been notorious, however, for some months that nobody was happy. The shippers of freight and the travelers were disgruntled by the increased costs to them, which were directly due to increased wages. But the recipients of the increased wages were even more unhappy. Things were all right so long as Mr. McAdoo did business only with the big brotherhoods; but when he undertook to improve the situation of everybody working on the railways he unbalanced the schedules. A man may be perfectly contented with his pay, but if he finds another man, whom he knows to be of inferior capacity and to be doing inferior work, getting just as much, or nearly as much, his contentment quickly vanishes. This is what happened on the railways.

It is shrewdly conjectured that one of the reasons for Mr. McAdoo's retirement is the mess that has been made of the railroad situation. The public is dissatisfied, and so are the employees. It was manifestly necessary to exercise considerable ingenuity to produce conditions that satisfy nobody.

The Journal Index

The Index for Vol. 106 will be issued sometime in February. Subscribers who wish a copy of the Index will please promptly notify the Subscription Department of the *Engineering and Mining Journal* by postcard.

When trade with Russia can be resumed, the American producers of metals should sell directly to the Russians. This would not merely save the European middleman's profit, but would also give the producers the enormous advantage of knowing as soon as the Germans, the English, and the French, what the demand in Russia is, and will be; and would, furthermore, preserve to American bottoms freight which heretofore has moved in foreign bottoms, principally German.

BY THE WAY

The New York *Times* stated on Jan. 8 that British capital is about to establish in Mexico a bank to be known as the Mineral Bank, which will make a specialty of loans on mining properties and also purchase partly developed claims.

Felix Frankfurter said in an interview published Dec. 15 in the New York *Times*, while discussing the labor problem, "It was no field for outside, dilettante interest." This led *Industry* shrewdly to wonder if that does not explain the failure of Mr. Frankfurter's War Labor Policies Board.

Promontory was a new place, where they had no "Hotel and Restaurant Keepers' Mutual Protective Association," wrote Dan De Quille in the "Great Bonanza." A Comstocker went out to Promontory to prospect; and when dinner was ready the landlord took a double-barreled shot gun from behind the bar, and stepping out in front of his house, fired off one of the barrels.

The Comstocker, who had followed him to the door to see what was up, said to him: "What did you do that for?"

"To call my boarders to dinner," said the landlord.

"I see," said the Comstocker, "But why don't you fire off both barrels?"

"Well," said the landlord, "you see, I have to keep the other to collect with."

J. Rambosson, of the French Academy of Sciences, in 1870 published a work entitled "Les Pierres Precieuses et les Principaux Ornements" ("Precious Stones and the Principal Ornaments"). He first describes the more important precious and semi-precious stones; then ivory; next the metals are taken up—first gold, then silver, then platinum; and lastly, to one's surprise in these days of its great commercial application, aluminum. In fact, to it Rambosson gives five times as many pages as to platinum. He states that because of the lightness of aluminum, one kilogram, valued at $60 (equivalent to about $27 per lb.), may replace four kilograms of silver, worth from $160 to $180, that is, aluminum was then from 33 to 50% more expensive than silver. Rambasson is of the firm opinion that because of the metal's beauty it will have a wide use in jewelry and the arts. The world moves, and in 1914 about 68,000 tons of aluminum was produced, and a kilogram was then worth about 40 cents.

There is nothing vague or incomprehensible about Bolshevism as it is explained in *The New Europe* by M. Rostovtzev, who says a group of agitators, almost microscopically small in the beginning, as compared with the whole population of that great country, raised themselves to power by the promulgation of a watchword of wonderful simplicity. It was as brief as simple—"Steal what has been stolen"—and to be perfect for its purposes it needed only the addition that was promptly made—"Kill those who resist." The result in Russia, as M. Rostovtzev says, has been what might be expected. "Civil liberty," he writes, "has been trampled on; there is no trace of personal freedom; unrestrained tyranny and bureaucracy reign supreme. Russia produces nothing and lives with difficulty on what was accumulated formerly, on the remains of its material and spiritual capital. The result is famine, cold, and cruel death, hovering over every man and waiting him at every crossroad."

"McDermott, recently appointed manager of the Ivanhoe, is one of a small group of Maorilanders, including J. A. Agnew and W. A. Macleod, who have made good in Westralian mining," says a writer in the Sydney *Bulletin*. "Formerly underground boss of the show he is now running, McDermott went to the Sons of Gwalia, mainly on the advice of Govett, Ivanhoe's chairman of directors, when that property was in a state of disintegration owing to bad handling. He put the show on its feet again, and a grateful company sent his salary up to £2000 a year. On the demise of Bob Nicolson, Ivanhoe's manager last year, Govett, remembering McDermott's work at the Gwalia, selected him to the gilded billet, worth £3500 a year, from hundreds of applicants all over the world. The Gwalia has made other reputations. Here W. J. Loring, a 'newchum' from the United States, got the chance of his life. Agnew was another helped on the upward path by the Gwalia, and so was H. C. Hoover, now U. S. Food Controller and mentioned freely as a future president of the Republic—a pallid, slimly built individual who eyed you furtively and didn't say much. He established the system of allocating costs of mining, treatment, and development to the separate departments, instead of the old-time generalization of expenditure, which made it difficult to discover waste and incompetency and sent good mines on the rocks. Macleod did not owe anything to the Gwalia, but came west from Charters Towers to take full charge for Bewick, Moreing & Co. on the recommendation of Dr. McLaren, the geologist (another Maorilander), and has since drifted to London in a superior capacity for the firm."

"So many o' these 'ere h'accidents can be prevented, m'son, if a man 'as proper h'understandin' o' things," said Cap'n Dick. "So h'often man says one thing w'en, dam-me, 'e means t'other, an so ut's naw wonner as 'ow there's confusion an h'accidents. Naow, 'ere's story 'baout 'Arry Pollard so thee'll naw w'ot I'm drivin' to. 'Arry, as thee may 'ave 'erd, wuz 'andy at fitin', but 'ol bloody trouble wuz 'e wuz h'over-confident. 'Ere 'e wuz braggin' 'baout w'ot a fiter 'e wuz, till, dam-me, one day long comes young feller 'oo said e'd 'ave a go with un. So ussen h'arranged one o' these 'ere bouts. 'Arry, 'e 'ad to 'ave a second, so Jan Kevern said 'e'd bear un h'out, an' so they started. Firs' raound this 'ere young chap, h'Irish 'e were, 'e druv 'Arry to one corner, poundin' 'im 'baout tha 'ead an h'eyes sumpin' h'awful. But 'Arry, 'e wuz smilin' as 'e went to corner, an' sez 'e to Jan, ''Ow ar't gawin' naow, Jan?' ''Andsome, 'Arry, 'andsome. Thee's lookin' like a bloody lion,' sez Jan. 'Gos h'up, naow, an scat to un next raound, 'Arry.' So 'Arry, 'e h'up an pasted, an, dam-me, did'nt seem to 'it nawthin' but h'air. W'en time wuz called for second raound, 'Arry, 'e sez, 'Jan, 'ow's makin' it naow? Better this time, was'nt un?' 'Oh, dam-me, m'son,' sez Jan, 'Th'art lookin' like a bloody lion. Gos on, naow, do; thee surely can clean un this raound.' So 'Arry 'e starts third time. Afore long 'e wuz wobblin' from side to side, an' this 'ere h'Irish chap wuz rainin' blaws somethin' h'awful. Short while, an' dam-me, 'ere wuz 'Arry flat on 'is back. So we 'ad to carry un h'out an give un h'air. W'en 'e come to, firs' bloody thing 'e said wuz, 'Well, Jan, 'ow's lookin' naow?' 'Like a bloody lion you,' sez Jan. ''Ere naow, Jan, don't believe th'art ever seen one o' these 'ere lions,' sez 'Arry. 'Coorse I 'ave,' sez Jan. 'Doan thee remember tha one ol' Mother 'Oney used to 'ave in 'er bairn, in ol' country, with gert flat h'ears?' 'Gos along, do, Jan; tha wer'nt no bloody lion; t'were a jackass." 'Well, 'Arry.' sez Jan, ''im were w'ot I meant.'"

Personal

Have You Contributed to the Association of the 27th Engineers?

Martin Schwerin is now in Cave in Rock, Hardin County, Ill., where he will remain for some time.

Herbert C. Hoover has been promoted to the grade of Commander in the Order of the Legion of Honor.

A. D. Nicholas has been appointed controller for the Calumet & Hecla Mining Co. and all subsidiary companies.

A. J. Edwards, of Batesville, Ark., has been made director of the newly created war-minerals section of the American Mining Congress.

Major John C. Greenway will soon return to Bisbee, Ariz., to resume his duties as general manager of the Calumet & Arizona Mining Company.

E. R. Watson has been elected president of the Balbach Smelting and Refining Co. He is a member of the law firm of Barber, Watson & Gibboney.

R. R. Seeber, mining engineer, formerly manager of the Winona Copper Co., Winona, Mich., is now in the lumber business at Dalhousie, New Brunswick.

Capt. Percy E. Barbour has been transferred from the 150th Engineers, Camp Shelby, Miss., to the 212th Engineers, at Camp Devens, Massachusetts.

Algernon Del Mar has left Superior, Ariz., and is erecting a concentrator for the Montezuma Mining and Reduction Co., near Big Pine, Inyo County, California.

C. E. Addams, formerly general manager of the Ray Hercules Copper Co., Ray, Ariz., has resigned as vice-chairman of the Arizona Council of Defense.

Harry Reeder, formerly engineer for the Isle Royale Copper Co., Houghton, Mich., has been appointed superintendent of the Naumkeag Copper Co., to succeed **Sidney S. Lang.**

E. M. Hamilton, metallurgical engineer, of the firm of Hamilton, Beauchamp, Woodworth, Inc., San Francisco, Calif., has gone to Parral, Mexico, where he will remain for about two months.

D. Sloane, manager of the Davidson Gold Mines, Ltd., of Porcupine, Ont., has resigned to accept a position with the Hollinger Consolidated Gold Mines, Ltd. **N. J. Evered** is his successor.

James Colquhoun, formerly president of the Arizona Copper Co., and now a resident of Tunbridge Wells, England, lately returned from Russia, having gone through all of the revolution there.

Holman I. Pearl, mining engineer, of Crosby, Minn., is spending the month of January in oil-examination and geological work in the Gulf Coast area and in southern Alabama and Mississippi.

F. E. Bourget has resigned from the U. S. Fuel Administration, Washington, D. C., and has been appointed special sales agent for the Interstate Coal and Dock Co., with headquarters at Cincinnati, Ohio.

R. L. Lee has been relieved from his duties in the metallurgical section of the U. S. Ordnance Department, and is now superintendent of the Arizona Smelting and Power Co., at Benson, Arizona.

William A. Burr, mining engineer, is recovering from injuries received in an accident last June, while on his way to Mexico. He is now visiting Arizona plants, but intends resuming his trip to Mexico soon.

Arthur L. Sweetser, mining engineer and chemist, has withdrawn from the editorial staff of the *Engineering and Mining Journal* and has sailed for Antofagasta, Chile, as metallurgical chemist for the Penyon Syndicate.

James M. Platt, assistant manager of the Sociedad Explotadora de Caylloma, Cons., operating mines at Caylloma, in southern Peru, has resigned to become mine superintendent of the La Blanca properties at Pachuca, Mexico.

Norman L. Bowen, for some time with the U. S. Geological Survey, has been appointed professor of mineralogy at Queen's University, Kingston, Ontario. During the war he successfully experimented in making optical glass.

William H. Hampton, metallurgical engineer, who was in charge of the miscellaneous gas defense apparatus department, General Defense Division, Chemical Warfare Service, U. S. A., has resumed his engineering practice.

K. B. Thomas has resigned as superintendent of the sulphuric-acid department of the Calumet & Arizona Mining Co., Douglas, Ariz., to become general superintendent of the Standard Chemical and Oil Co., of Troy, Alabama.

Robert W. Hunt was given a dinner in Chicago, on Dec. 9, on the occasion of his 80th birthday. A resolution extending greetings and congratulations, passed by the directors of the American Institute of Mining Engineers, was presented to him.

Prof. C. K. Leith recently sailed for France to act as mineral adviser for the U. S. Peace Commission. With him were **B. M. Baruch,** chairman of the War Industries Board, **Vance McCormick,** chairman of the War Trade Board, and **Walter Tower,** of the Shipping Board.

H. DeWitt Smith, superintendent of the United Verde Copper Co., Jerome, Ariz., who was called into the aviation service during the war, is among those returning to the company; likewise **Clarence V. Hopkins,** chief engineer of the company, who has been discharged from the service.

C. R. Seabrook, formerly structural engineer of the Chile Exploration Co., at Chuquicamata, Chile, and recently engaged in the Air Nitrates Division of the Ordnance Department, U. S. A., has accepted the position of structural engineer with the H. M. Lane Co., of Detroit, Michigan.

G. T. Hansen, manager of the Allis-Chalmers Manufacturing Co., Salt Lake City, and **F. B. Weeks,** engineer of the United States Refining, Mining and Exploration Co., Salt Lake City, recently made a final examination of the Lucky Deposit copper mine, situated at Aurum, White Pine County, Nevada.

R. H. Stewart, mining engineer, of Vancouver, B. C., has been appointed by the provincial government to direct the adjusting of the income tax to which the mining companies operating in British Columbia are subjected. He will review the companies' balance sheets from a technical point of view.

Henry Bruere has resigned as Federal director of the U. S. Employment Service for the State of New York. He will remain with the service as chairman. His successor as executive head of the service is **Dr. George W. Kirchwey,** who was assistant Federal director for New York State and at one time dean of Columbia University.

F. D. Baker, mechanical engineer, formerly engaged in mechanical and mill-design work in Colorado, and chief engineer of construction work for the Colorado department of the American Smelting and Refining Co. since its organization, in 1899, retired from the latter position on Jan. 1. He will be associated with his sons in consulting work in mine, mill, and mechanical practice in Denver, Colorado.

W. B. McKinlay has returned from Cuba and is now in New York. Others who have been in the city during the last week and who registered at the office of the American Institute of Mining Engineers were T. C. Roberts, Perth Amboy, N. J.; William T. Bates, Mascot, Tenn.; Capt. E. H. Clausen, Washington, D. C.; W. F. Ferrier, Ottawa, Canada; L. E. Booth, Anaconda, Mont.; Lieut. M. S. Mazansy, Camp Custer, Mich.; and C. W. Cromwell, Warren, Arizona.

J. R. Finlay is spending the winter at Tucson, Ariz. He is devoting a good deal of time to the revision of his book on the cost of mining, which will make it practically a new treatise, and is planning to introduce about 15 entirely new chapters, to condense and alter the old ones and to bring the statistics up to date. He also purposes discussing, with reference to coal and iron, the industrial clearing houses, the nature and use of capital, the international importance of mineral industries and resources, the community and national level of efficiency, broad geological facts, and other important related subjects.

Obituary

Martin Pattison, president of the Denn-Arizona Copper Co., died at his home in Superior, Wis., on Dec. 20, aged 78 years.

Manville Hendricksen, mining engineer, died on Dec. 19, aged 26 years. He was born in Grafton, N. D., and was a graduate of the University of Wisconsin.

Dr. L. P. Morgan died recently in San Diego, Calif., of pneumonia. He was interested in the International Syndicate of Mines and Smelters, and had important interests in Copper Basin, near Prescott, Arizona.

L. S. Woodbury, founder and president of the Great Falls Iron Works, Great Falls, Mont., died on Nov. 22 at the Hudson Sanitarium, Hudson, Wis., following a stroke of paralysis. He was born in 1838, in Nashua, Hillsboro County, N. H., where he received his education. When he resigned as general manager of the Canadian Copper Co.'s mines in Sudbury, Ontario, in 1890, he went to Great Falls, Mich., where he organized a company of his own, the Great Falls Iron Works. He was a member of the American Institute of Mining Engineers and the American Society of Mechanical Engineers.

Societies

Canadian Mining Institute will hold its twenty-first annual meeting on Mar. 5-7, 1919. An effort will be made to celebrate fittingly the conclusion of the war. Members have been advised that interesting papers are desired, especially those of a practical nature relating either to mining or metallurgy.

American Institute of Mining Engineers, Columbia section, elected J. C. Haas chairman at the annual session recently held in Spokane. William J. Hall, of the Federal Mining and Smelting Co., Wallace, Idaho, was elected vice-chairman, and L. K. Armstrong was reëlected secretary-treasurer. The section has 196 members, of whom 20 are in the Army.

Institute of Chemistry (British) held a meeting of its council on Nov. 29, at which the formation of local sections at Birmingham, Swansea, and Dublin, was duly confirmed. The finance committee submitted a further report on the subject of raising the annual subscriptions of members and students to whose interests the additional income will be devoted in every possible way.

American Society of Mechanical Engineers announces that hereafter it will compile and publish the "Engineering Index," which has been published for 25 years in the *Engineering Magazine* and its successor, *Industrial Management*, and universally regarded as a standard index to engineering periodical literature. The first issue of the "Index" under its new management will appear in the January number of the "Journal" of the Society.

Industrial News

Union Carbide Sales Co. announces that, as the war is over, no difficulty will be experienced in obtaining prompt shipments of Union carbide.

Syracuse Smelting Works, of Brooklyn, Chicago, and Philadelphia, will hereafter conduct the sale of its products under the name of the parent company, "United American Metals Corporation."

Consolidated Steel Corporation announces that it is now prepared to receive and give prompt attention to all export inquiries for steel products. Its new offices are at 165 Broadway, New York. In addition to E. A. S. Clarke, who was chosen president of the company, the following have been elected: Vice-president, H. H. Barbour; secretary and controller, L. W. Hesselman; treasurer, A. Van Winkle; and traffic manager, William Hayman.

New Patents

United States patent specifications may be obtained from *The Engineering and Mining Journal* at 25c. each. British patents are supplied at 40c. each.

Acid-Concentrating Apparatus. John Patten, Baltimore, Md. (U. S. No. 1,286,188; Nov. 26, 1918.)

Acid-Concentration, Apparatus for. John Patten, Baltimore, Md. (U. S. No. 1,286,080; Nov. 26, 1918.)

Amalgamator, Centrifugal. Albert J. Anderson, South Pasadena, Calif. (U. S. No. 1,284,963; Nov. 19, 1918.)

Copper, Lead and Phosphorus, Composition of. George P. Kline, Moline, Ill. (U. S. No. 1,285,231; Nov. 19, 1918.)

Flotation Apparatus. Arthur C. Daman, Denver, Colo. (U. S. No. 1,285,061; Nov. 19, 1918.)

Flotation—Apparatus for Separation of Minerals. Frederick D. S. Robertson, Toronto, Ontario, Canada. (U. S. No. 1,286,111; Nov. 26, 1918.)

Furnace Construction. William S. Robinson, Benton Harbor, Mich. (U. S. No. 1,286,114; Nov. 26, 1918.)

Editorial Correspondence

SAN FRANCISCO—Jan. 11

The Gold Mines in Amador County of California are again full handed and are turning applicants away. This is because of the stoppage of the Liberty shipyard building on San Francisco bay; and it is expected that the copper curtailment about to take place will give the other gold mines practically all the miners they can use.

A California Chapter of the American Mining Congress is in process of being organized. The organization meeting, having been postponed on account of influenza in October, will be held at the Palace Hotel, San Francisco, on Jan. 15 and 16. It was called by a committee formed at the time of the visit of James F. Callbreath, secretary of the parent body. This committee is composed of Albert Burch, L. D. Gordon, Capt. John Barneson, Fletcher Hamilton, of San Francisco, and Philip Wiseman, of Los Angeles. It is hoped to interest representatives of all branches of metal mining and the petroleum industry. These interests are in need of the legislative assistance that the Mining Congress has been striving to obtain for its chapters in other parts of the West.

DENVER—Jan. 10

Committee on Mines and Mining of the Colorado State Senate is composed of the following: John H. Slattery, chairman; Walter F. O'Brien, Siewers Fincher, Henry O. Andrew, John J. Tobin, W. W. King, L. A. Puffer, and John B. Stephen.

"Blue Sky" Laws were the subject of considerable discussion at the recent meeting of the Colorado Metal Mining Association, and bid fair to receive much attention in the new Legislature now in session. After correspondence with 29 states which have "blue sky" laws, Dudley B. Humphrey has prepared the draft of a bill which has caused lively interchange of opinion and discussion among mining men. Among miners of the state there is a feeling against the establishment of a commission to control stock operations, and against the growth of commissions generally. The average citizen appears to resent being told by any commission how he shall invest his money, or in what stocks he may gamble. However, no one seems to disagree with the proposal that there must be new legislation designed to curb the irresponsible promoter and punish those who deliberately misrepresent the possibilities of mining securities.

SALT LAKE CITY—Jan. 10

Mining in Utah is facing the problem of adjustment to post-war conditions. The question is complicated by the more or less artificial conditions prevailing during the latter period of the war, price fixing and other emergency regulations, and the war demand for minerals. Copper and lead producers are feeling the fall in prices most heavily, but the steady price of silver is helping the situation in the state, especially as to lead ores in which silver is also present. The problem in the matter of labor supply has been reversed, and mining companies are facing the question as to what proportion of their men not needed in production can be turned to development work and how large a proportion will have to be discharged. Labor is still high, and the excessive cost of materials precludes the undertaking of too much dead work, especially that requiring the use of timber and other materials. The Utah Copper Co. is cutting down both its output and its working forces. Smaller companies are doing the same. In general, the industry may be said to be in a waiting position pending the stabilization of prices and the more regular operation of the law of supply and demand.

Production of Potash From Leucite rocks of Wyoming has attracted Utah capital. Articles of incorporation of the Liberty Potash Co. were recently ready for recording with the Secretary of State. The capitalization stated is $11,000,000, of which $1,000,000 is preferred. The company has holdings of 2030 acres containing leucite lava flows, 50 to 75 ft. in thickness, at Superior, near Green River, Wyo. A spur has been extended from the Union Pacific R. R., and a plant is being built about a mile from Green River. About 120 men are employed. The process will consist of roasting the finely crushed rock with salt and limestone to obtain potash in the form of chloride. Work will be done on a large scale. Cheap fuel will be obtained from the Wyoming coal fields. There is no question regarding tonnage of leucite rock available, which carries 10% and upward in potash, if the process works out commercially on a large scale as indicated by the experimental plant. Those interested are T. W. Boyer, president; Guy Sterling, J. B. Scholefield, Moylan C. Fox, and E. M. Allison, Jr., of Salt Lake City; A. Kendall, Rock Springs, Wyo., and P. J. Quealy, Kemmerer, Wyoming.

PHOENIX, ARIZ.—Jan. 10

Curtailment in Arizona Copper Activities has begun in the larger properties. For some time there has been a tendency in this direction on the part of smaller operators. As indicated several weeks ago, the Shannon has ceased mining operations at Metcalf and has announced that smelting will stop at its Clifton plant as soon as ore supplies are exhausted. Old Dominion, at Globe, has shut down, though this was caused by sabotage within its works. Whatever the cause of the outrage, it has served to throw out of work about 1500 employees of a company noted for its liberality and consideration for its men. Local labor representatives claim that 500 men are unemployed at Clifton, 1600 at Bisbee and Douglas, and about an equal number at Ray and Hayden, though these statements may not have an accurate basis. They claim, also, that many miners are arriving in Arizona camps from Butte and other northern points. It would appear that Arizona, for the first time in years, is beginning to have a condition of unemployment. Already there is agitation in favor of starting large road works. The Bisbee mines, particularly, have announced that they are about to start upon an extensive development campaign, for their reserves, particularly of the higher grades of ore, have been seriously depleted by war demands. This policy is expected to provide work for possibly a third of the men who have been on the payroll of some of the larger copper producers. Possibly seizing upon the necessary curtailment of employment as an excuse, many I. W. W. are reported to be flocking into Arizona and to have started their work of trouble breeding.

JOPLIN—Jan. 11

The Premier Mine, at Picher, Okla., has paid $80,000 in dividends and has $30,000 in the treasury after paying off $40,000 of debts. Operations were started at the Premier in February, 1918, and it has been a large producer of lead as well as of zinc blende. A. M. Gaines, of Joplin, is manager.

Proving of a New Sheet Ground Field south of the old camp of Granby is continuing. During the last week in December, Heaton & Hodges put down an eight-inch hole through 205 ft. of lime and 30 ft. of overburden into sheet-ground formation similar to that reported in previous strikes in the section. The hole was drilled so that a Pomona pump may be installed immediately for shaft sinking. Two other shafts are being sunk near the first strike on the land, about a quarter of a mile distant, but progress has been slow.

The Tri-State Mine Safety and Sanitation Association is in good financial condition. This is the principal mine operators' organization in the field at present. The semi-annual report of A. E. Bendelari, treasurer, made at the last meeting, showed that, though expenditures during the last six months were $3616, there was a balance in the treasury of $1107.65 on Jan. 1. Most of the expenditures in the last half year were made in an effort to better the zinc-ore market. A number of committees have been sent to Washington, and some good has been accomplished.

Hope in the American Zinc Institute has revived, in the Joplin district, as a result of the announced early departure of George C. Stone, of the New Jersey Zinc Co., to investigate conditions in Europe, looking toward a possible market abroad for American zinc ore or spelter. It is understood that, though Mr. Stone's appointment was made by Pope Yeatman, the whole move was really inspired by the Zinc Institute; and that though C. E. Siebenthal was the original choice of C. T. Orr, of Webb City, Mo., president of the Institute, Mr. Stone is entirely satisfactory both to him and to other members of the institute from the district.

The Webber and Pelican Mines of the Commerce Mining and Royalty Co. are making a recovery that is exceptional even for the rich mines of the Oklahoma-Kansas section of the zinc and lead field. The Webber is situated in Kansas, across the state line north of Picher, and has been in operation since last June. On account of a poor ore market, production has not been pushed and the mill has never put on more than one shift. The mine, nevertheless, has been a large producer and much ground has been cut out. Last week, the mill recovered from the ore as taken from the ground 17% of its weight as blende and lead (locally termed 17% recovery). The Pelican is a new mine, recently opened, situated southwest of the Webber and across the state line in Oklahoma. Its mill recovery last week was 16% blende and lead (in the language of the district). Though recoveries higher than these have been reported from time to time, they are exceptional, and rarely does a mine that has been operated for eight months show a recovery above 10% from the run of mine material.

HOUGHTON, MICH.—Jan. 7

The Seneca Shaft cut the Kearsarge lode on Dec. 28 at 1625 ft. depth and has penetrated it for some distance. Thus has been proved the correctness of diamond-drill interpretation and of the showing made in the Mohawk and Ahmeek properties adjoining. The lode material appears to meet requirements and carries little mass copper, in which the new opening is in line with the general characteristics of the formation. The copper content is estimated at about 30 lb. per ton at the point cut. Shaft sinking will continue through the lode and beyond for at least 700 ft. more.

BOSTON—Jan. 2

Actions To Recover Taxes Illegally Assessed from 1913 to 1915 were recently filed in the U. S. Court in Boston by 15 copper companies. Total involved is $384,000. Papers were served upon the Collector of Internal Revenue. Actions were based upon interpretation of terms "capital" and "income" as applied to copper companies. Calumet & Hecla filed an action for $125,000. Other plaintiffs are the Champion Copper Co., Allouez Mining Co., St. Mary's Mineral Land Co., Copper Range Co., Assignee Baltic Mining Co., Ahmeek Mining Co., Trimountain Mining Co. and Osceola Consolidated.

VICTORIA, B. C.—Jan. 10

An International Mining Convention will be held in Vancouver, B. C., some time during March, 1919. It had been proposed that this gathering should be called for January, but a postponement to the latter date has been agreed upon by the members of the Vancouver Chamber of Mines. The convention has the endorsement of William Sloan, Minister of Mines, and the resident mining engineers of the various mining districts of the province are expected to take an active part. The proceedings are likely to be of special importance because of the problems bearing on the mining industry and the reconstruction period that will come up for consideration.

TORONTO—Jan. 11

Cobalt Mines are hampered from power shortage due to a breakdown of part of the equipment at the Matabitchewan power plant. One of the large castings set in concrete that led from the penstock to the turbines has cracked badly, and necessitated a shut-down of the unit. The accident occurred a couple of months ago, and much dissatisfaction has been expressed at the length of time it is taking to make repairs. Some of the mines have had to start up compressor plants which have not been in use for years, and there is talk of a couple of the deeper mines having to shut down altogether.

The Mining News

ALASKA

KENNECOTT (Kennecott) — December production of copper was 14,114,000 lb., including the output of Braden Copper Company.

ALASKA GOLD (Juneau)—In December milled 117,310 tons of ore, averaging $0.983 per ton. Extraction was 80.57%; tailings loss 19.1c. per ton.

ARIZONA

Cochise County

COPPER QUEEN (Bisbee)—Has paid bonus to 1400 employees of mines and smeltery of $96,040, based on second year's service. Same system effective in Calumet & Arizona mines and works. Bonuses to be paid monthly, on expiration of employees' year or two-year periods of service.

PHELPS DODGE (Bisbee)—December production of copper was 12,563,000 lb. for all properties.

SHATTUCK ARIZONA (Bisbee)—December output was: Copper, 506,332 lb.; lead, 401,593 lb.; silver, 21,506 oz.; and gold 85.98 oz. Output for 12 months was: Copper, 9,081,959 lb.; lead, 2,420,690 lb.; silver, 161,230 oz.; and gold 1220.12 ounces.

CALUMET & ARIZONA (Warren)—December production of copper was 3,094,000 pounds.

Gila County

LONDON-ARIZONA (Chilito)—Internal affairs adjusted and plans made to resume operations. Several profitable leases expired with end of year. Company plans to ship to Hayden, and to Lavelle company plant as soon as latter is completed.

OLD DOMINION (Globe)—This and Arizona Copper Co.'s mines forced to close down on Jan. 8 when electrical equipment of Old Dominion flotation mill was put out of operation by bolt thrown into motor, destroying windings; 1500 men idle in consequence. Sabotage held responsible. December copper output of Old Dominion was 2,686,000 pounds.

INSPIRATION (Miami)—December production of copper was 7,350,000 pounds.

MIAMI (Miami)—December production of copper was 4,989,435 pounds.

Greenlee County

SHANNON COPPER (Clifton)—December output was 688,000 lb. of copper.

ASH PEAK (Duncan)—Goldfields Consolidated sunk main shaft to 800 ft. under lease and option. Charles Starr, manager.

ASH PEAK EXTENSION (Duncan)—Working small force. J. Horgan, superintendent.

Maricopa County

ABE LINCOLN (Wickenburg)—Shipping high-grade chalcopyrite ore from tunnel, which is being driven to cut new 700-ft. shaft about 280 ft. from surface. C. E. Nathorst is manager.

Pima County

NEW CORNELIA (Ajo)—December production of copper was 4,248,000 pounds.

Pinal County

MAGMA CHIEF stockholders have ratified purchase of Sombrero Butte property in Copper Creek district. Exchange of stock will be at par.

GOLDEN BELL (Kelvin)—Station cut at 200 level and drifting in progress on two feet of copper ore.

TROY ARIZONA (Kelvin)—Retimbering of Alice tunnel completed, and tunnel equipped with new rails. No. 5 Buffalo blower, driven by gasoline engine, installed to afford ventilation at face. Development now in progress on low-grade ores opened up when tunnel was originally driven.

RAY CONSOLIDATED (Ray)—December production of copper was 5,800,000 pounds.

QUEEN CREEK (Superior)—Shipments of copper ore begun. Sinking continued with good results.

SILVER KING (Superior)—Operating 30-ton Marcy mill, with flotation equipment. Second mill ordered. Five tons of concentrates shipped to El Paso sampled $1500 a ton, mainly in silver. Main shaft retimbered to 400 ft. Management claims development of 10,000 tons of ore sampling above $20.

Yavapai County

COPPER KING (Hillside) — Shipping 45% zinc ore by motor truck to railroad from property near Bagdad in Eureka district. Operated by Hillside Development Co. E. D. Gluwas in charge.

JEROME-PORTLAND (Jerome)—Reorganized as Jerome-Bisbee, with stock exchange at par. Receiver R. B. Westerveldt, of Prescott, discharged. President is George Brookshire, former owner of ground; L. H. Beyerle, of Prescott, secretary. Exclusion made of 11,000 shares issued by former manager, A. B. Frame. Property has 500-ft. shaft and 2800 ft. of development work.

PITTSBURG-JEROME (Jerome) — To resume operations under C. C. Arata, to follow streak of glance ore found on 500 level.

VERDE COMBINATION (Jerome)—Shaft down 1200 ft. in blue schist and quartz.

ZONIA (Kirkland)—Has changed hands. New owners developing copper orebody and building offices and roads.

SIMMS GROUP (Mayer)—Sold to Halling P. Overton, who will develop property.

MARK TWAIN (Prescott)—Option taken by R. E. Moore, J. F. Healey, and O. F. Smith from Cleveland owners. Mine is old silver producer, with production record of $250,000; opened by three tunnels, tapping 16-ft. ledge.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Trouble with highgraders reported, involving several arrests. New ore disclosed in lower levels. Increased production contemplated. Labor supply better.

PLYMOUTH CONSOLIDATED (Plymouth)—Operating with full crew. Development, retarded by war conditions, now resumed. Mill ran steadily during 1918.

Butte County

WESTERN ORE (Oroville)—Will resume chrome mining, despite market conditions. Contracts with chemical companies said to make resumption possible.

Calaveras County

EASZY BIRD (Mokelumne Hill)—New shaft down 80 ft. Will go to 150 ft. before crosscutting.

Contra Costa County

BUTTERS ELECTROLYTIC ZINC (Martinez)—New machinery installed. Operating on ore from which good results are reported. Thirty men employed. Charles Butters manager.

Humboldt County

CHROME INDUSTRY at standstill. Representatives who were to take up the matter of prices and marketing of chrome and manganese ores and concentrates with American Mining Congress have made no report.

Nevada County

IN GRASS VALLEY DISTRICT, six large mines and several small ones operating full time and employing in all 1200 men. Crews increased at Empire, North Star, Union Hill, Golden Center, Sultana and Allison Ranch. Le Duc and other small mines preparing for increased production.

SAILOR FLAT gravel mines making ready for new development on large scale. Field formerly supported several large operations. Present undertaking by H. L. Engelbright, Dan McFall and other Nevada City mining men.

Placer County

LIBERTY HILL (Dutch Flat)—Dam on Bear River approved by California Debris Commission. Bypass closed and hydraulicking to begin as soon as reservoir is full.

Nevada County

QUAKER HILL (Nevada City)—Machinery installed and ready for resumption of hydraulic mining. Water supplied by 21-mile flume. Operation by New York men. H. L. Engelbright, manager.

San Benito County

NEW IDRIA (Idria)—Old furnace No. 1, in use for 20 years, being torn down. Bricks and stone will be run through new furnace to recover quicksilver. Product hauled by motor trucks to Tres Pinos, 65 miles distant, and shipped by Southern Pacific. H. W. Gould, of San Francisco, manager; 700 men employed at three camps.

Shasta County

MAMMOTH (Kennett)—December output of smeltery was 1,660,000 lb. of copper.

PIT RIVER POWER (Redding)—Contract for deed stipulating price of $194,093 filed with county recorder.

COLORADO

Clear Creek County

WESTERN TUNNEL (Idaho Springs)—Control secured of Vindicator property on Chicago Creek. Systematic development will begin in next 30 days. New compressor ordered. Egan mill to be remodeled and new equipment installed, including flotation unit. Mill operated by water power. Cleveland capital back of enterprise. J. H. Marshall manager.

San Juan County

SILVERTON SHIPMENTS during December were as follows: Iowa-Tiger, 11 cars; Mayflower Leasing, 7; S. D. & G. Lease, 3; Mativi Bros., 2; Dives Leasing, Caledonian Mining and Milling, and Henrietta, one car each; miscellaneous small lots, 23 cars; total, 49 cars.

GOLD KING EXTENSION (Gladstone)—During last few months much underground development and repair work done on Gold King properties, which company is operating. Mill remodeled and new equipment installed. W. Z. Kinney is manager.

San Miguel County

TELLURIDE SHIPMENTS during December were as follows: Tomboy, 35 cars; Smuggler-Union and Black Bear, 90 cars; total, 125 cars.

Teller County

KOMAT LEASING (Cripple Creek)—Company operating Victor mine will drive laterals from 1000 level to prospect ground of Anona Gold Mining Co. Latter's property, including Little Ella, Minnie, Lee, Cactus and Clionian mines, or about 26 acres, has been secured under five-year lease by Komat. Math Korff is general manager.

BLUE FLAG (Victor)—Operations resumed under superintendence of F. J. Yates. Shaft to be deepened from 1227 ft. to 1400 level, where crosscut will be driven to prospect property. Will then raise from 1100 level. Reported ample finances are available to carry out development scheme proposed.

MICHIGAN

Copper Country

ALLOUEZ (Allouez)—Shipped 36,000 tons of rock in December, and 500,000 during 1918.

CALUMET & HECLA (Calumet)—Company and subsidiaries using 42 storage batteries for tram haulage, 12 at Isle Royale, 12 at Ahmeek, 5 at North Kearsarge, and 13 at Calumet & Hecla. Five more ordered for last named. Working satisfactorily. Allouez using all trolley locomotives.

CENTENNIAL (Calumet)—Rock output in 1918 over 170,000 tons, against 148,332 in 1917 and 138,136 in 1914.

LA SALLE (Calumet)—Produced 160,000 tons of rock in 1918.

SUPERIOR (Calumet)—Rock shipments in 1918 approximated 104,000 tons, production for last five years declining steadily.

FRANKLIN (Demmon)—Produced 18,000 tons of rock in December.

HANCOCK (Hancock)—December rock output, 16,000 tons, making 190,000 tons for year

MASS (Mass)—Rock output for December was 20,000 tons.

OSCEOLA (Osceola)—Rock output for December 94,000 tons, making year's total 1,230,000.

MINNESOTA

Mesabi Range

SHIRAS MINE (Buhl)—Failure of miners to notify officials of Oliver Iron Mining Co., operators of property, of a blast in one of the stopes, resulted in injury to three of the men who were making an inspection of the property and entered the room just as the explosion occurred. They were struck by flying pieces of rock.

MISSOURI

Joplin District

C. C. & B. (Joplin)—Making two cars of calamine weekly from output of new mine south of old McGee silicate mine at Duenweg. Mill running only one shift. Ore level at 120 feet

MONTANA

Jefferson County

LEGAL TENDER (Clancey) — Ore shipped from 200 level.

MONEY (Clancey)—Drifting on 140 level and preparing to ship ore mined from shaft.

ANGELICA (Wickes)—Sixty tons crude ore per day shipped to smeltery from Mt. Washington mine.

Lewis and Clark County

BELL BOY (Marysville)—Crosscut encountered gold-bearing ore.

VALLEY FORGE (Rimini)—Stoping and shipping lead-silver ore from above 600 level.

Powell County

MONARCH (Elliston)—Large tonnage of low-grade lead-silver ore exposed in workings. Property taken over by New York-Montana Testing and Engineering Co., Helena. Mill to be built in spring.

Silver Bow County

ANACONDA (Butte)—Announced on Jan. 2 that directors have authorized issue of $50,000,000 ten-year secured gold bonds, one-half of which, known as Series A, to be issued immediately as of Jan. 2. Proceeds to be used for equipping properties of Andes Copper Mining Co. and Santiago Mining Co. and to replace in current account part of company's invested earnings. Andes company has completed wharfs and warehouses at Barquito; has built 58 miles of main line railroad; is building 5½-mile section from mill site to mine, also office buildings and houses for employees. Temporary power plant transmission from coast to mine, water supply line, and other necessary features of plant operation are also under construction, and definite plans for permanent plant are being prepared. South American mines not fully explored. At Butte, the Original and Leonard mines closed Jan. 2 for repairs requiring several months; Pennsylvania shut down Jan. 10; Anaconda and Neversweat shut down in December on account of Parrot fire, and are still down indefinitely. December copper production was 21,900,000 lb. Company's smelteries have reduced working forces over 50 per cent.

BUTTE & SUPERIOR (Butte)—December production was 10,600,000 lb. of zinc in concentrates and 220,000 oz. of silver. Petition of Minerals Separation company for order restraining the mining company from dissipating its assets was denied by U. S. Supreme Court on Jan. 7. Court set Mar. 3 for argument.

EAST BUTTE (Butte)—December production of copper smeltery was 1,929,720 lb. of copper.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Mill treating about 6000 tons monthly from Mohawk, Clermont, and Grizzly Bear workings, one-half by cyanidation and half by flotation. Development at Combination mine opening milling-grade ore. Treatment of mill tailings discontinued for winter.

GRANDMA (Goldfield)—Lateral development to open up contact zone now under way. Shaft 830 ft. deep. Further development at 250 level planned.

Humboldt County

ROCHESTER (Rochester)—Winze from 1100 level has proved oreshoot to 1200 level. Blocking out ore between tenth and eighth levels. Daily tonnage milled during first half December averaged 178. Will increase mill capacity to 200 tons when thoroughly adjusted.

Lander County

FARRETTA & CHILDRESS (Battle Mountain)—Operating cinnabar property in Jersey district 72 miles southwest of Battle Mountain; have completed addition to reduction plant, also bunk house, boarding house and office.

Mineral County

SIMON LEAD (Mina)—Crosscut on 400 level cut mixed lead-zinc sulphide oreshoot 35 ft. wide. Shoot developed on upper levels. Strong flow of water opened, valuable for milling.

SUMMERFIELD & ELGES (Mina)—Lessees have successfully developed Booth quicksilver mine. Installing two new retorts at reduction plant. Development pushed on Farnham & Drew property, and good tonnage commercial mercury ore blocked out. Lessees on Pepper & Keough shipping regularly.

Nye County

EAST DIVIDE (Divide)—Shaft down 150 ft. Sinking will continue.

GOLD ZONE (Divide)—Shaft sunk to 500 level and crosscutting to Divide vein under way.

HASBROUCK (Divide)—Long tunnel nearing objective. Shaft workings still in ore, and large tonnage of milling-grade ore developed.

TONOPAH EXTENSION (Tonopah)—Clean-up second week in December was 61,000 oz.

White Pine County

NEVADA CONSOLIDATED (Ely)—December production of copper was 5,800,000 pounds.

NEW MEXICO

Grant County

DUNCAN M. AND M. (P. O., Duncan, Ariz.)—Work started on first 80-ton unit of 500-ton cyanide mill for Mount Royal district of Grant County, New Mexico. Power to be installed for 125 tons. Primarily to treat ores from company's Golden Fleece mine. Latter has developed oreshoot 40 to 60 ft. wide and over 400 ft. deep of clean cyaniding ore. Recovery on mill tests 97-98% of gold and up to 90% of silver. Will mill 10 to 15 ft. of vein, which is high-grade milling ore, in first unit and take remainder when other units are built. Will also treat ore from six other properties within 2½-mile radius, all of which can be brought by aërial tramways. Water plentiful. Altitude of mill, 4500 ft. Roads good. Conditions for cheap operation good. Skilled Mexican labor readily secured.

SAN JOSE (Central)—Shipping high-grade copper-silver ore from 240 level.

ATWOOD (Lordsburg)—H. V. Snell and others will install new hoist on Southern group, intending to sink 300 ft. J. Tangye, superintendent.

BONNEY (Lordsburg)—Shipped 15 cars of ore to Copper Queen smeltery during December. Have completed exploration work for present, with 36,000 tons of ore in sight. Arrangements being made for 100-ton mill. Ore reserves average 2½% Cu and $3.77 precious metals. J. P. Porteus, general superintendent.

BOSTON-HECLA (Lordsburg)—Building four mile wagon road from mine to Pyra station on Southern Pacific. R. E. Vandruff, manager.

ROUNDS (Lordsburg)—Two cars of fluorspar ready for shipment.

CAP-ROCK (Lordsburg)—Continues to mine manganese ore, grading 42% Mn and 2% silica; two cars ready to ship.

GREAT-EAGLE (Lordsburg)—Continues regular shipments of fluorspar. Preparing to run tunnel 300 ft. on orebody. Fred Kroll, manager.

OCTO (Lordsburg)—Preparing to sink main shaft.

CHINO COPPER (Santa Rita)—December production of copper was 5,507,635 pounds.

AUSTIN-AMAZON (Silver City)—Large block of ore running 3% copper recently opened on this property in Burro Mountain district.

OKLAHOMA

Joplin District

IMPERIAL DEVELOPMENT (Miami)—Starting new shaft on Osage tract, where 18 months' fight against water was unavailing. Fight on water to be renewed soon.

LUCKY INDIAN (Quapaw)—Taken over by Municipal Excavator Co., of Oklahoma City, which will tram from shaft to Red Rose mill, a quarter-mile away.

THELMA JANE (Quapaw)—Has taken over Gander mine and will install 10 hand jigs.

UTAH

Salt Lake County

CARDIFF (Salt Lake City)—New oreshoot followed for 100 ft., a good deal being high-grade silver-lead ore. Shipments of 40 tons a day or 275 to 300 tons a week being made. Ore hauled on sleds in South Fork, and by trucks in main canyon, to Murray. Trucks haul six tons and make 1½ trips a day. Distance ore bins to Murray, 18 miles.

UTAH COPPER (Garfield)—December production of copper was 13,835,000 pounds.

CANADA

British Columbia

CONSOLIDATED M. AND S. CO. OF CANADA (Rossland)—Making progress in applying old treatment methods to Rossland ores. Methods old, but application is new as regards these ores. No definite announcement as yet.

Manitoba

REX (Herb Lake)—During November, company produced $5600 in gold. Shipments to Ottawa mint since June totaled $27,368.

Ontario

BOURKES (Bourkes Station)—New vein encountered at 100 level. Winze being sunk to 200 level.

BAILEY (Cobalt)—Toronto broker asking for proxies in effort to settle litigation of several years' standing. Proposal is to form new company called Bailey-Northern Customs, Ltd., with $1,250,000 capital and authorized bond issue of $150,000, which will buy out Northern Customs mill and give 425,000 shares in new company for Bailey.

CROWN RESERVE (Cobalt)—Development shows new discovery of increasing importance on 200 level. Drift on vein now in 100 ft., with high grade all the way. Vein in conglomerate.

LA ROSE (Cobalt)—Station cut at 470 level of Violet, where ore shows enrichment as compared with that on 370 level.

M'KINLEY DARRAGH (Cobalt)—Has discovered new high-grade vein on 300 level.

NIPISSING (Cobalt)—Was largest silver producer in 1918 in British Empire, with production of approximately 4,000,000 oz. Mining Corporation was close second.

TEMISKAMING (Cobalt)—Number of men laid off; shortage of power rendering curtailment necessary.

KIRKLAND TOWNSITE (Kirkland Lake)—Deal put through by English parties for control.

LAKE SHORE (Kirkland Lake)—In November, mill treated 1320 tons of ore, with recovery of $14,578, running 95.5% of possible running time.

OTISSE (Matachewan)—Heavy machinery arriving for sinking shaft to 500 feet.

CASTLE OIL AND GAS (Mosa)—Company has brought in two new wells and now has 16 producing in Mosa field. Starting several new wells.

HOLLINGER CONSOLIDATED (Timmins)—Planning extensive additional house accommodations for employees.

MEXICO

Sonora

GREENE CANANEA (La Cananea)—December production was 5,100,000 lb. copper, 174,901 oz. silver, and 1,180 oz. gold.

PERU

Junin

CERRO DE PASCO (La Fundicion)—December production was 6,410,000 lb. of copper.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—December clean-up yielded $124,000; ore above the average.

The Market Report

SILVER AND STERLING EXCHANGE

Jan.	Sterling Exchange	Silver		Jan.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
9	4.7580	101⅛	48$\frac{7}{16}$	13	4.7575	101⅛	48$\frac{7}{16}$
10	4.7580	101⅛	48$\frac{7}{16}$	14	4.7580	101⅛	48$\frac{7}{16}$
11	4.7580	101⅛	48$\frac{7}{16}$	15	4.7575	101⅛	48$\frac{7}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
9	*	68	5.75 @5.90	5.60 @5.70	7.20 @7.25
10	*	67¾	5.70 @5.75	5.50 @5.60	7.15 @7.25
11	*	67¾	5.60 @5.65	5⅜ @5½	7.15 @7.20
13	*	67¾	5½	5⅜ @5½	7.15 @7.20
14	*	67¾	5.40 @5.50	5.30 @5.35	6.95 @7.05
15	*	68	5.40 @5.50	5.30 @5.35	6¾ @7.00

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

* Undetermined.

† For American tin of 99% grade.

LONDON

Jan.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
9	95	85	105	255	246½	40	33	56
10	94	84	105	252	243½	40	32½	56
11								
13	94	83½	105	255	246½	40	32½	56
14	94	83½	105	254	246½	40	32½	56
15	91	81	105	252	246	40	32½	56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Jan. 15, 1919

The metal markets this week were weak and disappointing. Lead failed to exhibit any stability following the little advance last week, and zinc, which has been declining for a long time, fell off sharply.

Copper—No material change developed from the situation of last week. The business that has been transacted so far since the first of the year has been almost entirely by the smaller producers. We said last week that at least three had been selling, but it appears that sales were made by at least six. We have direct reports from only a few of them, but we consider 15,000,000 lb. to be a liberal estimate of the total business done by them since Jan. 1. There has been very little reselling by consumers. The big producers have made no sales except a few at 23c., on which each seller guaranteed the price against himself. The total of such business was very small. Certain wire-drawers are quoting copper wire at 22½@23c., which, under present conditions, is probably not very different from 20c. for electrolytic wire bars.

During the present week the amount of business done by the small producers dwindled, and subsequent to Saturday we did not receive reports of anything being done by anybody. On Jan. 9-11 a few million pounds were sold at 20c. The market, if it be called such, continued so small and so vague that we are unable to determine a daily price as a matter of record. It is certain that some copper was sold on some days at 20c., that the big producers did nothing, that buyers were few, and that more copper was offered at 20c. than was sold, but, even so, it was doubtful whether any great quantity was to be had at that price.

Copper Sheets—The base price of copper sheets is 29c. per lb. Copper wire is quoted at 22½@23c. per lb. f.o.b. mill, carload lots.

Tin—There was very little business done. All that we heard of was in American tin. We did not hear of any Straits, Banka, or Chinese being offered.

The quotations for spot tin as given in the *Journal* of Jan. 11, for Jan. 6, 7, and 8 are in error. The corrected quotations are: Jan. 6, 68½; Jan. 7, 68½; Jan. 8, 68½.

Lead

Lead—This market was disappointing. After rallying to 5¾c. and exhibiting some stability for a few days, the interest of buyers waned, and sellers offered quantities at lower figures in order to make the metal move. Since Monday, lead has been offered freely at 5½c. in such ways as to invite counter-bids, and, indeed, 5.40c. was accepted.

Zinc—The crumbling away in the price for spelter continued up to Jan. 14, when the metal was freely offered at sharp concessions, and a considerable business was done at 7c. for January delivery and 6¾c. for February. The ore situation in the Joplin district was an immediate factor, it being possible for smelters to buy ore on terms permitting sales at these figures and at the same time realize a profit.

Zinc Sheets—Unchanged at $13 per 100 lb.

Other Metals

Aluminum—Unchanged at 33c. per lb. It is said that offerings are being made at 32½c. Actual consumers are not making purchases.

Antimony—A fair amount of business was reported done at 7½ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50@1.75 per pound.

Nickel—Market quotation. Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Dull at $110. No quotation received from San Francisco.

Silver and Platinum

Silver—The price of silver in London and New York remains unchanged at 48 7-16d. and $1.01⅛ per oz., respectively. Shipments to London for the week ended Jan. 11 were 527,000 oz. The volume of bullion going forward to the East via San Francisco continues large, but figures for recent shipments are not yet available.

Mexican dollars at New York: Jan. 9, 77½; Jan. 10, 77½; Jan. 11, 77½; Jan. 13, 77½; Jan. 14, 77½; Jan. 15, 77½.

Platinum—Refined ingot quoted at $105.

Palladium—Unchanged at $125

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 11—Blende, per ton high, $52.50; basis 60% zinc, premium, $50; Class B and Prime Western, $45@42.50; sludge and flotation, $42.50@40@37.50; calamine, basis 40% zinc, $35@30. Average selling prices: blende, $43.05; calamine, $35.60; all zinc ores, $42.77.

Lead, high, $82.10; basis 80% lead, $65@60; average selling price, all grades of lead, $63.66 per ton.

Shipments the week: Blende, 11,366; calamine, 447; lead, 987 tons. Value, all ores the week, $568,300.

All the large producing mines are again running full day shifts, but none at night. All mines are running that can afford to run and make the slightest profit.

Platteville, Wis., Jan. 11—Blende, basis 60% zinc, $50 per ton base for premium grade; $45 base for high-lead blende. Lead ore, basis 80% lead, $56 to $60 per ton. Shipments reported for the week were 1340 tons blende, 40 tons galena, and no sulphur ore. For two weeks of the year to date the totals are 2380 tons blende, 74 tons galena, and no sulphur ore. During the week 2281 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—Some inquiries for future deliveries are mentioned.

Manganese Ore—Foreign ore is now being offered.

Molybdenum Ore—Considerable business was done in 5- and 10-ton lots, for the first time in many weeks. Prices ranged from 75 to 85 cents.

Tungsten Ore—No business was reported but it is probable that ore of good grade could be bought at $15.

Pyrites—Spanish pyrites is quoted, subject to the raising of the embargo, at 16½c. on the basis of 10s. ocean freight. Restrictions still continue. Unchanged. Ocean freight is now 30s. or less per long ton.

Iron Trade Review

New York, Jan. 15

An incomplete analysis indicates that the aggregate of peace-time buying is larger than generally supposed. No attempt is made to express it in figures, but in spite of good shipments in December the bookings on Jan. 1 were probably less than 10 per cent. below those of Dec. 1. Mills have meanwhile worked into the backlog which is usually so desirable for an efficient operating régime. Generally the producer describes conditions as better than expected. The trade, according to *Iron Age*, has been so long used to full steam activity that it is not yet accustomed to the present period of low demand.

With operations not quite so good as a week ago, it is to be expected that reports are numerous of plant shutdowns. The industry cannot, of course, expect 60 per cent. operation and not have idleness. A surplus of labor has already become apparent at steel works, with offers to work at lower than existing wage schedules.

The December estimated output of steel ingots, 2,992,306 tons, is, with the same number of working days, only 2 per cent. less than the November production and there was no noticeable stocking of the rolled product, a fact which is favorable.

Inquiries of a promising nature are appearing from Belgium, though likely for British negotiation. Fresh export inquiries here include 3000 tons of light rails and 1500 tons of ties for portable tracks, and one of 500 tons of standard rails for Spain.

The drop in prices has been accepted in spots in the foundry trade, as instanced by a 25 per cent. cut by radiator makers and some recessions in malleable casting prices. Guidance in respect to prices on old contracts is expected from a meeting of pig iron producers in Pittsburgh on Jan. 15.

PITTSBURGH—Jan. 14

In many respects conditions in the iron and steel industry parallel those which obtained during the early months of 1908, following the panic of October, 1907. The one conspicuous difference is that there is no question about credits. There is practically no new buying, and furnaces and mills are operating on old orders, but are not able to ship against the full volume of business they have on books, because many buyers are seeking cancellation of contracts or postponement of deliveries. Instead of business picking up, producers are gradually running out of orders, and the rate of production is decreasing rather than increasing.

The monthly statistics of steel-ingot production show a slightly heavier rate of ingot output in December than in November, but this is no criterion for the present. The shipments of finished steel in December probably fell off, and much of the tonnage shipped was against long accumulating requirements of jobbers and manufacturing consumers, which do not represent any prolonged demand. In many cases, also, mills were able to make shipments because buyers did not realize the sudden change in conditions and were taken by surprise with the quantity of steel shipped them. Steel production in November and December was about 88% of capacity, and production this week is estimated at about 65%, and the present outlook is that a rate of 50% or even less may be attained in a few weeks. There are no buyers of steel, either by way of making fresh commitments or of specifying against old contracts, except those who can turn the material over at once, among whom are jobbers who have immediate sale for the material and automobile makers who can sell their cars as fast as made.

Irrespective of prices ruling for steel, no construction work is in prospect, because investors must be satisfied as to the stability of conditions and are awaiting lower costs of labor and commodities other than steel. The common opinion is that before investors take hold in the matter of putting up bridges, buildings, factories, and new construction generally, the peace treaty must be signed and the Bolshevik menace completely removed.

Steel mills have been offered scrap at $10 a ton below former prices, but will not buy even small lots, whereas they have reduced their finished products only about $4 a ton. The common interpretation is that they have no confidence in their quoted prices as a sales proposition, but are holding them so that holders of contracts will specify against the contracts.

Pig Iron—A few furnaces have refused to reduce their quotations $3 a ton, as suggested, but the majority are disposed to revise contracts by this amount, and, even with such revision, consumers are indisposed to accept full contract tonnages. On account of present high costs, furnaces are indisposed to store iron, and a number will probably have to go out of blast. This may make for labor efficiency when they resume. There is no thought of reducing wage rates. The market is quotable at $3 under Government prices: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel

Steel—Regular quotations on soft steel are Billets, $43.50; sheet bars and small billets, $47; slabs, $46; rods, $57. Excepting rods, which are unchanged, these prices are $4 under the old Government prices. They are purely nominal as a market proposition, however, there being no buying The British government is offering regular shell steel, in billet form and in rounds, at prices said to be $27 to $28, yet there is scarcely any material moving Discard steel is offered at about the same level, but would not be as attractive as the regular shell steel which has passed inspection. The U S Government will have much material of these classes to sell, but is holding off, awaiting a market with more absorbing power.

Ferroalloys

Ferromanganese—It is practically impossible to sell ferromanganese or spiegeleisen at any price Producers recently reduced their nominal quotations to $225, delivered, for 70% ferromanganese and $65, furnace, for 16% spiegeleisen Consumers are seeking cancellation of contracts and would not be content with an adjustment on the basis of these reduced prices.

Coke—Though coke production has increased little, supplies are proving more nearly adequate, and furnaces are content with the quantity of coke received, but in many cases not with the quality, which still leaves much for improvement. The Fuel Administration price limits of $6 on furnace and $7 on foundry coke will continue at least to Feb. 1 and perhaps to Apr. 1. There is no longer any prospect of an advance in the market if the control were removed.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan	56 775	75.630	88 702	26 960	36 682	44 356
Feb	56 755	77 585	85 716	26 975	37.742	42 792
Mar	57 935	73.861	88 082	27.597	36 410	43 620
April	64 415	73 875	95 346	30.662	36.963	47 215
May	74 269	74 745	99.505	35.477	37 940	48 980
June	65 024	76.971	99.500	31.060	39 065	48 875
July	62.940	79.010	99 625	30 000	40.110	48.813
Aug	66.083	85 407	100 292	31.498	43.418	49 077
Sept	68 515	100 740	101 125	32 584	50.920	49.500
Oct	67 855	87 332	101.125	32.361	44.324	49 500
Nov.	71 604	85 891	101 125	34 192	43.584	48 969
Dec.	75.765	85.960	101.125	36.410	43.052	48.492
Year	65.661	81 417	96 772	31.315	40.851	47.516

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28 673	23 500	131.921	110 000	142 895	125 000
Feb.	31 750	23 500	137.895	110 000	148.100	125.000
Mar.	31 481	23 500	136.750	110 000	151.000	125.000
April	27 935	23 500	133.842	110 000	147.158	125.000
May	28 788	23 500	130 000	110 000	142.000	125.000
June	29.962	23 500	130 000	110 000	142.000	125 000
July	26.620	25 904	128 409	119 913	140 409	134 913
Aug.	25.380	26 000	122.391	122 000	137.000	137 000
Sept.	25 073	26 000	117.500	122 000	135 250	137 000
Oct	23 500	26 000	110 000	122 000	125 000	137 000
Nov.	23 500	26.000	110 000	122.000	125 000	137 000
Dec.	23.500	(a)	110 000	118.447	125 000	. . .
Year	27.180	24 628	124 892	115 530	138 401	

(a) No Market.

Tin	New York		London	
	1917	1918	1917	1918
January	44 175	85 500	185 813	293.227
February	51 420	92.000	198 974	311.525
March	54 388	(a)	207 443	318.875
April	55 910	(a)	220 171	329.905
May	63 173	(a)	245.114	364 217
June	62 053	(a)	242 083	331.925
July	62 570	(a)	242 181	360.347
August	62 681	(a)	243 978	380.900
September	61 542	(a)	244 038	343 905
October	61 851	(a)	247 467	335.543
November	74 740	(a)	274 943	323.550
December	87.120	(a)	298 556	267.736
Av year	61 802	88.750	237 563	330 138

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7 626	6 782	7 630	6 684	30 500	29 00
February	8 636	6 973	8 595	6 899	30 500	29 00
March	9 199	7 201	9 120	7 091	30 500	29 00
April	9 288	6 772	9 158	6 701	30 500	29 00
May	10 207	6 818	10 202	6 704	30 500	29 00
June	11 171	7 611	11 123	7.511	30 500	29 00
July	10 710	8 033	10 644	7 750	30 500	29 00
August	10 594	8 050	10 518	7 750	30 500	29 00
September	8 680	8 050	8 611	7 750	30 500	29 00
October	6 710	8 050	6 650	7 750	30 500	29 00
November	6 249	8 050	6 187	7 750	30.500	31 20
December	6 375	6 564	6 312	6 324	30 500	40 00
Year	8 787	7.413	8 721	7.222	30 500	30 10

Spelter	New York		St Louis		London	
	1917	1918	1917	1918	1917	1918
January	9 619	7 836	9 449	7 661	48 329	54 000
February	10 045	7 814	9 875	7 639	47 000	54 000
March	10 300	7 461	10 130	7 286	47 000	54 000
April	9 459	6 890	9 289	6 715	54 632	54 000
May	9 362	7 314	9 192	7 114	54 000	54 000
June	9 371	8 021	9 201	7 791	54 000	54 000
July	8 643	8 688	8 473	8 338	54 000	54 000
August	8 360	8 985	8 190	8 635	54 000	54 000
September	8 136	9 442	7 966	9 092	54 000	54 000
October	7 983	8 801	7 813	8 451	54 000	54 000
November	7 847	8 491	7 672	8 141	54 000	54 100
December	7 685	8 163	7 610	7 813	54 000	56 050
Year	8 901	8 159	8 813	7 890	52 413	54 180

New York and St Louis quotations, cents per pound. London, pounds sterling per long ton

Pig Iron Pgh	Bessemer‡		Basic‡		No 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35 95	$37 25	$30 95	$33 95	$30 95	$33 95
February	36 37	37 25	30 95	33 95	30 95	33 95
March	37 37	37 25	33 40	33 95	35 91	33 95
April	42 23	36 15	38 90	32 95	40 06	33 95
May	46 94	36 20	42 81	33 00	44 60	34 00
June	54 22	36 36	50 05	33 18	50 14	34 18
July	57 45	36 60	53 80	33 40	54 95	34 40
August	54 17	36 60	50 37	33 40	53 95	34 40
September	46 40	36 60	42 24	33 40	48 68	34 40
October	37 25	36 60	33 95	34 40	33 95	35 40
November	37 25	36 60	33 95	34 40	33 95	35 40
December	37 25	36 60	33 95	34 40	33 95	35 40
Year	$43 57	36 87	$39 87	33 70	$40 83	34 45

‡ As reported by W P Snyder & Co

STOCK QUOTATIONS

N. Y. EXCH.†	Jan. 14
Alaska Gold M	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	72
Am.Sm & Ref., pf	107
Am.Sm.Sec., pf., A	92
Am Zinc	11
Am. Zinc, pf	42
Anaconda	60
Batopilas Min	1
Bethlehem Steel	57
Butte & Superior	18
Butte Cop & Zinc	6
Cerro de Pasco	34
Chile Cop.	17
Chino	34
Colo. Fuel & Iron	35
Crucible Steel	56
Crucible Steel, pf	91
Dome Mines	11
Federal M. & S.	10
Federal M. & S., pf	36
Greater Nor., ore ctf	35
Greene Cananea	43
Gulf States Steel	60
Homestake	94
Inspiration Con	43
International Nickel	29
Kennecott	32
Lackawanna Steel	64
Mexican Petrol	182
Miami Copper	24
Nat'l Lead, com	64
National Lead, pf	108
Nev. Consol	16
Ontario Min	6
Ray Con	20
Republic I &S.,com.	73
Republic I &S., pf	100
Sloss-Sheffield	49
Tennessee C. & C.	13
U. S. Steel, com	91
U. S. Steel, pf	114
Utah Copper	71
Va Iron C & C	57

BOSTON CURB*	Jan. 14
Alaska Mines Corp	‡ 12
Boston Ely	92
Boston & Mont	50
Butte & Lon'n Dev.	14
Calaveras	1
Chief Con	3
Contact	‡ 05
Corbin	‡ .25
Cortez	12
Crown Reserve	.34
Crystal Cop	18
Eagle & Blue Bell	2
First Nat Cop	‡2
Houghton Copper	30
Intermountain	‡ 05
Iron Blossom	45
Iron Cap	15
Majestic	22
Mexican Metals	27
Mines of America	‡ 75
Mojave Tungsten	05
Nat Zinc & Lead	.09
Nevada-Douglas	36
New Baltic	1
New Cornelia	‡16
Oneco	20
Pacific Mines	‡ 35
Rex Cons	‡ 05
Yukon Gold	80

SAN FRAN.*	Jan. 14
Alta	02
Andes	04
Best & Belcher	‡ 01
Caledonia	02
Challenge Con	03
Confidence	‡ 05
Con Virginia	‡ 05
Gould & Curry	‡ 01
Hale & Norcross	‡ 01
Jacket-Cr Pt	‡ 08
Mexican	18
Occidental	40
Ophir	01
Overman	01
Savage	02
Sierra Nevada	06
Union Con	18
Utah Con	‡ 01
Belmont	2 65
Jim Butler	32
MacNamara	29
Midway	25
Mont.-Tonopah	14
North Star	06
Rescue Eula	07
West End Con	1 22
Atlanta	04
Booth	13
Comb Frac	‡ 02
Florence	12
Jumbo Extension	14
Kewanas	06
Nevada Hills	03
Nevada Packard	‡ 31
Round Mountain	25
Silver Pick	05
White Caps	16

COLO SPRINGS*	Jan 14
Cresson Con	4 93
Doctor Jack Pot	04
Elkton Con	05
El Paso	14
Gold Sovereign	‡ 02
Golden Cycle	‡ 75
Granite	20
Isabella	06
Mary McKinney	08
Portland	1 00
United Gold M	15
Vindicator	39

BOSTON EXCH.†	Jan. 14
Adventure	‡ 60
Ahmeek	71
Algomah	‡ 30
Allouez	42
Ariz. Com	11
Arnold	‡ 20
Bingham Mines	‡9
Bonanza	‡ 10
Butte-Balaklava	21
Calumet & Ariz	60
Calumet & Hecla	‡426
Centennial	13
Copper Range	41
Daly West	‡2
Davis-Daly	‡5
East Butte	5
Franklin	3
Granby	‡79
Hancock	‡5
Hedley	‡12
Helvetia	‡ 20
Indiana	‡ 80
Isle Royale	25
Keweenaw	‡1
Lake	5
La Salle	‡3
Mason Valley	‡2
Mass	‡4
Mayflower	‡3
Michigan	3
Mohawk	53
New Arcadian	1
New Idria	‡10
North Butte	10
North Lake	‡ 55
Ojibway	‡1
Old Dominion	35
Osceola	52
Quincy	‡59
St. Mary's M. L.	42
Santa Fe	‡ 25
Seneca	‡15
Shannon	‡2
Shattuck-Ariz	‡14
So. Lake	1
So. Utah	‡ 10
Superior	‡5
Superior & Bost	2
Trinity	‡2
Tuolumne	‡ 77
U. S. Smelting	44
U. S. Smelting, pf	45
Utah Apex	3
Utah Con	8
Utah Metal	1
Victoria	1
Winona	‡ 90
Wolverine	18
Wyandot	‡ 50

N. Y. CURB†	Jan. 14
Big Ledge	
Butte & N Y	
Butte Detroit	‡ 02
Caledonia	29
Calumet & Jerome	
Can Cop. Corpn	2
Carlisle	‡2
Cashboy	‡ 08
Con Ariz Sm	1
Con Coppermines	5
Goldfield Con	23
Goldfield Merger	06
Greenmonster	‡
Hecla Min	4
Howe Sound	‡4
Jerome Verde	‡ 50
Louisiana	‡
Magma	‡25
Marsh	04
McKinley-Dar-Sa	‡ 47
Milford	‡ 75
Mother Lode	35
Nixon Nevada	44
Ohio Cop	‡ 75
Rawley	‡2
Ray Hercules	2
Richmond	‡ 56
Rochester Mines	27
St Joseph Lead	‡11
Standard S L	25
Stewart	‡ 16
Success	05
Tonopah	‡3
Tonopah Ex	2
Tribullion	‡
Troy Arizona	‡ 10
United Eastern	‡4
United Verde Ext	‡35
United Zinc	‡
Utica Mines	‡ 08

TORONTO*	Jan. 14
Adanac	08
Bailey	04
Beaver Con	40
Chambers Ferland	08
Coniagas	‡2 00
Hargraves	02
Kerr Lake	‡5 37
La Rose	25
Lake Shore	90
Min Corp of Can	2 25
Nipissing	18 75
Peterson Lake	10
Temiskaming	30
Wettlaufer-Lor	03
Davidson	1 60
Dome Exten	22
Dome Lake	17
Hollinger	6 12
McIntyre	1 75
Newray	12
Porcu Crown	28
Teck-Hughes	25
Vipond	20
West Dome	14

* Bid prices † Closing prices ‡ Last quotations

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	3 90	5 52	5 52	6 55	5.17	5 44½
No. 12	3 95	5.57	5 57	6 60	5.22	5 49½
No. 14	4 00	5 62	5 62	6.70	5 27	5 54½
Black						
Nos. 18 and 20	4 50	6 32	6 32	7 30	5.92	6 24½
Nos. 22 and 24	4.55	6 37	6.37	7 35	5 97	6 29½
No. 26	4 60	6 42	6 42	7 40	6 02	6 43½
No. 28	4 70	6 52	6 52	7 50	6 22	6 53½
Galvanized:						
No. 10	5.05	6 97	6 77		6 42	6 69½
No. 12	5.15	6.97	6.87	7 85	6 52	6.79½
No. 14	5 15	6 97	6.87	8 00	6 67	6 79½
Nos. 18 and 20	5.45	7 17	7 17	8.15	6 97	7 09½
Nos. 22 and 24	5 60	7.32	7.32	8 30	7 02	7.24½
No. 26	5 75	7.47	7 47	8.45	7 17	7 39½
No. 28	6.05	7.77	7.77	8.75	7 57	7 69½

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$55.00	$38 00	$65.00	$38 00
Standard openhearth rails	57.00	40 00	67.00	40.00
Light rails, 8 to 10 lb	3 13½*	83 00	3.13½*	68 00
Light rails, 12 to 14 lb	3.09*	82 00	3.09*	67 00
Light rails, 25 to 45 lb	3.00*	75 00	3.00*	65 00

* Government price per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger	$3.90	$5 00	$4 50	$5.30	$6.70
Track bolts	4 90	6 25	5 50	Premium	8 00
Standard section angle bars	3.25	3.65	4 45	Premium	5.15

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$3 00	$4 27	$5 25	$4 27	$4 27	$5 25	$5 05
Channels, 3 to 15 in.	3 00	4 27	5 25	4 27	4 27	5 25	5.05
Angles, 3 to 6 in. ¼ in. thick	3 00	4 27	5 25	4 27	4 27	5 25	5 05
Tees, 3 in. and larger	3 00	4 27	5 30	4 27	4.27	5 25	5 05
Plates	3 25	4 52	10 00	4 52	4.52	5 50	5 28

STEEL SHEET PILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4–5	$4–5	$4.50

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
¾-in. and larger	$4.65	$5 675	$7 00	$5.57	$5 55	$6 70	$7.00
CONE HEAD BOILER							
¾ in. and larger	4 75	5 775	7 10	5 67	5.65	6.80	7 10
⅝ and 11/16	4.90	5 925	7 25	5 82	5.80	6 95	7 25
½ and 9/16	5.25	6 275	7.60	6.17	6.05	7 30	7 60

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+17½%
Galvanized cast steel rigging	2½%
Bright plow steel	30%
Bright cast steel	17½%
Bright iron and iron tiller	List

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$6 25	$7 25	$6 50	$6.25	$8 00	$7 25
Assorted	6 40	7.75	6 50	6.40	8.25	7 50

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh

Iron bars	3 5c.	Steel bars	2.90c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0 16½	$0 18	$0 19	$0 18½	0.16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	6c.	14c.	15c.	16c.
Hollow	4c.	25c.	...	28c.

STEEL AND IRON PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Jan. 1 for steel pipe and iron pipe:

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent
BUTT WELD					
¾ to 3	54	40½	¾ to 1½	36	20
LAP WELD					
2	47	34½	1¼	21	6
2½ to 6	50	37½	1½	28	14
7 to 12	47	33½	2	29	15
13 and 14	37½		2½ to 6	31	18
15	35		7 to 12	28	15
BUTT WELD, EXTRA STRONG PLAIN ENDS					
¾ to 1½	52	39½	¾ to 1½	36	21
2 to 3	53	40½			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45	33½	1¼	22	7
2½ to 4	48	36½	1½	28	14
4½ to 6	47	35½	2	30	17
7 to 8	43	29½	2½ to 4	32	20
9 to 12	38	24½	4½ to 6	31	19
			7 to 8	23	11
			9 to 12	18	6

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	40%	43%	41 1%
3½ to 6 in. lap welded	36%	39%	37 1%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	28%	28%	26 1%
3½ to 6 in. lap welded	25%	25%	23.1%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 5%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0 80	List	$1 25	$1 40	$0 98	$1 05
Hot pressed hexagon	.80	List	1 05	1 20	.78	85
Cold punched square	2 50*	List	.75	.75	1 00	1 50
Cold punched hexagon	2.50*	List	.75	75	1.00	1.50

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	50%
Chicago	50%	45%
Cleveland	50–10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	40–10%	40–10%	40%
Larger and longer up to 1 in. by 30 in.	20–5%	20–5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York	$2 00	Cleveland	$1.25	Chicago	$1 75

For cast-iron washers the base price per 100 lb. is as follows:

New York	$6.00	Cleveland	$4 25	Chicago	$4 50

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$64 00	$57 00	$65.00	$58 00
Tar pitch (in 400-lb. bbl.)	21.00	18.00	22.00	19.00
Asphalt pitch (in barrels)	36 00	36 00	41.50	41.50
Asphalt felt	67 50	67 50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1 35	$1 60	$1 70	$1 95	$2 05	$2 30
No. 2 grade	1 20	1 45	1.50	1.75	1.80	2 05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.10 per roll in carload lots and $2.35 for smaller quantities.

Shingles, red and green slate finish, cost $5.50 per square in carloads, $5.75 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$ 056	$0 11	$0 162
Cincinnati	.086	.165	218
Seattle	09	175	30
Los Angeles*	079	144	181
New Orleans	14	20	29

* F.o.b. factory, 4, 8 and 10 inch.

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Y. P	Fir	Hemlock	Spruce	Y P	Fir
Cincinnati	$42 00	...	$38 00	$41 00	$37 00	$39 00
Kansas City	39 00	40 50	$40.50	38.50	45 50	42 50
Seattle	19 50	19 50	29 50	19 50	19 50	19 50
New Orleans	45 00			.	50 00	
St. Paul		52 00	48 00	48 00		48 50
Denver	43 00	33.50			48 00	39 00
Los Angeles	*	*	*	*	*	*

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In T. and G. 10 In. x 16 Ft.	
	Y.P.	Fir	Hemlock	Y P.	Fir
Cincinnati	...	$35 00	..	$40 00	$39 00
Kansas City	$46 00	54 75	$54.75	53 50	60 00
Seattle	19 50	19 50	19.50	19 50	19 50
New Orleans	52.00			60.00	
St. Paul	62 50	48 00	43 00		48 50
Denver	43 25	32 50	32 50	35 00	31.00
Los Angeles	39 00	33 00	34 00	*	*

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 50	$4 37	$4 75	$4 32	$5.35
Cut	4.00	6 50	....	6.50	6.75

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Current	One Month Ago	One Year Ago
New York	$4 00	$4 00	$2 22
Jersey City	3 64	3.64	2 16
Boston	3 67	3 67	2 37
Chicago	3.05	3.05	2 21
Pittsburgh	3 15	3.15	2 31
Cleveland	3 32	3.32	2 44
Denver	3.67	3.67	3.20

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17 50	$14 50	$2 90	$2 65
Chicago	18 00	17 50	1 80*	1 10*
St. Louis	22 00	16.00		1 75
Boston	22 20	18 20	3 65	3.35
Dallas	16 50		.	2.50
San Francisco	20 00		.	2.15
St. Paul	25 00	19 00	1 97*	1 93*
New Orleans	19 74	16 45	19 47‡	19.27‡
Cincinnati	14 20	11 95	...	..
Denver	..	26.25‡	...	2 50*
Los Angeles		.....	...	2.50*

* 200-lb barrels. ‡ Per ton.
Note—Refund of 10c. per bag, amounting to $2 per ton; barrel refund is 10c.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1 59	$1 28	$1 90	$1 30	$1 77	$1 26
5-gal. cans	1 84	1 38	2.00	1 40	1 97	1 35

WHITE AND RED LEADS in 500-lb lots sell as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Yr Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	14 00	14 50	12 25	12 50	14 00	12 50
25- and 50-lb. kegs	14 25	14 75	12 50	12 75	14 25	12 75
12½-lb keg	14 50	15 00	12 75	13 00	14 50	13 00
5-lb cans			14 25	14 00	16 00	14 50
1-lb cans			14 25	14 50	17 00	14 50

MINING AND MILLING SUPPLIES

HOSE

Fire

	50-Ft Lengths
Underwriters' 2½-in	85c per ft.
Common, 2½-in	40½%

Air

	First Grade	Second Grade	Third Grade
¾-in per ft	$0 60	$0 35	$0 30

Steam—Discounts from List

First grade	25%	Second grade	30%	Third grade	40%

LEATHER BELTING—Present discounts from list in the following cities are as follows.

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	40 + 5%	35%
Chicago	45%	40 + 5%
Birmingham	35%	35%
Denver	40%	30%
Cincinnati	40—10%	40%

RAWHIDE LACING 40—5% off list

MANILA ROPE—For rope smaller than ¾-in the price is ½ to 2c extra, while for quantities amounting to less than 600 ft there is an extra charge of 1c The number of feet per pound for the various sizes is as follows ½-in, 8 ft, ¾-in, 6 ⅞-in 4½ 1-in, 3½, 1¼-in, 2 ft 10 in, 1½-in, 2 ft 4 in. Following is price per pound for ¾-in and larger, in 1200-ft coils

Boston	$0 25	Denver	$0 26
New York	23	Kansas City	22½
Cincinnati	23½	New Orleans	23
Chicago	21½	Los Angeles	24
St. Paul	24	Seattle	24
San Francisco	22	St Louis	.22½

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1 76
Duck and rubber for piston packing	1.10
Flax, regular	99
Flax, waterproofed	1 21
Compressed asbestos sheet	1 10
Wire insertion asbestos sheet	1 30
Rubber sheet	.66
Rubber sheet, wire insertion	99
Rubber sheet, duck insertion	55
Rubber sheet, cloth insertion	25
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1 21
Asbestos wick, ½- and 1-lb. balls	73

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh.

Chrome brick	net ton	$120 00	at Chester, Penn.
Chrome cement	net ton	65 00	at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30	at Clearfield, Penn
Clay brick, 2nd quality	net ton	38–48	at Clearfield, Penn.
Magnesite, dead burned	net ton	37 50	at Chewalah, Penn.
Magnesite brick, 9 x 4½ x 2½ in.	net ton	90 00	at Chester, Penn.
Silica brick	net ton	45–55	at Mt. Union, Penn

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $40 to $55.
Birmingham—Fire clay, $50; silica, $50; magnesite, $110; chrome, $165
Chicago—Second quality, $25 per ton.
Denver—Silica, $35 per 1000.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft 6 In	6 In. x 8 In. by 8 Ft
Chicago	Plain	1 48	1 33
San Francisco	Douglas Fir—Green	1 35	96
San Francisco	Douglas Fir—Creosoted	2 75	1 92

Prices per tie at Missouri mills; St. Louis prices about 75c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0 70	No. 1	$0 55
No. 2	80	No. 2	65
No. 3	90	No. 3	75
No. 4	.98		
7x9x8 white oak.			1 05
7x9x8 red oak, No. 4	.80	No. 5	87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago In Bbl.	Chicago Car	Denver In Bbl. Lots	Denver In Carload Lots
Pure steam-distilled pine oil, sp. gr 0.925-0.94	$0 67½–$0 70	$0 70	$0.65	$0.76	$0 62
Pure destructively distilled pine oil.	65 – .67½	60	57	55	.
Pine tar oil, sp. gr. 1.02 = 1.035	38 – 40	40	38	65	.
Crude turpentine	45 – 47	70	65	60	
*Hardwood creosote, sp. gr. 0.96-0.99	.23	40	38	42	.

* F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11 00 to 13 00	13 00	16 50	12 00 to 16 50
Colored mixed.	8 50 to 12 00	10 00	13 00	11 50 to 14 00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58 00
Chicago	48 00	50 00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York		$0 29½	$0 34½		$2 40
Boston	$0 23½	26½	31½	$0 35½	2 35
Cincinnati	18½	22½	26½		2 35
Kansas City	20½	25½	30½	38½	2 45
New Orleans	20½	24½	28½		
Seattle		25½	32½		
Chicago	18½	22½	30	36	2 35
St. Paul	19	24½	30½		2 45
St. Louis	19	25½	30½	36½	.
Denver	17½	24	29	35	2 60
Dallas	21	25	29	39	
Los Angeles.	23	29	37		3 10

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb. Denver, 42c., Chicago, 31½c.; St Louis, 31c

SODIUM SULPHIDE In New York the price per pound is 8½c. for concentrated, 4½c for crystals The St Louis price is 10c for concentrated, 20c. for fused; the Chicago price is 7½c for concentrated, 3½c. for crystals. Concentrated comes in 500-lb drums, the crystals in 440-lb bbl

ZINC DUST—For 350 mesh the New York price is 16c per lb.; Chicago, 16c, Denver, 14c f o b Pueblo, St Louis, 13c

ALUMINUM DUST—Chicago price is $1 65 per lb.

MINERS' LAMP CARBIDE—Prices net f o.b cars at warehouse points

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb Drums Per Ton	Union 25-Lb Drums Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101 00	$1 52
Southeastern portion U. S. A	115 50	110 50	1 63
Texas (except El Paso)	124 00	119 00	1 74
El Paso, Texas	126 00	121 00	1 77
Denver, Colo.	124 00	119 00	1 74
West Coast	129 00	124 00	81

Engineering and Mining Journal

January 25, 1919

Volume 107 Number 4

MEXICAN WOMEN SORTING ORE

Mining in Mexico Today

BY AN AMERICAN ENGINEER

The writer of the following notes is an American mining engineer who is exceptionally well qualified to speak of present conditions in Mexico, with particular reference to the mining industry. It is well known that banditry is, happily, rare in a few parts of the country. Over the greater area, however, the conditions described by our contributor are proving a serious detriment to industrial and social progress. Moreover, such conditions, if allowed to continue unchecked, must inevitably lead to a state of indescribable chaos. Grave danger will result, not only to Mexico as a nation, but also to the people of those countries which are morally bound to do something more than watch the rapid disintegration of the country and the demoralization of its industries.

SO LITTLE has recently appeared in the daily press regarding Mexico that many have been led to believe that conditions in that country have become normal. If this is so, then those prevailing under the Diaz regime were abnormal, and were due entirely to his strong personality. Everyone is looking forward hopefully to the resumption of business, especially mining, but it is becoming increasingly evident that this is impossible until a radical change takes place.

I have spent the greater part of the last 10 years in Mexico, and until recently operated an important mining property, directed by United States interests, only a few miles from one of the principal cities in one of the central states. Work was carried on by brute force; and but for the fortunate opening of an exceptionally rich oreshoot, operations would have resulted in financial disaster. The property could not have been operated with the average grade of ore of former times, even with silver selling at a dollar an ounce.

Although comparatively close to one of the large cities, we were ever threatened, and twice during the year we were attacked. Our hacienda resembled a fort, surrounded by a 10-ft. wall, with shooting towers at the corners and at least 20 men always on guard, day and night. And such precautions as these were needed within one of the districts said to be '"normal"! For guards we employed ranchers of the old school—men who had lost their all, and were as anxious as we were to end the existence of the bandits.

Inefficiency of Federal Troops

Only half-hearted attempts were ever made by the federal troops to suppress banditry, although a good-sized garrison was close at hand. I know that 30 head of cattle were sent to the "general" in charge of the federal troops within our state last spring, in consideration for which a burro train of ammunition was dispatched to the bandits. Within a few weeks these very same bandits attacked our camp, and, no doubt, used against us the ammunition furnished by the federal "general."

Even Mexico City is not exempt from the activities of those who live by looting. This last summer a detail of federal troops looted one of the suburbs. Frantic appeals were made over the telephone, and in the afternoon a second detail was dispatched to arrest the first. Both returned to headquarters loaded down with loot; and to judge from the expressions on the faces of the first men, it was evident they were not expecting severe punishment.

I never heard of any loot being returned. The opinion was expressed at the time by a federal employee: "What can you expect? The troops have not been paid for months. They have to live."

During a threatening period at our mine, I once made the mistake of appealing for help to the governor, who sent out an insipid-looking "captain" with a detail of 15 men and a letter stating that the "captain" would take charge of our "escolta" for five pesos per day. We could pay the soldiers if we so desired. Within a few hours after its arrival the detail had looted a part of our town, even to the women's clothing, and had robbed a freighter of several hundred pesos' worth of corn. The loot was then sold to the peons for a song, and the proceeds were invested in drink. The men amused themselves by taking "pot shots" at animals and stray peons on the hillsides, but, fortunately, no one was hit. We had a week of sleepless nights before it was possible to have the detail recalled. We never again asked the governor for help.

Federal Troops Kill Innocent Mexicans

Occasionally the federal troops made a trip out in the mountains, advertising the project well in advance so that there would be no possibility of meeting the "enemy." Devil help any poor peon caught by the federals when so occupied! Last spring, during such a trip, about 18 charcoal burners were caught, killed, and strung up as an object lesson for bandits. I knew four of these poor devils personally, and am convinced that all were innocent victims, killed to make a "showing." We were dependent on charcoal for all mine blacksmithing and for use in our local foundry. The killing so frightened the burners who survived that we were unable to obtain charcoal for several weeks. We actually lost several days' work as a direct result of this killing, for we were in urgent need of some castings, and this work could not be carried out until we had found a small supply of charcoal in another district.

In northern Mexico an effective "home guard" is now in existence that has done wonders in cleaning up the bandits in that section. An armed guard of this type is dangerous, however, and needs to be handled with gloves. The minute it feels its strength it may prove a boomerang to those who are looking for protection. Or it might overestimate its strength, get into trouble with the authorities, and be driven out.

Difficulties in Obtaining Cash in Many Districts

Mexico is now on a straight gold-silver basis. To get the actual coin to meet local expenses was a great worry, and fully a third of my personal time was spent thus. The nearest bank was over 200 miles away, and we depended entirely on selling drafts locally. Under this system a merchant may be given a draft today for several thousand pesos, and one has to wait a week or so for the cash, during which time it is necessary to finance several merchants and corn dealers, and to trust to luck that they don't leave. It is possible to ship money by express from Mexico City, insuring with Lloyds for a little over 1% against loss. This company, however, will not ship if there is the slightest danger of a hold-up, and so the service cannot be depended upon. In desperation we were, on several occasions, forced to send an agent to Mexico City, and he would bring back several thousand pesos in a valise—a risky procedure. As an alternative plan, money was deposited with the treasurer of the Constitutional R.R. at Mexico City, and advanced to us by their local agent. This worked out satisfactorily, except that no dependence could be placed on the amounts likely to be available over any period. It also took the local agent about a week to hear of the deposit. We required about 8000 pesos per week for local needs, and it was necessary to keep at least a three-weeks' supply on hand.

How Supplies Are Obtained in the Camps

Regular freight service can hardly be said to exist. The large companies and smelters operate their own trains under special arrangements with the Constitutional R.R. The smaller concerns were dependent on "trading" companies, which operate special chartered trains from the border to the important centers within the country at definite intervals. On the whole, the service was quite satisfactory. The extra charge is from 60 to 75% of the regular freight. One of the largest "trading" companies is operated by José María Pescador, brother of the general manager of the railroads. To appreciate this situation in the United States, one need only to imagine a special train service (and the only service available) run by Mr. McAdoo's brother, for which you had to pay 160% of the regular rate.

Our product was shipped to the smelter in the latter's own equipment, as per contract. No extra charge was made for this service by the smelter.

To obtain cars for their exclusive use the various large companies and smelters have contracted to rehabilitate the partly destroyed rolling stock. The terms of exclusive service depend on the condition of the cars before rebuilding. In general, the exclusive use of a car is obtained for one year, and that of a locomotive for a term of two years. It often costs as much as 10,000 pesos to repair one engine. The system is fairly effective and is aiding greatly in the rehabilitation of the railroads.

Condition of the Railroads

The main line of the old National R.R. from Laredo, Texas, to Mexico City is in fair condition, and trains are operating without interruption, as well as on the Central R.R. from Mexico City to Torreon. Practically no other line is safe. Trains from Vera Cruz to the city are attacked frequently; also those from El Paso to Torreon. One dare not leave the railroad or a big city without an armed force.

Labor costs today little more than formerly in the matter of dollars and cents paid per man. In actual practice, however, labor costs have increased fully 50%, and this is due to the decrease in the efficiency of the men, who have lived so long without working that there is little desire to return. Another big factor has been the emigration of the better men to the United States. This refers especially to mechanics, carpenters, and the better class of miners. Fortunately our camp was not troubled by demands by the men for three months' pay when they were discharged. This custom is obligatory in some states, and if not adopted with care will break up the morale of any organization and force the mine to close.

No great difficulty was encountered in obtaining supplies, except as a result of delays occurring during 1918 in connection with mining requirements shipped from the United States. It was next to impossible to buy special equipment in Mexico City, and one cannot obtain miscellaneous supplies from the city at any reasonable figure, and so material is bought there only in an emergency. An article purchased there will involve an expenditure of 150% of the cost of the same article bought and imported from the United States. There are few exceptions to this. The Mexico City houses are making a great mistake. They plead the high cost of doing business and few sales; but the greater part deserve none. They should realize that their only hope is to reduce prices and increase sales. Failing this, there is an opportunity for a large hardware house to go into Mexico and take over the business previously carried on by the Germans. Action should be taken at once or the opportunity will be lost.

The Small Rancher Now Non-Existent

Thousands of Mexicans would have starved last year had not the United States allowed corn to be exported into Mexico. All the large companies and communities imported corn and sold it at cost to the people. A good crop was obtained in 1918, but only the large valleys were cultivated. There are no signs of the thousands of small corn patches up in the canyons and on the hillsides, as of old. The farmer dares not take his oxen out in the hills, because, if he were to do so, a bandit would, in all probability, swoop down within an hour and drive off the animals. Should he gather his corn by hand, it would only be stolen at harvest. Consequently, the small rancher no longer exists. Meat is still cheap, for it is practically all obtained from stolen cattle. Livestock, however, is fast disappearing, and soon it will all be gone.

In conclusion I would add that there is no one man capable of controlling the entire country. Carranza, no doubt, will hereafter heed us a little more than formerly, but his authority extends only to the centers of the large cities. The other chieftains have little idea of the difference between Americans and Germans. The truth of the matter is that self-determination, as we understand the term today, is a farcical idea and impracticable of application to the conditions prevailing in Mexico. The present state of affairs will continue until some one, and it could properly be the United States, goes down there and puts the country in order. There is no other alternative.

New Chromium Deposits in Rhodesia

Over a year ago a deposit of high-grade chrome ore was discovered in the Umvukwes Range, in Rhodesia, according to *Commerce Reports*. A systematic survey has already proved the existence of 2,000,000 tons of ore, and further large quantities are expected. The ore occurs in an area of 4500 acres. An average test of 300 samples shows 53% chromic acid. Besides the massive ore there is an alluvial deposit covering 1500 acres, which yields a mineral that assays 48% chromic acid. Provided a branch line be constructed to connect the mines with the main line at Banket Junction (a distance of 30 miles), it is estimated that the cost of ore delivered at Beira will be less than 35s. per ton.

Negligently Arranging Machinery

By A. L. H. Street*

The suit of Sharp *vs.* Athletic Mining and Smelting Co. (*205 Southwestern Reporter, 695*), recently before the Arkansas Supreme Court, involved the liability of the defendant for injury to an employee in its smelting plant. He sued for damages for personal injury claimed to have been sustained through negligence of the defendant company in constructing a track and bull wheel in such close proximity to a supporting form for a pier of an ore drier, at which plaintiff was working, as to make his work hazardous. He also asserted negligence in starting a rabble rake without notice or warning to him while he was imperiled thereby.

Granting the employing company a new trial after verdict in favor of plaintiff, it is held by the Supreme Court that the trial judge erred in instructing the jury as to the law of the case. It is decided that, notwithstanding any negligence on the part of the employer, the plaintiff must be held to have assumed the risk of being caught by the wing of the rabble rake and injured, if he knew the character of his surroundings and voluntarily remained at work.

---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Mining in Utah in 1918

BY EDWARD R. ZALINSKI*

THE year 1918 can hardly be said to have been an entirely successful one for the mining industry of Utah. Labor was scarce and inefficient. The influenza epidemic struck a number of the camps in October and November, and increased wages, higher freight rates and smelter schedules, and added cost of supplies made general operating conditions abnormally high. However, it is doubtful if Utah suffered any more than surrounding states or other mining communities. There were some bright spots, namely silver, throughout the year, and copper, up to the end of the year. Lead was also fair during the first half or three-quarters of 1918.

Production for the first six months was good, though less than for the same period of the banner year, 1917. After that, however, output decreased. The new freight rates, which went into effect on June 25, increased wages and smelting rates, and higher operating costs began to curtail operations and cut off lower-grade shipments. Relatively little new construction was undertaken, and little extensive development attempted beyond that consistent with good mining. Despite various drawbacks, preliminary estimates indicate that tonnage of ore and value of output in 1918 were equal to or above the figures of a normal year, though, of course, less than in 1917, when all records were broken. Nineteen Utah mines paid dividends in 1918, amounting to $19,236,189, up to Dec. 23, as compared with $29,410,169, in 1917, and $24,790,140, in 1916. There were two new dividend payers—the Western-Utah Copper Co., in Deep Creek, and the Columbus Rexall company, at Alta.

ORE MARKET CONDITIONS GOOD

The ore markets were good, with no refusal or embargoes on the part of smelters. Production of lead-silver ores was satisfactory in the early part of the year, continuing at almost the pace set in 1917, though modified by winter hauling conditions. Heavier shipments were made in the spring from accumulated winter stockpiles, including ores from smaller producers. Shipments were good up to June 25, when the increase in freight rates went into effect. Copper ores were also shipped, but, after June, mostly by the larger producers. Shipments continued through summer and autumn at a progressively decreasing rate, and the output of lead ores decreased during the latter months, except where the lead was carried by ores running well in silver. In general, there was a decrease in the amount of dump ores and low-grade ores, and of shipments by small producers and lessees. The lead market was not as favorable for the miner as in normal times with normal costs, and the same conditions may be said to have applied to copper and most other ores.

Smelting rates were advanced several times through 1918, on account of increased wages and cost of coke and other supplies, though there was no scarcity of coke. There was a decrease in leasing as compared with times when labor is not in great demand, for when labor and costs of supplies are high, many lessees find it more profitable to work for wages.

The increase in freight rates, as stated, went into effect on June 25, all class and commodity rates being advanced 25%, with a heavy flat increase on base bullion. The increases per ton on ores shipped to the Salt Lake Valley smelteries ranged from 10c. to $3.03 on ores up to $300. The new schedule applied a 30-c. flat increase per ton on iron ores shipped to smelteries for fluxing purposes. The highest increase on ores from within the state was from the Deep Creek section, on which the rate was raised $2.125 per ton on $40 ore, with corresponding raises on ores of lesser value. The increase on bullion from smelteries to the East was $6.50 per ton, an advance of 65%, making a freight rate of $16.50 per ton on base bullion. This increase was passed along to the producer, as the smelters made additional deductions from New York metal quotations to offset it.

Wage increases of 25c. and of 50c. per shift were made at Park City and Tintic on Apr. 1, and again later in the year, so that the prevailing wages were the same as at Bingham in practically all the camps, the scale being: Muckers, $4.75; hand miners, $5; machine men, $5.25; machine helpers, $5; timber men, $5.25; trammers, $4.75; and laborers, $4. Wages at Alta were increased on Aug. 1. Wages were also advanced at smelteries and mills. A semi-monthly pay day was adopted in some camps. The prevailing scale for common labor in mills and smelteries in October was: Arthur and Magma, $4.25 per day; Garfield, $3.65; Murray and Midvale, $3.55.

During the first six months of 1918, mining, development, and operating costs increased 33 to 50% and, in some cases, as high as 65%. These increased costs are reflected directly in the dividends.

TAX LEGISLATION AROUSED OPPOSITION

The Utah Legislature at its last session passed resolutions proposing an amendment to Section 4, Article 13, of the state constitution, relating to the taxation of mines and mining properties. This amendment gave the State Board of Equalization, an appointive body, power to tax mines at some multiple or submultiple of their net proceeds, plus an occupation tax. This question was voted on at the general election in November, and the amendment was adopted by a majority of 13,901 votes out of 56,773 votes cast. The measure was carried by the organized efforts of the governor and his staff, state officers, the school boards, and teachers. It was naturally voted against in the mining counties of the state, but was favored by the agricultural interests. The 3% net-proceeds tax became delinquent Nov. 30, and payment was refused by nearly all of the 486 mining companies in the state. The mine occupation and privilege tax of $1 was not opposed. The net-proceeds tax was operative in 1918 for the first time, as it became a law too late to apply to 1917 taxes. The total amount assessed under the 3% tax was $989,341. The sale of mining properties for delinquent taxes was scheduled for the third Monday in December by the State Treasurer, who, however, was enjoined by the mining companies, who brought suit to test the constitutionality of the act.

---

*Mining engineer, Salt Lake City, Utah.

The various camps, Bingham, Tintic, Park City, Alta, and the Cottonwoods, produced steadily except as affected by the influenza epidemic and the other conditions mentioned. There was a smaller output from Deep Creek, American Fork, Ophir, Stockton, Beaver County, and Dugway, approximately in the order named. Silver, lead, and copper ores were shipped.

PARK CITY

Conditions at Park City, as elsewhere, were generally unsatisfactory. The district was seriously handicapped by labor shortage. Wages were increased two or three times to the scale prevailing at Bingham and other camps. The labor was also inefficient, and miners worked less steadily than usual, laying off at frequent intervals. Most of the mines worked only one shift, owing to lack of men. Some drawback was experienced on account of influenza, the camp being quarantined twice. This also affected the labor supply, as many miners left to avoid the quarantine. No trouble was experienced on account of lack of fuel, but from time to time there was a moderate shortage of railroad cars. Cars were often furnished in poor condition for handling fine ores and concentrates. Early in the year, the Union Pacific was forbidden to handle ore. In general, there were few new installations, all properties curtailing construction work, and there were also relatively less extensive prospecting and development.

Though the output of Park City was less than that of 1917, a fair tonnage was shipped, estimated at approximately four-fifths of the 1917 output, when 100,000 tons was shipped. The most prominent producers were the Silver King Coalition, Judge Mining and Smelting, Ontario, Daly West, Silver King Consolidated, and Daly. The Ontario developed a good oreshoot on the main vein between the 1500 and 1700 levels, and shipped a large tonnage of dry siliceous silver ore, and paid dividends. A change took place in the management of the Daly West on Feb. 22, and under the new regime an extensive campaign of development was laid out, operations on which were to start about January, 1919. Connections were made between the Judge transportation tunnel and the main working shaft of the Daly West at the 750 level—a new level here—and ore pockets, a self-dumping skip, and other necessary equipment were installed. Everything above the 1550 level at the Daly West was operated by lessees.

JUDGE ZINC PLANT ENLARGED

The Judge Mining and Smelting Co. did some new development work in the southwestern part of the property under Bonanza Flat, and opened good ore there and in other parts of the mine. At the company's zinc plant, changes and additions were made, preparatory to starting the second unit about Jan. 1, 1919. The first section operated throughout 1918 and produced premium spelter exclusively, the product assaying 99.9% zinc or above in purity. With two units working, this plant will handle about 50 tons of zinc concentrates daily, as compared to a former production of 30 tons. By treating 45 tons of concentrates, the output will be around 15 tons of spelter daily, according to the grade of ore. The tonnage of silver, lead, and zinc ore mined by the Judge was approximately the same as in 1917.

The Park-Utah, a newly incorporated company, operated from the main Ontario drain tunnel and crosscut several mineralized fissures in the quartzite not far from the famous old Ontario vein. The Silver King Coalition operated mine and mill as usual, but with reduced forces, and produced a fair tonnage of high-grade silver-lead ores. The accounting in the case with the Conkling Mining Co. came up in 1918, there being a judgment of between $400,000 and $500,000 against the Coalition, as at present figured, though the matter was not finally settled. Thomas Kearns and David Keith, two of the chief owners of the Coalition, died during the year, and W. W. Armstrong, of Salt Lake City, was elected president. Toward the end of the year an examination of the company's property was being made, and it was said that detailed conditions would be reported to stockholders, although there were also rumors that an option had been given on the property.

The Three Kings operated and prospected from a winze below its lowest or 550 level, by cross-cutting southeasterly in the limestone toward the contact of the underlying Ontario quartzite. Several fissures mineralized with silver and lead were opened. The main ore-bearing horizon of the Silver King Coalition, adjoining, and of other properties—the 200 ft. of limestone overlying the quartzite—was not reached. The Nail Driver was operated under lease, and made shipments. The Silver King Consolidated advanced its new 14,000-ft. drain and operating tunnel, started in 1917, to beyond the 8000-ft. point, and completed a 150-ton flotation mill in Thayne's Canyon for silver-lead and zinc ores. The orebodies at the old shaft were exhausted, and operations there, high up on the hill, were discontinued and transferred to the California-Comstock section in Thayne's Canyon. The lead and zinc milling ores were obtained from this section of the property.

ALTA, COTTONWOOD, AMERICAN FORK AND OPHIR

The production from Alta, including that of the Cardiff mine, is estimated at approximately 30,000 tons in 1918. The largest shippers were the Michigan-Utah, South Hecla, Emma Copper, Sells, Alta Consolidated, Wasatch Mines, Columbus-Rexall, and Cardiff, the latter property being over the divide in Big Cottonwood. About 250 miners were employed in the camp, including those at the Cardiff. The output of this section was principally silver and lead ore, and copper-silver ore. There was some increase in tonnage over 1917, there being no appreciable curtailment on account of the war, though the camp was hampered seriously by labor shortage. This started about July 1, and was acute in September and October. Wages were increased to $4.50 for outside men, $4.75 for muckers, $5 for miners, and $5.25 for machine men, the same scale in force at Bingham and Tintic. The Little Cottonwood Transportation Co. completed and put in operation an eight-mile 36-in. gage railroad from Wasatch, at the eastern terminal of the Salt Lake & Alta R.R., to the camp. This road has a capacity of 150 to 200 tons of ore per day. The South Hecla opened a new sulphide orebody, 25 ft. thick, carrying copper and silver, and shipped extensively from this deposit, as well as from the older lead-carbonate stopes in another part of the mine.

Shipments were made by the Michigan Utah, and the Triangle Lease yielded a good output of silver-lead ores. The latter also shipped 40% manganese ore, and some copper. The Columbus-Rexall produced a fair tonnage of sulphide copper-silver ore and became a dividend payer. The Wasatch Mines extended its drain and operating tunnel to 3300 ft. The total length is to be 5000 ft., to connect with the old Columbus-Consolidated main workings. This tunnel should be completed by spring. Silver-lead ore was opened in the Braine fissure near the old-time productive ground. The Alta Consolidated opened a new silver-lead orebody and shipped. The Cardiff shipped extensively and developed a new orebody, eight feet and upward in thickness, in the main tunnel beyond the original oreshoot. The Sells mine built and put in operation a 2000-ft. 100-ton tramway, and shipped silver-lead.

In American Fork, the Pacific mine, under lease to the Fissures Exploration Co., produced silver-lead concentrates at its 150-ton mill, and shipped some ore direct. The Miller Hill shipped silver-lead ore. At the Bellerophon, a small mill was put in by the American Fork Exploration Co., lessees. A moderate amount of ore was shipped by the latter and from the Bay State. Altogether the output from American Fork was small. At Ophir, in Tooele County, the principal producer was the Ophir Hill Consolidated, which shipped silver-lead ores and a few cars of manganese ore running 44 to 45%. Lessees operating on Lion Hill, at the Lion Hill Consolidated and Buffalo, shipped a few cars of siliceous silver ore.

ACTIVITIES IN BEAVER AND TOOELE COUNTIES

In Beaver County, the Red Warrior shipped silver-lead ore. The Moscow shipped a few cars of zinc ore which had been stored, and one or two cars of lead ore. The Commonwealth was operated under lease, and shipped a small amount of copper. The Wild Bill produced 18 or 20 cars of good silver-lead ore by lessees. The Milford Copper, formerly the Montreal, shipped from low-grade copper deposits, the ore carrying considerable magnetic iron. The Majestic Mines Co. made shipments from its Old Hickory mine adjoining the Milford Copper. The Horn Silver, at Frisco, shipped lead ores to the U. S. Smelting Co. The dump at this company's old mill was treated by the Caldo Mining Co.'s flotation plant, which produced zinc and lead concentrates. At Newhouse, the flotation mill of the Utah Leasing Co. treated copper tailings from the old South Utah dump, and paid dividends.

At Stockton, in Tooele County, the Bullion Coalition mine was operated chiefly by lessees, who shipped lead ore. A small amount of lead ore was shipped from Dry Canyon, and also zinc ore from the same section by D. W. Lynch. At Deep Creek, in Tooele County, the Western Utah Copper shipped copper and also lead ores, and paid its first dividend. This company began work on a 100-ton mill. The Monocco mine, near Clifton, in the Deep Creek section, shipped 20 cars or more of good copper ore; and the Southern Confederate, near Clifton, shipped a high-grade silver-lead ore. Small shipments of tungsten and bismuth ore were made by Wilson Bros. from Bold Hill. Among other properties operating in this section were the Western Utah Extension, Pole Star Copper, and Seminole Copper. The Deep Creek R.R. handled ore and freight between Gold Hill or Goodwin and the Western Pacific R.R. at Wendover.

The Utah mine, at Fish Springs, about 30 miles southeast of Deep Creek, built and nearly completed a 100-ton mill for treatment of silver-lead ores. This mine paid dividends for a number of years, but was handicapped by the hard 80-mile haul to the railroad at Oasis. There are extensive dumps of low and of medium grade.

The Dugway district, about 15 miles east of Fish Springs, produced a few cars of copper ore; also lead ore. A car of fluorite was shipped from Granite Mountain, six miles north of Dugway. With better transportation, this section should develop. The nearest railroad point at present is Faust, 55 miles distant, on the San Pedro, Los Angeles & Salt Lake Railroad.

Fluxing iron ore carrying a little copper was shipped from the Salt Lake Copper Co.'s property by Tibby & Howell, lessees. The mine is in the western part of Boxelder County near the Nevada state line, the shipping point being Tunnel Station, near Tecoma, Nev. Approximately 3000 tons, carrying 0.5% copper and 45% excess iron, was shipped.

TINTIC DISTRICT

Production in the Tintic district was fair in the first six months of 1918. There was no serious car shortage. No figures are at present available relating to shipments, but they are roughly estimated at about 80% of the total in 1917, or approximately at 325,000 tons. The mines produced under difficulties, the influenza being so severe that the camp was quarantined for practically the last three months of the year. Labor was also scarce and inefficient. Good shipments of silver-lead ore, some copper, and straight siliceous silver ore were made. Among the properties operating were the Iron Blossom, Chief, Gemini, Ridge & Valley, Eagle & Blue Bell, Victoria, Mammoth, and May Day, all of which shipped lead-silver ores. The Centennial Eureka shipped copper-silver ores; the Dragon Consolidated iron ore during the first 10 months, also shipping silver-lead ore. Part of the Dragon workings was leased to the Tintic Milling Co., which mined and treated the lower-grade silver-lead ores at its mill at Silver City, and produced bullion. The Empire Mines Co., a consolidation of the Black Jack, Lower Mammoth, and other properties, by the Knight interests, shipped a little iron ore and occasional cars of silver-lead. Copper ore was shipped by the Grand Central and Iron Blossom.

The Tintic Standard continued the development of the large new orebody of siliceous silver ore opened between the 1300 and 1600 levels. This orebody, which showed indications of large size, on an entirely new far-east ore zone of the camp, was one of the important developments of the state during 1918. Much of the ore was broken with machine drills, carrying 40 oz. and upward in silver, without sorting. The limits of the orebody at the end of 1918 had not been determined. Arrangements were made to extend a spur from the Denver & Rio Grande R.R., but no work was done on this, hauling being accomplished by trucks. Several dividends were paid by the company. A new shaft 1300 ft. deep was sunk, and a new electric hoist, capable of hoisting from a depth of 2500 ft., and compressor equipment were installed. Other properties near the Tintic Standard were active and sunk shafts and did other development to prospect for the continuation of the

Standard's ore zone. Among these were the South Standard, Eureka Lily, North Standard, Copper Leaf, and Apex Standard.

The Tintic drain tunnel at the south end of the district was advanced. The Chief Consolidated sunk a new three-compartment, concrete-lined shaft, starting July 1, the depth being 324 ft. on Nov. 1, and to be 2000 ft. deep ultimately. A new 2500-cu.ft. compressor, an electric hoist, and pumping equipment were installed. The North Beck, controlled by Raddatz and associates, of the Tintic Standard, sunk a 1200-ft. shaft on the northwest side of the camp and is crosscutting for the west ore zone on which are the Centennial Eureka, Eureka Hill, Gemini, Ridge & Valley, and others. This shaft is in limestone not far from the underlying Tintic quartzite. Iron and other indications of mineral are found in the limestone at the surface. The Godiva had 15 lessees operating, and shipped some unusually high-grade silver ore. Work was also done on company account, a winze being sunk to the 1400 level. The Eureka Hill, Yankee, and Uncle Sam were worked largely by lessees. The Gemini, Ridge & Valley and others worked on company account and had various lessees working. The May Day started new development on the bottom, or 1100, level in mineralized ground.

OPERATIONS IN BINGHAM CANYON

The total output of Bingham Canyon in 1918 was approximately 14,000,000 tons of ore. The Utah Consolidated shipped copper and lead ores; the Utah Apex produced lead and zinc; the United States Mining, Utah Metal and Tunnel, and Bingham Mines shipped lead and some copper, and the United States company also produced lead-zinc ores. This lead-zinc product was milled at the last-named company's Midvale plant and the lead and zinc were separated at the Huff electrostatic plant. The Utah Apex produced lead and zinc concentrates at its mill in Bingham. The Ohio Copper completed the installation of its new 3000-ton flotation plant and operated it, producing copper concentrates. Bingham Mines operated the Dalton & Lark and the Yosemite mines, and produced lead-silver and copper ores. Other producers included the Montana-Bingham Consolidated, which shipped a small amount of lead and low-grade pyritic copper ores, and the Silver Shield, shipping lead-silver ore.

The Utah Copper Co. operated steadily. Approximately 13,000,000 tons of ore was produced for the year, as compared with about 12,500,000 tons in 1917. The production of copper for 1918 was a little over 198,000,000 lb., slightly less than that of 1917. The record production of ore was made on Sept. 26, when 49,537 tons was mined in 24 hours. Of this 80% was produced on day shift. Several increases in wages were made by this company. On Feb. 1, wages were raised 25c. a shift for skilled labor at the mine and mills; 20c. for common labor at the mine (nine hours); and 15c. for common labor at the mills. On July 1, all employees at the mine and mill were granted an additional 50c. a shift. Wages in December ranged from $3.90 for common labor at the mines (nine hours) to $250 a month for steam-shovel engineers. Common labor at the mills received $3.55 for eight hours. All mechanics and skilled labor received $6.25 for eight hours. Influenza retarded production to some extent, as did also the inefficient labor. The Bingham & Garfield R.R. operated satisfactorily, and in the third quarter handled a daily average of 37,711 tons.

Some interesting questions of apex were raised in the Bingham camp in 1918. The Utah Consolidated, Utah Apex, and Utah Metal and Tunnel became thus involved, and a number of suits and counter-suits were filed. The Utah Consolidated purchased the old Yampa claim, and is also understood to have acquired possible apex rights from the Utah Metal and Tunnel, in connection with the above. Questions of apex were also under consideration in the southeastern part of the camp between Col. E. A. Wall and the U. S. Mining company, involving parts of the Jordan limestone. These cases will probably come before the courts in 1919.

SMELTERIES AT FULL CAPACITY EARLY IN 1918

The Salt Lake Valley smelteries operated almost at full speed the first part of the year. There was a fair ore tonnage, and surplus capacity was used in treating material from the large stockpiles accumulated in 1917. Later, heavier inroads on stockpiles were made to replace the decrease in current production. No marked car shortage was felt by the smelters, though shortage of labor at the plants, and also influenza, held back operations. Wages were increased several times at about the same time as at the mines.

The Utah Ore Sampling Co. ran its Murray sampler and that at Silver City, in the Tintic district, and, in addition to the output from Utah, sampled ores from Nevada, Idaho, Colorado, Montana, and California, which came into the valley plants. Ore shipments also arrived at this market from Washington, Oregon, Arizona, Mexico, and British Columbia. The ores from without the state showed approximately the same relative decrease in tonnage as in Utah.

PRODUCTION OF GOLD, SILVER, LEAD AND ZINC

A limited amount of gold was produced from copper, lead, and mixed ores in 1918. Little straight siliceous gold ore has been mined in Utah in recent years, though a few cars were shipped from the Wedge, at Marysvale, in Piute County, and by lessees from the Blue Bird workings of the Annie Laurie mine, in Sevier County. The Centennial Eureka, in Tintic, produced a number of cars of 6-oz. gold ore. Also, some of the oxidized capping at the Utah Copper was found to carry an ounce and better in gold after having been discarded, and a number of cars of this capping was shipped. Some gold was contained in siliceous Park City silver ores from the Ontario and Daly; also in ores from various properties in Tintic, and a small amount from pyritic ores from Bingham. The Utah Copper concentrates carried appreciable amounts of gold and silver. These had an aggregate value of $804,409 in the second and third quarters of 1918. Some siliceous gold ores came in to the Valley smelteries from Goldfield and other parts of Nevada, and from Oregon.

Lead ores furnished a large part of the silver produced during 1918. The producers were the Silver King Coalition, Judge Mining and Smelting, Silver King Consolidated, and Daly West, at Park City. The Chief Consolidated, Centennial Eureka (copper-silver), Gemini, Ridge & Valley, Eagle & Blue Bell, and others in Tintic produced silver from lead ores, as did various properties in Alta, the South Hecla, Michigan Utah, Wasatch Mines, Columbus Rexall (copper-silver ore), and the Cardiff, in Big Cottonwood. Straight siliceous silver ores were shipped by the Ontario, at Park City, and by the Tintic Standard, at Eureka, from its new large orebody. This ore carried 40 oz. and better, and was broken with machines without sorting. A few cars of siliceous silver ore was shipped by lessees from the Lion Hill Consolidated, at Ophir. Some silver was contained in the lead and copper ores from Bingham, from the Utah Apex, Utah Metal and Tunnel, Utah Consolidated, and the United States properties. Nearly every camp in the state shipped ores carrying lead and silver. The Deer Trail, at Marysvale, completed and operated its 100-ton flotation and cyanide mill for treatment of gold-silver-lead ore, and also produced direct-shipping ore. Utah ranks high among the silver producing states, and the 1918 output was somewhat greater than that of 1917, silver being practically the only metal which showed an increase.

Zinc-Ore Output in 1918 Relatively Small

A relatively small amount of zinc ore was produced in Utah in 1918, chiefly by the largest mines, the miscellaneous production from the various camps being light. The chief producers of zinc sulphides, mostly concentrates, were the Judge Mining and Smelting, at Park City, which treated its output in its electrolytic zinc plant, producing a high-grade spelter, and the U. S. Mining Co., at Bingham, which shipped a good tonnage of lead-zinc ores to its Midvale concentrator during the first 10 months of 1918, and produced several hundred tons of zinc-blende concentrates per month from material treated by the Huff electrostatic plant. Later, the company stored its output. The Utah Apex produced zinc sulphide ores and concentrates. The Midvale Minerals operated its 250-ton flotation tailings plant on the old United States concentrator dumps, and shipped lead-zinc concentrates to Anaconda. The Childers and Leasing Co. also made a production from a different part of the same tailings dump. The Caldo Mining Co., operating a flotation mill on the old Horn Silver dump at Frisco, Beaver County, made zinc concentrates running 43% and better, which were shipped East, and lead concentrates were shipped to the U. S. Smelting Co. The extraction was unusually good for an old dump of this character, being 68% and upward for the zinc, and 12 to 20% for the lead. Most of the lead had oxidized to anglesite.

Carbonate zinc ores were shipped by the Lake View Mining property, in Boxelder County; the Scranton, in North Tintic, and an occasional car of zinc ore was shipped by other mines in Tintic. A few cars were shipped by D. W. Lynch from Dry Canyon, near Ophir, but no zinc ore was produced in 1918 in Ophir itself. The Moscow, in Beaver County, shipped a few cars of ore mined in 1917. More zinc ores could easily have been produced with more moderate freight rates and lower operating costs.

Manganese ores were shipped during the first 10 months of 1918 from the Homansville section of the Chief Consolidated, in Tintic; by various properties in West Tintic, among which was the Liberty Manganese company; also from Green River, Utah, by the Needles Mining Co.; and by Hanawalt Bros., of Denver, who shipped most of the Utah output. The Stewart & Snyder lease and the Triangle lease of the Michigan-Utah, at Alta, shipped manganese ore carrying 42% and over. The Ophir Hill Consolidated shipped 44% manganese ore. A few cars were shipped from near Monroe and Marysvale, in the southern part of the state. Practically all of the manganese ores was shipped East. Production was discontinued soon after the signing of the armistice in November, on account of market conditions.

Relatively little interest was taken in antimony, there being only a few cars shipped. The Stibnite Mining Co., near Brigham City, in Boxelder County, shipped a car of good-grade ore. One shipment, less than a carload lot, was made from near Marysvale. Practically no antimony ore from Nevada passed through the Salt Lake market.

Scheelite was shipped in 1918 from near Lucin, in Boxelder County, and from Deep Creek, the latter being produced by Wilson Bros. This firm also shipped a small amount of bismuth ore, which was milled in Salt Lake, producing concentrates containing 20 to 30% bismuth. A small shipment of bismuth ore was received in the Salt Lake market in 1918 from Mexico. One car of bismuth ore was shipped from the Mammoth, in Tintic. A small shipment from near Douglas Ariz., was marketed through Salt Lake. A small consignment of molybdenum, less than a carload lot, was shipped from Deep Creek by Wilson Brothers.

Regarding uranium and vanadium, some carnotite ores were shipped to Pittsburgh from near Cisco, in Grand County. These ores were also mined at Castleton, in the south-central part of Grand County, by the U. S. Metals Reduction Co. The shipping ore carried about 2% U_3O_8.

Potash was produced from alunite by the Mineral Products Corporation at Marysvale, in Piute County. This company rebuilt its mill, which was destroyed by fire in 1917, and enlarged it to 200 tons. Steady shipments of potassium sulphate were made. The alumina was stockpiled, though some of it was shipped for the manufacture of high-grade fire brick and refractory material. The Florence Mining and Milling Co., at Marysvale, built and completed a 100-ton alunite mill at its mine in Upper Cottonwood Canyon. This installation consisted of roasting furnaces, or kilns, and a leaching plant. Some ore was treated. Swift & Co. became interested in the Bradburn claims, adjoining the Florence and Mineral Products claims, and erected buildings and installed a compressor. A 17-ft. vein of clean crystalline alunite was developed, and shipments were started to one of Swift & Co.'s fertilizer plants near New Orleans. The American Smelting and Refining Co. also worked the Yellow Jacket claims, on the east side of the camp. The Caraleigh Chemical Co.'s custom alunite mill at Marysvale treated ore from the Florence and other properties, the finished product being roasted alunite, which was shipped East.

Potash was also produced from the brines of Great Salt Lake, from the mother liquors of the Inland Crystal Salt Co., by the Utah Chemical Co., at Haskell, near Saltair. The Salt Lake Chemical Co., at Burmeister Station, on the Western Pacific, on the southwest side of Great Salt Lake, produced potash and common salt.

This plant is popularly supposed to belong to the Diamond Match Co. The Solvay Process Co. has a large potash plant at Salduro, on the salt beds near Wendover, on the Western Pacific, and produced common salt, potash, and magnesium chloride liquor. The common salt was made by a related or subsidiary company, the Capell Salt Company.

A car of high-grade fluorspar was shipped from the Granite Mountain district north of Dugway. The shipping point was Clive, on the Western Pacific, 18 miles from the Silver Queen Mining Co.'s properties. This car carried 97% calcium fluoride, and was shipped to California.

Here should also be mentioned a sulphur deposit near Black Rock, in Millard County, on the Salt Lake route, which was taken over in 1918 by Chicago interests represented by Michael Morrissey. A plant was built and preparations were made to produce sulphur, but so far as is known there was no output in 1918. Arsenic and cadmium were produced as byproducts from the baghouse at the U. S. Smelting Co.'s Midvale plant.

Petroleum in the United States

The petroleum output in 1918, amounting to 345,000,000 bbl. according to the U. S. Geological Survey, includes no less than 6,500,000 bbl. of crude oil removed from field storage, but excludes drafts aggregating 20,500,000 bbl. additional from stocks of pipe-line companies. The surface reserve of crude oil held by oil producers and pipe-line companies in the United States at the end of 1918 is estimated at 123,000,000 bbl., compared with 150,000,000 bbl. at the end of 1917. From these figures it is apparent that the demand for domestic petroleum in 1918 approximated 366,000,000 bbl. Exports of crude oil, for the most part to Canada and to northwestern Mexico, aggregated about 5,500,000 bbl., leaving a total of 360,500,000 bbl. available for domestic needs. This quantity was insufficient, however, and approximately 36,500,000 bbl. was imported, almost wholly from Mexico, to meet domestic requirements, that amounted in all to about 397,000,000 barrels.

The increase in output noted was effected in response to a steadily growing demand for petroleum, expressed in advancing prices for crude oil, which were stabilized, with governmental approval, at record levels during the closing months of 1918. As indicated by statistics the most pronounced response to the stimulus of war-time demand for petroleum was in the Central and North Texas, North Louisiana, and the Rocky Mountain and California fields, though the moderate gain credited to the old Appalachian field is significant. In the field last named the increase was due in large measure to the success of drilling in Kentucky, particularly in Estill, Lee, Lincoln, Breathitt, and Allen counties.

In California the principal source of new production was the Montebello field, a discovery of 1917, in Los Angeles County, which, with the Casmalia district, in Santa Barbara County, and with the older districts in both the San Joaquin Valley and the Coastal-Southern division, apparently succeeded in establishing a new record for oil production in California, in excess of 100,000,000 barrels.

The gain in the Rocky Mountain oil region is credited to Wyoming and is ascribed in part to the Big Muddy field, in the western part of Converse County, in part to the drilling of a few new wells of large capacity in the heart of the Salt Creek district, in Natrona County, and partly to the results of the provision of marketing facilities to the Warm Springs field, Hot Springs County, and to the Pilot Butte-Maverick Springs district in Fremont County. New and potentially important sources of oil production were proved in Wyoming in 1918, on Buck Creek, in Niobrara County, and on Rock River, in the eastern part of Carbon County.

Credit for the gain in the North Louisiana region belongs almost wholly to the Pine Island district, in Caddo Parish, opened near the end of 1917, and extensively and successfully developed during 1918. Near the end of 1918 a new oil pool of apparent significance, termed the Bull Bayou district, was opened in the southeastern part of De Soto Parish, about three miles south of the Crichton field.

Momentous developments, affecting the future supply of high-grade petroleum in the United States, took place in 1918 in the central and north Texas field, following discoveries of petroleum in considerable quantities near Ranger, Eastland County; near Caddo, Stephens County; near Brownwood, Brown County; and near Burkett, Coleman County, in 1917. About 60 oil wells were completed during 1918, and at the end of the year the new field was credited with a potential capacity of 50,000 bbl. of oil a day, though its actual capacity, limited by pipe line facilities, was only about 18,000 bbl. a day. The campaign of "wildcat" drilling radiating from the centers named extended over more than 40 counties in northern Texas before the end of 1918, and will doubtless result in the opening of other pools of high-grade oil in 1919. The decrease charged to the Oklahoma-Kansas field is accounted for by the failure of "wildcat" drilling to discover new areas comparable with the declining Cushing, Healdton, Eldorado and Augusta districts.

In Kansas new territory was opened in Butler County, north of the Eldorado field, and in Greenwood County, east of that district. In Oklahoma a prolific producing area, known as the Youngstown pool, was developed in Okmulgee County, and strictly new oil territory was opened in Stephens County, several miles west of the Healdton district.

The diminished output of the Gulf field is assigned to the settling of production in the Goose Creek pool, Harris County, Tex., and to the normal decline in yield of the other dominant pools in that field. New pools of promise were discovered in the Gulf field in 1918 at West Columbia, Brazoria County, Tex., and at Big Hill, Matagorda County, Tex., though neither added materially to production in that year.

Asbestos Production of five of the largest shippers in Canada during 1917 was 3708 tons of crude, 50,506 tons of fiber, and 3550 tons of sand, according to the Asbestos and Mineral Corporation. In 1918, the same five companies produced 2896 tons of crude, 74,109 tons of fiber and 14,038 tons of sand. The increase in tonnage in 1917 over 1916 was 3%, and that of 1918 over 1917 approximately 2%. The increase in value in 1917 over 1916 was 39%, and the value was even greater in 1918. Stocks at the mines are depleted, and it is believed that higher prices will rule during 1919.

The Economic Duties of the Engineer*

By W. R. INGALLS

DURING the last six months we have heard much in this country on the subject of reconstruction, or readjustment. Great Britain and France had begun considering it a long time previously. With us, however, the armistice came so suddenly that we had hardly got into it. Being thus taken by surprise, there was for two or three weeks a good deal of panicky talk about it, but since then, although the subject is about the most important of those confronting a sorely tried world, the academic interest in it has waned considerably. Apparently some people, who during the last two years have been drawing diagrams of organization and formulating plans on paper for the regulation of all human and industrial conduct—and, indeed, putting not a few of those plans into practice—had visions of restoring conditions to normal in a similarly official way. Their conception was not unlike what they might have had of a clock whose complicated mechanism had been altered to run in an abnormal way, which had to be taken apart once more and reconstructed according to its previous organism. But the interest of officialdom was distinctly moderated when the President in his address to Congress early in December revealed the absence of any Administration plan for reconstruction, and dismissed the matter with the suggestion that the people would probably work out their problems for themselves. Since then the mushroom bureaucracy has been most interested in dissolving and getting back to pristine occupations as rapidly as possible.

The President's remarks were, it seems to me, a mixture of wisdom and inattention. There was wisdom in the thought that the people would solve their industrial and commercial problems better than a bureaucracy could do it for them. There was inattention to the pressing need for readjustment in matters of direct business relations between the Government and the people, requiring prompt legislation to apply to conditions of canceled contracts, legitimate claims and the disposition of enormous accumulations of goods.

There were people who, scoffing at the bureaucratic ideas about elaborate, theoretical plans for reorganizing things, believed all along just what the President expressed, although perhaps their thoughts were based differently and were of broader scope. They knew from their previous business experience that commerce and industry, overtaken by a sudden emergency, could not, and would not, wait for plans to be drawn; but would go ahead and do things in their own ways, and that their doings would be expressed in the commodity markets and in the relations with labor, both of which expressions would be practical, not theoretical. Let alone, the mere readjustment would be completed before any academic plans could be drawn. The situation was not unlike that of the old story of a railway bridge in Montana that had been destroyed by fire. The bridge engineer and his staff were ordered in haste to the place. Two days later along came the superintendent of the division. Alighting from his private car, he made haste to see the old master bridge builder.

"Bill," said the superintendent, "I want this job rushed. Every hour's delay is costing the company money. Have you got the engineer's plans for the new bridge?"

"I don't know," said Bill, "whether the engineer has the picture drawed yet or not, but the bridge is up and the trains is passin' over it."

Our own industrial bridge is going up pretty fast, though the trains are not yet passing over it, and no plans were drawn. Yet the President was wrong, I think, in pronouncing that readjustment was simply an affair that the people themselves ought to manage. There are relations between the people and the Government to which the latter, in justice, should give earnest attention, as indeed it is now doing, but only partially.

Many contracts into which producers entered upon telegraphic or verbal instructions, as they do in ordinary business affairs, have been repudiated by governmental bureaus on the ground that they had not been signed and sealed in the statutory way. In many cases these contracts, now repudiated, were accepted by producers at the urgent request of Government officers, and shipments to fill them had begun.

The Government has canceled contracts that were duly signed and sealed and in so doing has given the other contractual party good ground for claim for indemnification of loss. Under present conditions of adjudicating such matters many legitimate claimants who are now young men will be old, old men before they receive what is due them.

The Government accumulated immense stocks of material of many kinds, which will have to be liquidated. The method of this liquidation will have a great influence upon the markets and consequently upon industrial conditions.

Unless broad and generous arrangements to provide for these plainly required matters of readjustment, to which the Government is a direct party, are promptly made, the situation will be fraught with some serious and immediate industrial dangers.

But while the people are rapidly attending to the general matters of readjustment that are involved in changing from a war basis to a peace basis, and while the Government is neglecting some of the relatively simple matters that obviously pertain to it, there is a broader phase of the new economic conditions that as yet we have scarcely begun to consider. Indeed, there is danger that we may be heedless in an hour of peril.

We began some time ago to talk about reconstruction. Then we made up our minds that readjustment was a more expressive word. I am not sure but that a word that is even more expressive of what we must consider is *reorganization*. That which has heretofore been uppermost in our minds, and perhaps is still, was the restoration of our old organisms, our old systems and methods of doing things. We may question whether so simple and so complacent a program is either all that is required, or even is safe. In the common happiness over the termination of the war, we run the danger of failure to appreciate the cataclysm that the world has experienced. I have listened to eminent financiers and industrialists prophesying an era of such prosperity as was never previously enjoyed by this country, and I have read many essays on the same subject that exuded optimism. Some have even dismissed the possibility, if not the probability, of troublesome conditions during the period of preliminary readjustment that many economists expected to follow immediately after the armistice, and that, indeed, is already upon us.

---

*Presidential address before the Mining and Metallurgical Society of America, Jan. 11, 1919.

It is never popular to be pessimistic, but I suspect that many of those who have drawn the most optimistic pictures in public do not see things in quite so rosy a light in the privacy of their studies. A preliminary period of irregularity in business, accompanied by disturbances of more or less serious character, is inevitable. This will be the period when the pains experienced in changing from a war basis to a peace basis will be most acute. Following this there is reason to expect a longer period of illusory prosperity, during which the actual reconstruction in Europe is going on, during which the depleted warehouses for ordinary commercial goods are being filled up, and during which the deferred wants, both at home and abroad, for many articles are being filled. The housing and transportation facilities of this country are both, probably, behind the demands, and a great deal of material and labor will be required to furnish what the people need. But, nevertheless, I cannot foresee a long-enduring period of prosperity, not unless there be a good deal of reorganization in industrial methods.

The wealth of the world before the war was estimated roughly at about $600,000,000,000. The cost of the war is not uncommonly mentioned as being about $200,000,000,000, which is approximately the sum of the war debts of the several countries. Apparently, then, the wealth of the world has been diminished by about one third; but a little reflection will show that this cannot be so. America, Great Britain, Germany, Austria, and the neutral countries have all of the houses, railways, factories, farms, and public improvements that they possessed previously, although some of this plant, especially in Germany and Austria, has deteriorated by wear that has not been made good. France, Belgium, Poland, and Serbia still have the most of their physical property, the actual destruction in France being estimated at about $8,000,000,000 and in Belgium at about $2,000,000,000. German authorities estimate the destruction in France and Belgium at about $5,000,000,000. The destruction in Serbia and Poland is large, but is less than in France and Belgium. Russia had most of her property intact, though badly deteriorated until the Bolsheviki began to destroy it, since when the destruction there has been catastrophic. There is grave danger that the German bolshevists may do something similar in Germany. The world's loss of shipping is estimated at about $3,000,000,000. Great as these losses will total, they will be far short of $200,000,000,000, which figure includes the cost of the direct withdrawal of tens of millions of men from the production and accumulation of wealth; and the occupation of other tens of millions in supporting them. Such loss is of course the loss of what might have been created and saved rather than what was. Even the use of the metals and other materials in warfare, at the expense of the depletion of our mines and forests, has been largely the loss of what might have been rather than what was. The war debts of the several countries are in the main internal affairs, representing redistribution of accounts among the several nationals. Thus, the fact that the German debt is nominally a large proportion of the wealth of Germany does not mean that the latter has been impaired to that extent, or that Germany cannot assume the payment of a huge indemnity to the countries that she maltreated.

Nevertheless, the real loss by the war through the destruction of property and the impairment of property, and by the destruction and crippling of men, women and children, is not to be minimized. Although the property loss may not amount to one third of the world's total wealth, there is no doubt that its real amount can be represented only by a stupendous figure, and the same is to be said of the loss and impairment of population. It is estimated that the world's loss of life from causes due to the war, including the influenza, has been 26,000,000 souls during the last 4½ years. The number of those wounded, maimed, and shattered in health is greater than that. A world that has suffered such losses in material wealth, in life, and in the deterioration of the physical and mental powers of the populations of many of its countries cannot confidently look forward, it is evident, to any era of great prosperity, or even to a prosperity like what might have been expected if the war had not been; not unless some new ways and means of a superlatively compensating character can be devised. Any other thought would be equivalent to the idea that it would be a good thing for business if all the windows in the United States should be broken, which is an economic fallacy that was long ago exposed, although it is still entertained among labor unions. I say it would be preposterous to build hopes of a coming era of prosperity if the world is simply going to readjust itself to old conditions. Even if it does more than that—even if it institutes economic improvements of the first order of magnitude—there is grave doubt whether it can do much more during the next generation than make good its losses during the five or six years of war and demobilization.

There are, however, plenty of signs that the world is entering upon the new era with new ideas. Some of these are very hopeful. Others are distinctly ominous. Among the hopeful factors are the new thoughts and habits of the people, which may be summarized as the broadening of the vision of national and international relations respecting industry and welfare, the better appreciation of the principles of economics, the inculcation of habits of thrift, and the better understanding of common interest and the advantage of coöperation. The manner in which the American people saved food and fuel, exemplified best of all by the prompt adoption of gas-less Sundays, upon a mere request communicated through the newspapers, was one of the most exhilarating of events during the last year. Who will venture to prophesy that this spirit, now that it has been excited, is going to disappear?

On the other hand, there have been alarming exhibitions. Labor has been loyal during the war, but to a large extent it has been misguided. It has failed to take full advantage of its opportunities. Enabled by the natural law of supply and demand to obtain wages that in many cases were fantastic, it has neglected to exercise thrift, and, on the contrary, has squandered not only its earnings but also its time, and even has let its efficiency diminish. It is unnecessary to go into details of this indictment, which every employer of men knows to be true in the main. Never before in the history of modern civilization did labor have such an opportunity to elevate itself in the economic scale while what are called the capitalistic and burgess classes were being reduced by taxation that was caused to fall especially upon them; and never was there such a misunderstanding of the nature of wealth as labor exhibited. Even now is there a demand, not only in America but also in Europe, that although the war is ended the war scale of wages shall not be reduced. Analysis of the fundamental conditions will be convincing, I think, that wages cannot be maintained at the recent level, that wages are not broadly a matter of arbitrary dictation to employers, and that when there is such dictation the result in the main is the profit of one group of labor at the expense of other groups of laboring men. The only way whereby real wages may be increased is quite a different one.

There prevails among workingmen, or among many of them, the idea that they are exploited by a class whom they call the capitalistic class, which is supposed to enjoy the major part of the fruits of industry, and that idea is cultivated by agitators and professional doctrinaires. Thus I read in a recent treatise entitled the "High Cost of Living" by Dr. Frederic C. Howe, that "In 1916 we (the United States) produced $45,000,000,000 of wealth. That is $450 a person, or $2250 for every family in the country. It is a sum adequate to raise a family in comfort even at the present high cost of the necessities of life." . . . "The total wages paid in the United States in 1916," continued Dr. Howe, "amounted to but $5,320,000,000, or 11% of the total wealth produced. . . . The explanation is to be found in monopoly, which has become all-pervasive." Therefore, according to Dr. Howe, the average wage per person was $53.20 per annum, or $266 per family. What could be more absurd? Consider that the 2,000,000 railway men averaged approximately $1000 per annum, or a total of $2,000,000,000, according to Mr. McAdoo's figures; that the employees of the United States Steel Corporation, about one-fourth of a million in number, averaged $1050. We ourselves know well enough what the men average in the great mining and metallurgical industries.

Scott Nearing, one of the most blatant of our socialists, asserted recently that if incomes were equalized all over the United States there would be enough for every workingman in the country to have $60 a week. Now let us see about that. Let us convert Professor Nearing's $60 per week to $3000 per year, disregarding the odd hundred. To give every worker $3000 per year the total income would have to be $120,000,000,000, whereas, in fact, it was only five-twelfths of that, according to the highest estimate for 1916, which was a very prosperous year.

The spread of such lunacies, which have been put into hideous practice by the Bolshevists in Russia, constitutes one of the great economic dangers that confront the world. It is true that the workmen of Russia, who acted upon the theory of "steal what has been stolen," have learned to their sorrow that the only things worth stealing are the accumulated stores of food, fuel and clothing, that they represent but a trifling part of the wealth of a country, and that when they have been consumed the rest is of no use without work; and that work is of insufficient productiveness unless intelligently directed. The facts that the experiments in uplifting the proletariat by stealing have failed in Mexico, and then in Russia, do not convince the socialistic doctrinaires. They will not learn until they have tried the same experiment everywhere. It is one of the great duties of intelligent people of all kinds, but especially of engineers, to eradicate this poison from the minds of the workmen, who exhibit its symptoms in various ways and in various degrees. The engineer is the natural enemy of Bolshevism, the natural enemy of all uneconomic thought.

In 1917 one Robert Bruere went to Arizona to report upon the social and industrial conditions at the time of the general strike among the copper miners. In one of Mr. Bruere's articles there was a subcaption "Copper Companies Regard Mining as a Matter of Engineering Rather Than of Democracy." Mr. Bruere reported an interview with a mine manager whose idea was that if mine managers played with democracy they would never get out the ore. "He did not consider mining to be either a problem of democracy or autocracy, but simply a problem in engineering," naïvely remarked Mr. Bruere, who added that the dream of this manager was a mine from which the ore might be extracted by automatic machinery, just as it is now crushed and concentrated by machinery.

Mr. Bruere was right in his discernment that we regard mining as a matter of engineering rather than of democracy. If we did not so regard it there would be mighty few mines of any kind in operation today, and the world would be wondering about its metal supply. There are big ore deposits today whose output will be needed, that we cannot yet manage to work, but hope that we can if we succeed in getting more mechanicalized. If anybody has any notion about running mines by democracy, he may usefully examine what the workmen did with the Spassky, Kyshtim, Ridder, and other great mines of Siberia. We know that Mr. Bruere was wrong in his fantastic notion that "democracy implies intelligence, initiative; and these are precisely the most undesirable qualities in a mucker." On the contrary, he might have learned, if he had taken the trouble to do so, that the great effort of enlightened managements everywhere is to increase the intelligence and initiative of the men and enable them to draw more pay for the simple reason that they earn it.

What engineer is there who does not know that the essential assumption of pure democracy as applied to industry—that production should be controlled by the people themselves—is in direct antithesis to the fact that in modern industrial life efficiency of production has increased as the efforts of the many have been directed and organized by the talents of the few? Must not every engineer of experience in leadership agree with Mallock, the great philosopher, that the oligarchic principle is as dominant in industry as it is in political democracy?

But superior to all industrial and political principles are economic laws, for it is those laws, which are laws of nature, that create and determine principles and practices. One of the greatest of economic laws is that of the survival of the fittest, which exhibits itself in competition, and from that is derived the classic economic doctrine that labor is the residual claimant upon the produce of industry. After the shares of the state, the landlord, the capitalist, and the entrepreneur have been deducted, all the rest goes to labor, and here is what is mystifying to many, to wit, rent, interest, and profits are limited by competition, and of them the laborer can get neither the share of the landlord nor of the entrepreneur by any economic means, while, as for interest, the residual claimant is benefited by every payment on account of capital used in the production of wealth, and is better off when a high rate of interest is being paid than when a low rate is paid. We may apply the principles to the concrete case of the United States.

The wealth of the United States at the end of 1916 was estimated at about $250,000,000,000. The production of things was about $50,000,000,000. These are very rough figures, as they are bound to be. Estimates relating to this subject vary considerably. I have mentioned the highest that I have seen. There is reason to suppose that the higher figures are more nearly correct than the lower. Anyhow, I am going to use the highest only to give an approximate idea of proportions. This was before the United States entered the war, and, according to the United States Bureau of Labor, we had 40,000,000 workers. Let us assume that rent, interest, and profits averaged 4% of the wealth of the nation, which would hardly be extravagant. That would account for $10,000,000,000 out of the total produce, leaving $40,000,000,000 for labor, or $1000 per worker. We have already seen that 2,000,000 railway workers and 250,000 iron and steel workmen received about that sum. Those figures are specific expressions of two whole industries. The workmen in some other industries earned more; in some they earned less. However, there is considerable evidence that the general average was about that figure, or something near it, and, anyhow, whatever error in statement there may be will not invalidate my following argument.

That labor does not get increased wages at the expense of capital (unless capital be confiscated, in which event the increased wages will not long endure) is illustrated by the experience with the railways in Great Britain and America. The governments guaranteed the bond and stock holders their average return for a series of pre-war years. In the United States this was $1,000,000,000 per annum, or just about 5% on the capital as reported by the Interstate Commerce Commission. The increase of $800,000,000 in wages has been paid by the public in higher freight and passenger rates. To have left the roads in private hands, compelling them to pay higher wages without permission to make higher charges, would have resulted, first, in impaired service and finally in the state having to take over the lines and supply the deficit in order to have any service at all, just as has happened with some of the street railway lines in Massachusetts. Thus, what is virtual confiscation aids the wage earner only slightly and only temporarily.

But apart from confiscation, the winning of increased wages by one group of labor is obtained only at the expense of other groups. The inequality in the distribution of wealth is not between the capitalist and the laborer, but rather is it among laborers themselves. There is ample ground for the surmise that the professional, clerical, shop-tending, and similar classes, and the salaried classes generally, have suffered especially at the hands of the railway operators, mechanics, artisans, builders, and miners, but the farmers and the factory folk have not been immune.

I am not going to enter upon any fine analysis of the very rough statistical data that I have given, and shall point out merely that after the state, the landlord, the capitalist and the entrepreneur have got their taxes, rent, interest and profits, of which the last three are severely limited by competition, labor gets all the rest, and what it gets is what it produces. The only way it can get more is to produce more.

It is unfortunate that the only way of expressing production is in terms of money. If it were possible to express it in terms of goods, there would be less misunderstanding. However, it is clear that if the total goods and the total population remained the same, it would not matter if the money value of the goods fell from $50,000,000,000 to $30,000,000,000, i.e. it would not matter at all if money wages fell from $1000 per annum to $600, as, indeed, they would fall inevitably. On the other hand, if commodity prices remained the same, and the value of products should rise from $30,000,000,000 to $50,000,000,000, labor would get so much more, for it would be producing more goods. This is the only way that the war scale of wages can be maintained, and it is a problem of capital, labor, and talent to coöperate in accomplishing it, for only by coöperation can it be done.

This is no preaching of capitalism as commonly understood, but is simply classic and proved economic doctrine. The workman who wastes time and material, the farmer who lets himself be led astray by foolish agrarian policies, the small miner who is similarly misled, the manufacturer and the railway company which fail to adopt efficient methods, the interests large and small which create monopolies or enter into agreements to exact non-competitive prices—all of these are counter-agents to progress in human welfare, although in varying degrees. Probably, on the whole, there is more intelligence among the great corporations than there is among the labor unions, and a better understanding of economic principles, but there are some labor unions whose leadership is bright and some corporations whose management is stupid, while of both there are many that are only mediocre. My thesis is rather that the only way whereby the condition of the mass of the people can be improved is for it to produce more, and the loss of capital and life that has been suffered during the last 4½ years makes it particularly essential now to give attention to increased production, to accomplish which we shall undoubtedly need to develop new systems and new methods. This is what I mean by the necessity for reorganization, rather than readjustment, after the war. And it is in such reorganization that the engineer must play a great part.

England is already making her plans, and unless we are careful she will get the start of us. Thus, I recently noted the following paragraph in a letter from an observant American traveling abroad:

"England is knitting together for work. The directors of capital and the organizers of labor were never more together. There have been no strikes in England against capital, only against government wages or failure of government to equalize matters as between war bonuses and high cost of living. England is studying efficiency and is preparing for the overseas competition of the future. Forty-six English factories, without trade union or labor opposition, have adopted scientific management, but no stop-watch can be used in any factory controlled by the United States Government, nor is it allowed by the labor unions to make studies in time or motion, or to compile records to promote individual efficiency."

Now, more than ever, should labor in this country be taught that its real interest is to produce more, which is to earn more, and employers should not attempt to diminish labor's residual claim by abolishing competition among themselves or artificially enhancing profits by other means. And just as it is the interest of labor to earn the maximum, so is it the duty of the employer, which means that he should ever be alert to improve his methods of production. Wide differences of plant efficiency, administration, etc., are really the inspiration of social unrest among workers, rather than conditions that are intentionally designed to be evil. The social reformer, who does not understand production, is a far less important person in the promotion of human welfare than the engineer, who does.

My rather discursive presentation of some fundamental economic conditions, and some approaching problems resulting from them, has been to furnish a background for my thesis of the economic duties of the engineer. America and Great Britain may be in no danger of either political or industrial socialism—the results of the recent elections in each country are reassuring as to that—but, nevertheless, some of the virus has got into us, and, anyhow, our affairs are bound to be affected by the back-wash from the revolutions in Russia and in Germany. Those adversities come on top of the direct destruction by the war in the countries that have preserved their stability. You may mark my words that the engineer is going to have from now on such obligations as he never had before. How he will live up to them remains to be seen. Certainly he will live up to them best if he knows what they be. I can do no more than state them as I see them. Perhaps I see only a few of them. Without any doubt I fail to see all of them.

First of all what I see is that the engineer should saturate himself with sound economic doctrine. This is just as much the basis of his professional work as are the sciences of physics and chemistry; and the fundamental laws of economics are just as immutable as are the laws of gravitation and indestructibility of matter. The engineer-economist cannot possibly be a socialist, or a semi-socialist, nor even an industrial democrat; for it is his business to produce, and socialistic tenets do not tend toward production.

The engineer must be not only a counter-agent against the destructiveness of the proletariat, but also must he direct himself against the sluggishness of tortoise-like capitalists. One of the cardinal principles of American engineering during the last 20 years has been the exchange of information and the promotion of publicity about everything—technical processes, business relations, corporate affairs. We have seen America forge ahead largely owing to the absorption of this idea, while Great Britain lagged behind and almost went asleep at the switch. She is wide awake now. Let nobody forget it. But we ourselves have got to go further in publicity than we have gone heretofore. Publicity has been a favorite word among us, especially among mining engineers, who have created more openness in the affairs of their profession and their corporations than exists anywhere else. In reading one of Hobson's treatises not long ago I found a word that struck me more emphatically than publicity. He spoke about transparency, and said that "Perfect transparency of industrial operations, perfect fluidity of labor and of wealth, would effect incalculably great economies in the production of commercial wealth." And he said further: "No fact bearing on prices, wages, profits, methods of production, etc., merely concerns a single firm or a single body of workers." The more you think about that the more will you be impressed by its truth and its merit. Further effort toward perfecting the transparency of industry is, then, another of the economic duties of the engineer for the promotion of the production of wealth.

I have just quoted from Hobson's work on the "Evolution of Modern Capitalism." In an addendum to that book, written in August, 1916, he outlined post-war economic problems in a way that was prophetic. Let me quote one paragraph: "After the war, the task of economic reconstruction will compel the adoption of bolder experiments, both in public and private enterprise, than had hitherto been thought possible. To realize the enlarged productivity, more pacific coöperation between capital and labor, employer and employed, is a first essential. The immediate peril of an economic situation in which labor seems liable to a sudden fall of wage from the artificially inflated war level will evoke conscious efforts to find ways of harmonizing the interests of capital and labor. The issue is one of devising adequate and reliable stimuli to draw from the workers a larger and more regular output of productive energy, a greater willingness to adopt and apply new mechanical and business methods, and, in general, to coöperate more effectively with the other factors of production."

There was real vision in that forecast of 30 months ago. I may be captious in my criticism of it for its reference to capital and labor, which antithetical representation of two parties alone is always irritating to me. Even some of the socialistic writers recognized many years ago that it was necessary to consider the talented classes as well as the laboring and capitalistic; and recently Lenine and Trotzky, appreciating that the confiscation of capitalistic wealth would not reduce Russia to a dead level of equality so long as they allowed talent to exist, logically began the massacre of the intelligentsia. Labor, capital, and talent are a trinity, which one of our rough-and-ready philosphers not long ago represented as a three-legged stool. Among the talented, who are so eminent as the engineers, and whose is more clearly the duty of devising the new stimuli that must be provided?

But while devising stimuli for the workmen let us not forget the need for opening the eyes of the employer to his own defects, and I do not mean defects in his human relations, but rather his economic defects. For an employer may be a generous and lovable captain, whom those working for him may affectionately call "the old man," and yet he may be their worst enemy, an economic impediment, owing to his ignorance and backwardness. Just as there is a class of no-rent lands which determine the price of agricultural produce, so is there a class of no-profit employers who determine the rate of wages. I have previously in this address adverted to this subject, and indicated that the leaders of the workingmen should direct their energies against the inept employer who is their real enemy, rather than against the great profit-making entrepreneur who is their best friend.

Sometimes we see the backward manufacturer stirred to new and better things by the threat of imminent extinction through the advent of a new competitive process. Thus, about 20 years ago the contact process of making sulphuric acid promised to displace the classic chamber process, and abolish millions of dollars invested in plant, but the chamber-process men bestirred themselves, improved their practice, and held their own. Right now we see in the electrolytic process of zinc extraction a dire threat against the distillers, and the probable dislodgment of some of them. There will not be an extinction of them as a class, but there will be a case of the survival of the fittest; and those will be the fittest who first improve their practices in ways for which there is room, but which they will not take until necessity drives, necessity in this case being the danger of losing all of their capital tied up in plant.

We have seen how in ante-bellum days Great Britain practically lost important metallurgical industries, such as zinc smelting and copper smelting, in which she was once preëminent, and we see her now keenly studying and introducing improvements that will rejuvenate her and not unlikely put her ahead of us if we do not look out. Similarly in France, Spain, and other countries, where important steps are already being taken. But few people here appreciate the alertness and intelligence with which the Europeans are entering upon a new program, for the simple reason that they know they have got to do it. It is one of the immediate economic duties of American engineers to see that our own industries do not become blind to the reorganization that is being started elsewhere and ought also to be considered here. I am not now thinking in terms of individual enterprises, many of which may be, and doubtless are, very efficient; but rather am I thinking of industries as a whole.

And just as we must think of industries as a whole, so also must engineers think and act as a whole. The individual, no matter how superior he may be, cannot alone make very much of an impression. Indeed, his influence may be greater abroad than at home, and may be more to the advantage of foreign people than his own if he be unsupported by a body of colleagues at home, as witness the influence of Orville and Wilbur Wright in aëronautics.

I think it is an indictment of the engineering societies of this country that they have made no general efforts for the advancement of economic conditions. Their meetings have been pleasant social functions, the benefit of which is not to be decried. Their printed transactions have been the repositories of valuable technical papers, which are useful for reference and guidance. But in their practical indications, in their practical push toward better things, they have been insignificant in comparison with the splendid efforts of the American engineering press, respecting which we may proudly say *ne plus ultra*. Pray forgive any impropriety in my expressing this, for of course I have not in mind my own trifling part in what hundreds of papers have done with the coöperation of the industries and professions that they represent.

The Mining and Metallurgical Society of America is one of the few professional organizations that has aimed to improve economic conditions by active concerted pressure representing the consensus of professional opinion. Its efforts have naturally been confined to its own industry. In spite of its small membership, which smallness is, after all, inconsequential, so long as there is the right quality of membership, this society undeniably did most in recent years to improve the transparency of the mining industry. With equal assurance may it claim the credit of giving the impetus to the movement for greater safety for miners. And also may it claim the crystallizing of the movement for a reform of our archaic mining laws upon new lines, as to which the mining industry is in almost unanimous agreement, the actual drafting of the new legislation having been delayed by the advent of the war. It is exactly such kind of work, now with regard to some broad economic principle, now with regard to some plans for new legislation, and at other times, at the present time, with regard to purely technical questions such as the status and particular problems of the copper, lead, zinc, or iron mining industries, that mining and metallurgical engineers must act unitedly through a body like this, if we are going to achieve the right reorganization in this country. And what we do in our particular field, so must the civil, mechanical, and electrical engineers do in theirs.

With the entry of the United States into the war, the engineers of the country, like everybody else, enthusiastically offered their services to the Government. I think that the engineers were particularly eager, for they knew from the previous experience of our Allies that it was an engineering war. Our own members, and those of other societies, and engineers generally, entered the services and undertook duties at Washington and elsewhere in great numbers. Now, far be it from my thought to minimize their accomplishments. The job was done, the war was won, sooner than we expected and more victoriously than anybody ventured to prophesy; and that was the principal thing. We performed some marvelous engineering feats in building cantonments, in repairing the German ships, in organizing and equipping a great Army and transporting it to France, in building shipyards and ships, in feeding our Allies and supplying them with materials. I cannot hope to enumerate all the praiseworthy things that we did, largely through the instrumentality of our engineers. Yet I cannot overlook that according to General Pershing's official report, made after the armistice, his armies had fought with French guns, British tanks, and French and British aëroplanes, although 19 months had elapsed since the United States entered the war. Nor can I forget the coal famine, and other industrial troubles in this country, and consider that the engineers of the country did all that they might. It was not their fault that they did not. They wanted to do everything in the best way, anyhow to give the best that was in themselves. The engineering societies did loyal and effective work in so far as they were asked or permitted. Yet is seems to me that the delay in starting shipbuilding, the subsequent aëroplane fiasco, the mess about making the 75-millimeter guns, and some mix-ups in our own industry show that our engineering bodies did not exercise the pressure toward prompt and successful accomplishment that they might have done. Sometimes, when we knew that things were going wrong, we let ourselves be swayed by emotions and by condonations that any one of us would have regarded as short of his duty to an individual client.

The wicked war is now ended, thank God, and the hurly-burly of doing things quickly, without counting cost, is past. We are entering upon an era not merely of reconstruction or readjustment, but of reorganization in which it will be many years before we shall be able to form much of an idea of what the result is going to be. There is every probability that engineers are going to be called upon to play a great part in this, and now, fortunately, they will be able to give more deliberate consideration to the study of problems and the formulation of plans than they could during the war. They will have to work individually and also concertedly through professional bodies like this. If they fail to do so, they will be derelict not only in their economic duty, but also in their duty as citizens of the Great Republic, whose welfare must not be permitted to suffer during the coming period of competition and elevation among our friends and rivals.

Straightener Made From Old Air Pumps

By Claude T. Rice

In the machine shop of the Hecla mine at Burke, Idaho, there is a formidable-appearing as well as a much-used machine called the press or straightener. This machine was made several years ago from the air cylinder of an old compound 10 x 18 x 6 x 18-in. Jeanesville mine pump that was about to be sold for scrap. The cylinder is mounted vertically upon a base, which is an old compressor disk 52 in. in diameter and 6 in. thick. The water-end piston rod of the pump has been forged out into a plunger, and a lever arrangement has been mounted upon the valve chest so as to control the flow of air to the cylinders.

There are several different pieces that rest on top of the base to act as anvil blocks when pressing pulleys, etc., on and off shafts or axles, but one of the main uses of the press is in straightening old rail and pipe. By using a 4 x 4-in. steel bar, 4 ft. long, for a straightening block, and holding the pipe by means of discarded clamps from 6-in. rock-drill bars, and clamping one at the top of the pipe directly under the plunger, pipe up to 6 in. diameter can be straightened. For straightening rails, the same 4-in. bar is used shimmed up with thin pieces of iron. The rail is placed on this block and straightened 4 ft. at a time, working it back and forth under the plunger. As the bend in the rail is generally sideways, blocks are arranged so that pressure is brought upon the head and web of the rail rather than on the flange, and a steel block is put under the plunger so that it will press only against the head and web of the rail. The machine serves a useful purpose in salvaging old pipe, rails, and bar iron.

Grong Pyrites Mines, Norway

The purchase, by the state, of the Grong sulphur ore deposits for the sum of 10,593,000 kroner was recently sanctioned by the Norwegian Diet, and was reported in the *Chemical Trade Journal and Chemical Engineer*. The Grong mines are at present under the management of the Electrochemical Industry Co., and the more important deposits within the group are the Joma, the Gjersvik and the Skorova. The Joma deposits are said to contain 6,500,000 tons of ore, most of it carrying 44 to 45% sulphur and little copper. The Skorovas deposits contain at least 1,000,000 tons, almost entirely free from copper, having 50 to 51% sulphur, and free from arsenic. The Gjersvik deposits are estimated to contain about 1,200,000 tons of ore containing 2.2% copper and about 42% sulphur. Thus the aggregate content of the Grong mines is at least 8,500,000 tons. When the transport arrangements have been completed, the annual output should amount to about 400,000 tons. The shares of the Grong mines were principally in French hands.

Advantages of Underfeed Firing

Plants using underfeed stokers claim to have reduced the cost of power-house operation from 15 to 25%. The percentage of CO_2 in the flue gases is a guide to the efficiency of the furnace and may be determined by the use of the proper instruments, or by observing the amount of black smoke coming out of the stack, or the amount of carbon in the ash. Faulty combustion is due to several causes, one being that if fresh coal is shoveled directly into the furnace it is literally "too green to burn," whereas if the coal is preheated slightly, but not enough to distill the volatile matter, before it enters the incandescent fuel bed, the combustion is immediate and perfect.

The underfeed stoker permits the introduction of "hot" coal into the fire from below while fresh coal placed in the hopper is forced by cylindrical rams into retorts that underlie the fuel bed. These retorts resemble troughs, which are inclined from the hopper down and across the furnace, and are separated by rows of tuyeres that support the burning coal and furnish air to the fire. The rams fill the troughs and force in more coal, which crowds the coal already in the troughs up to the tuyeres, where the combustion is completed. During the time that the coal remains in the troughs, before it is forced up, it is heated to such a temperature that distillation readily takes place, and so it is in perfect condition for complete combustion.

Underfeed stokers are equipped with an auxiliary forced draft system that insures the correct amount of air for perfect combustion. Fewer firemen are required to handle them, so that labor is released for other purposes. The types are adapted to many kinds of coal and have a wide range of flexibility, which is desirable where a high peak load is necessary.

Bill Introduced To Legalize Informal Contracts

On Dec. 9 Representative Dent introduced a bill (H. R. 13,274), which was referred to the Committee on Military Affairs, to provide for relief to manufacturers who accepted orders on contracts by telephone or over the signature of persons not fully authorized to conclude contracts.

During the war many orders were given and accepted by manufacturers for war supplies required by the Government which the Controller of the Treasury now rules are not valid contracts, holding that payments thereunder cannot be made without special legislation. Certain contracts were signed by chief assistants instead of the chief of the procurement division of the Ordnance Department. Certain orders were not on proper forms and were not signed by both parties to the contract. In other cases agreements were entered into verbally or in writing, but owing to the urgency of the cases manufacturers were asked to and did proceed with their work pending receipt of formal contracts which were not fully completed before Nov. 12. In still other cases manufacturers had bought supplies and started work even before the details had been agreed upon.

It is on the assumption that manufacturers did their utmost to facilitate production on Government account without waiting for contracts, and trusting that the remuneration would come in due course, that this bill was introduced. The bill as reported back to the House from the committee authorized the Secretary of War to settle any agreements, expressed or implied, upon a reasonable basis, that were entered into in good faith prior to Nov. 12 by any agents of his department. These claims may include lands, supplies, materials, or equipment to be used for war purposes and contracted for in a manner not in accordance with the prescribed law. All claims must be presented before June 30, 1919. No provision is made for suit against the United States upon agreements of the nature specified. Provision is made, however, against fraudulent or unjust settlements, if in the hurry of their consideration it is subsequently found that injustice has been done.

The Senate Committee on Military Affairs has rejected Secretary Baker's recommendation that the War Department handle this matter, and has reported Senator Hitchcock's bill covering practically the same matter but placing adjustment in the hands of a non-interested commission. There is not much doubt that both houses, already in substantial accord, will early agree upon a bill that will permit of these very just claims being satisfied. It is to be regretted, however, that no provision has been made for the hundreds of claims that will be made not falling specifically within the bill.

Whether just or unjust, such matters will have to be brought before the Court of Claims, and if business is handled there as it has been in the past, equitable adjustment may be delayed until the third or fourth generation. In other words, the Court of Claims as now constituted cannot render justice. Men who will come before it have done more than their share, and it is the duty of our Government to see that they do not suffer unnecessarily. It is hoped that an amendment to this measure will provide for consideration of all war claims not otherwise provided for.

The Matthews Cable Clamp

Insulated-wire-cable electric conductors, whether in mill or mine, require special means for holding them taut when required to turn corners of whatever angle or to enter the side of a building. In the accompanying illustrations the Matthews cable clamp is shown both in detail and in use. It consists essentially of a tension insulator between a turnbuckle and a cable clamp. One end of the turnbuckle may be bolted to building walls, foundation or other anchoring medium, and a short circuit cannot be created, because of the provision of a strain insulator, as shown.

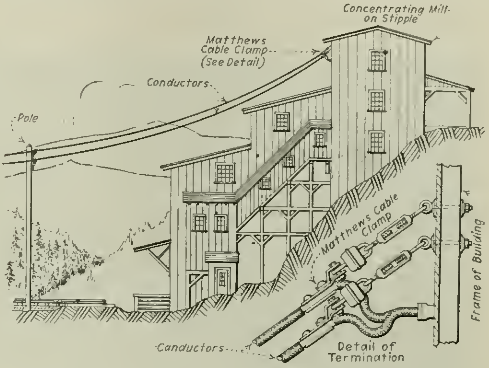


FIG. 1. CABLE CLAMP FOR POWER CABLES

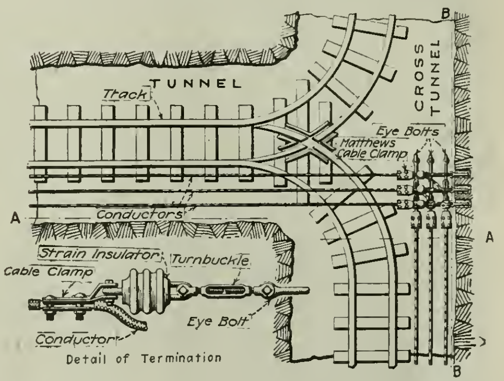


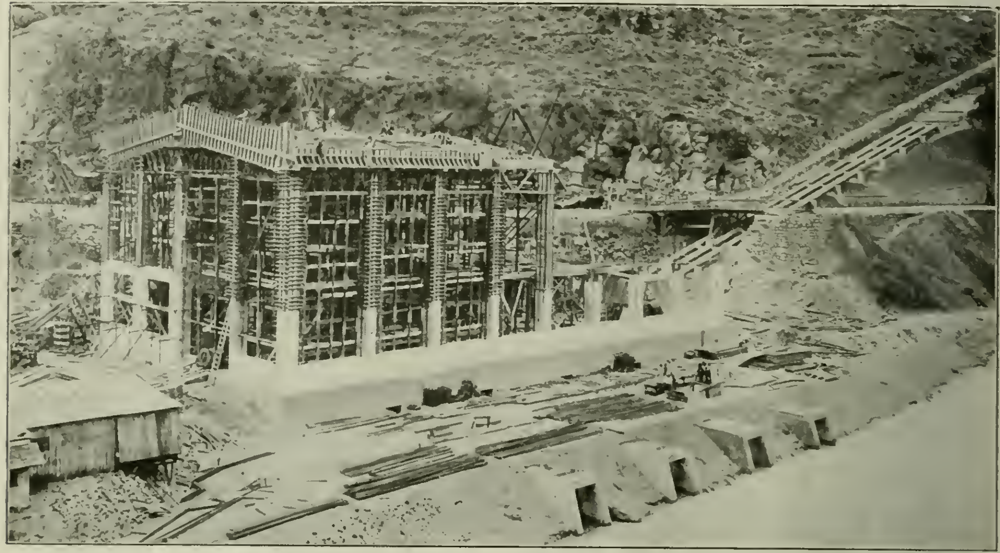
FIG. 2. USE OF CABLE CLAMP UNDERGROUND

Clips on Starting Sheets

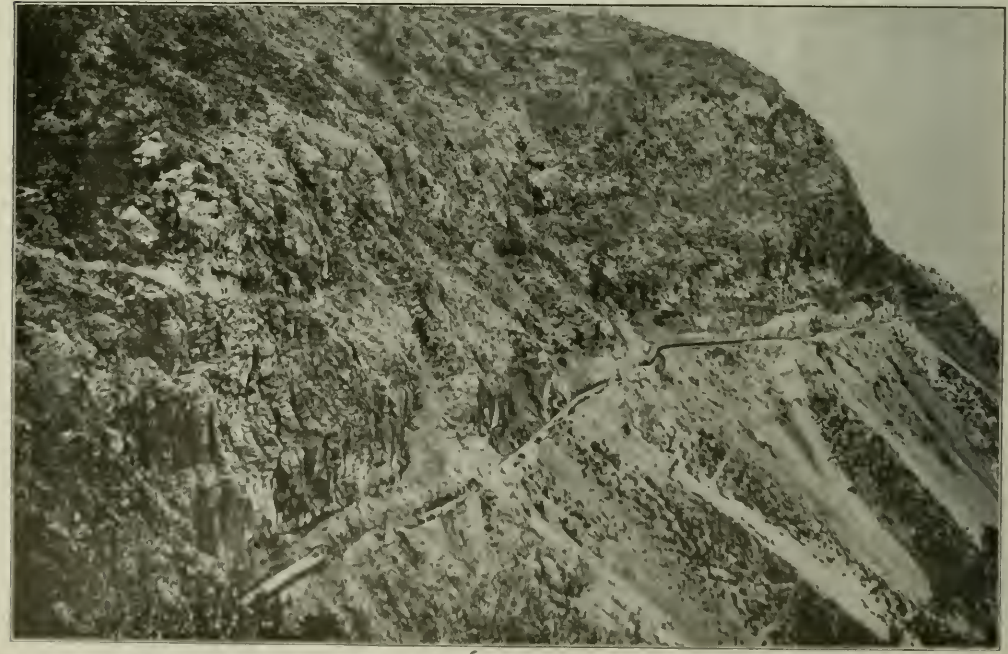
In the issue of the *Journal* of July 20, 1918, publicity was given, on p. 114, to a novel method of attaching clips to starting sheets when difficulties are experienced in using an electrolyte containing impurities having a corrosive action on the cathode.

Attention has recently been drawn to the fact that the modification was due to the ingenuity of H. A. Tobelmann and Henry S. Montgomery, and that it had been developed and had proved successful at the Ajo plant of the New Cornelia Copper Co. It is also interesting to note that patent No. 1,269,458, to cover the invention, was issued on June 11, 1918.

Braden Copper Company's Nev

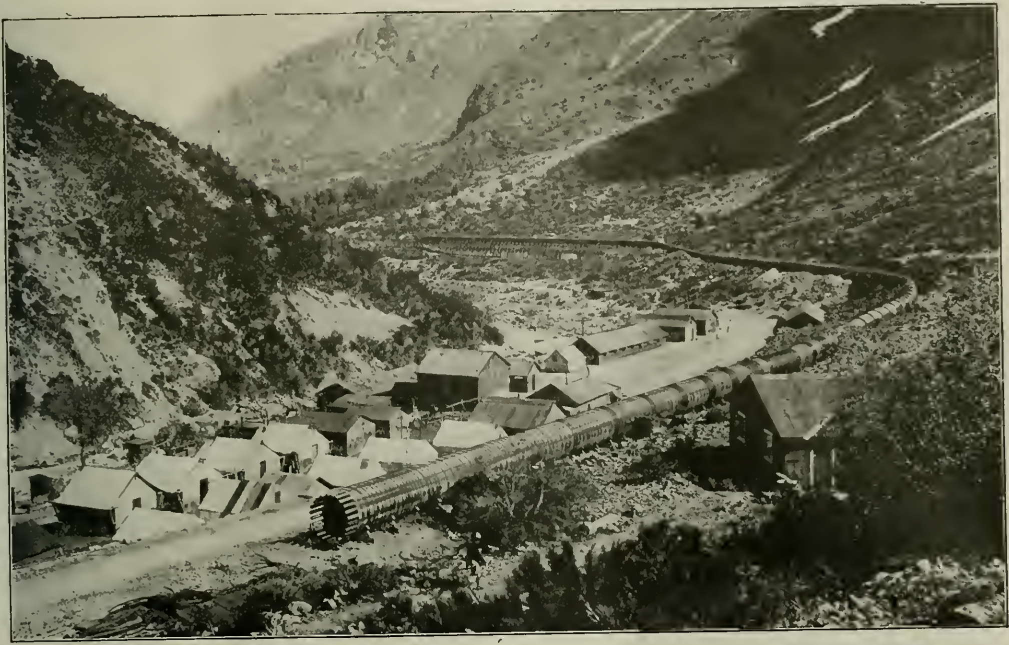


THE 20,000-KW. PANGAL POWER HOUSE UNDER CONSTRUCTION

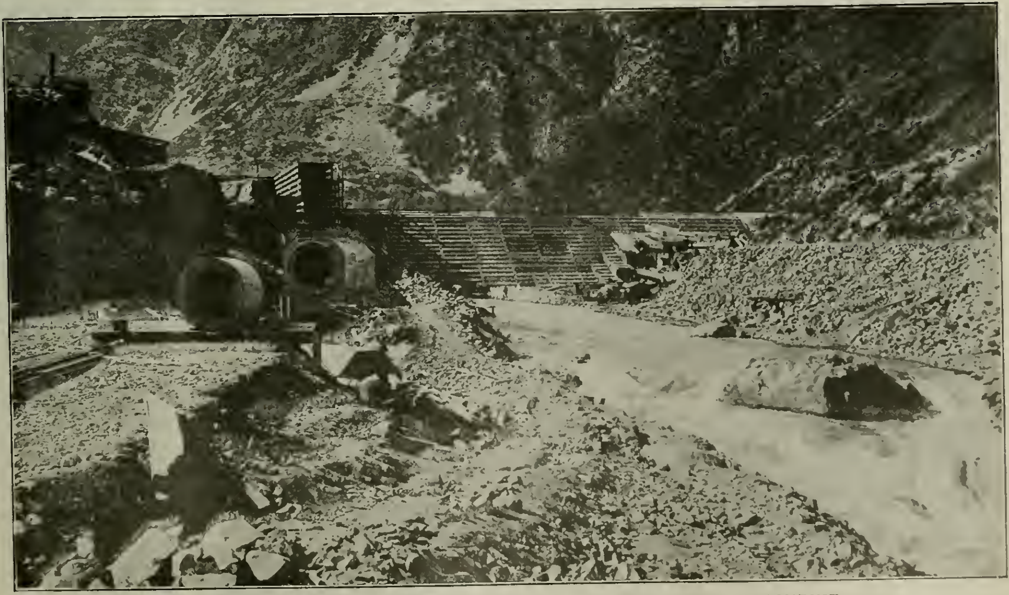


VIEW SHOWING RUGGED NATURE OF COUNTRY THROUGH WHICH 80-IN. FEEDER PASSES

angal Power Project in Chile



CONSTRUCTION CAMP AND 80-IN. DIAMETER REDWOOD STAVE FEEDER LINE AT DIVERSION DAM



DOWNSTREAM SIDE OF DIVERSION DAM WITH CONCRETE OUTLET CONDUIT

Alabama Graphite in 1918

BY W. F. PROUTY[*]

THERE was a steady growth in the Alabama graphite industry in 1918, despite the serious freight-car shortage in the latter period of 1917 and during the early part of 1918, and despite, also, the serious handicap produced by the labor shortage and the difficulty of getting repair parts and new machinery. Fourteen plants reported sales in 1917. Thirty plants were in operation in December, 1918; 24 of which were working in Clay County, 5 in Coosa County, and 1 in Chilton County.

Alabama is credited[1] with furnishing 59% of the quantity and 66% of the value of the domestic crystalline graphite sold in this country during 1917, an increase of 19% in value over 1916, and three times the value of the output from Alabama in 1913. The sales from Alabama in 1918 will probably show a still further advance of Alabama's position as a producer. During 1918, two mills, that of the Empire Graphite Co. and that of the Eagle Graphite Co., were completely destroyed by fire, which also destroyed the concentrating plant belonging to the Griesemer Graphite Co. Two of these plants are now being rebuilt, and the third company is making preparations to rebuild.

PRODUCERS TO IMPROVE METHODS RATHER THAN EXTEND PLANTS

Two or three new graphite companies are planning to construct mills in the near future, but the great rush for new plants is over, and the business is now settling down to determine ways and means of increasing the percentage of recovery, reducing the cost of production, raising the grade, and standardizing the product. Consolidation of some of the companies has already taken place, notably that resulting in the forming of the Quenelda Graphite Corporation. Other companies are considering consolidation, for the gain from such action secures not only economy of management and reduced cost of production, but, perhaps, what is more important, a better standardization of the product. The percentage of No. 1 flake is increased by the mixing of larger and finer flake from the different mills, and this is of especial advantage in the mixing of products from the wet and the dry processes.

PROCESSES PRACTICED IN MILLING ALABAMA GRAPHITE

A number of processes are used in the Alabama graphite field for the concentration and milling of the ore, and of these there are many varieties, so that no two mills in the whole field use the same process throughout. In a general way the processes can be classified into those which are entirely wet or entirely dry, or consist of a combination of wet and dry methods. The majority of the plants combine both wet and dry processes. In some, however, the dry process is restricted entirely to the finishing plant, whereas in others dry methods of concentration are used along with the wet. An example of an entirely wet process is seen in one of the mills where the wet concentrates from the oil-flotation method are run over Diester tables, with the result that the final concentrates are sufficiently high in carbon content to be marketed without first passing through the buhr. Two Alabama graphite mills are employing entirely dry processes. The Graphite Mills, Incorporated, near Ashland, uses the Sutton, Steel & Steel process, and the Flaketown Graphite Co., near Mountain Creek, Chilton County, makes use of a modified electrostatic method.

CLASSIFICATION OF WASHERS

The greatest diversity of methods is in the concentration plants, and there is considerable differentiation here in the type of washers used. These washers can be classified into those using water without oil, and those using water with oil. Of those using water without oil, there are the following varieties: The Ashland washer, which was the type first used successfully in the Alabama field for the separation of graphite from ore in commercial quantity. It consists of a long, narrow trough, into which the crushed and dried ore is fed from a steeply inclined surface on one side. The water moves across the surface of the trough to the opposite side, carrying the graphite by surface tension and spilling it into the launder, and the quartz and other gangue minerals, which are wet by the water, sink and pass out through small holes in the bottom of the trough with the surplus water to the dump. This type of washer has been installed in a few of the plants.

A more uniform distribution of the ore to the washer is accomplished by a roller feed, and in one of the plants such a modified Ashland washer is being used. The Monroe-Conklin washer is a still further modified and improved washer of the Ashland principle. Its advantages are in its adjustable roll feed, water control, easy-leveling possibilities, and smaller or unit characteristics. This washer can be adjusted to ore of different size, or ore containing much or little mica. The Colmar washer, which follows the general Ashland principle, is circular in shape, has a cast-iron bowl, and the core is fed from a revolving disk at the center of the washer. The water rises from the bottom and spreads out from the center of the top toward the sides. The advantages in this washer lie in the fact that the surface increases toward the periphery. The particles of ore and graphite are thus less crowded as the launder is approached, and the reduced velocity of the water gives a better chance for the settlement of the finer particles of quartz.

In some of the mills the revolving disk of the Colmar washer is replaced by a cone feed, the advantage being that less dust is produced. The disadvantage of the cone feed is a less even distribution of the ore. Still another type of water flotation without oil is to be found in the log washer, which has proved its worth as a means of separating graphite from the gangue. The crushed wet ore is fed to the washer. The sand is carried slowly up the inclined trough, and the graphite particles float off on the water and the sand is further removed from the overflow by settling on a sloping cement floor, which is constantly sprayed to remove the graphite.

---

[*] Chief assistant, Geological Survey of Alabama, University, Alabama

[1] "Mineral Resources of the United States," 1917.

Since 1915, oil-flotation processes have been tried in a number of Alabama mills, and on the whole are proving more popular than any other method of concentration. Both Callow and Minerals Separation cells are being used. The treatment of the ore in these plants varies chiefly in the kind of classifier used in front of the cells, or in the method of the reduction of the ore, as gradual reduction by rolls or reduction by ball mill.

Three other distinct but somewhat similar oil-flotation processes are to be noted in the field at this time. In each of these the agitation, if such it may be called, is accomplished by jets of water taking the air down into the oil-water-ore mixture. In each of these instances, unlike the result obtained in the Callow and the Minerals Separation processes, there is no accumulation of froth. In the Cobb-Jet washer, the jets of water are introduced along the central axis of a rectangular wooden trough. The launders are placed on the sides of the trough and there is a bottom discharge for the tailings. The Simplex washer is of metal and is elliptical in shape. The jets of water near the center cause a circular and outward movement of the surface water and the graphite toward the peripheral launder. In the Loventhall-Nunnaly washer there is a combined water jet and an inclined screw conveyor. The graphite floats off in much the same manner as when the log washer is used; the sand is also disposed of in a similar way.

In most of the mills, the dried concentrate is first sized and air treated, to eliminate as much sand as possible. In some cases a small percentage of the flake thus air treated is sufficiently high in carbon to go immediately to the shipping room, but the larger percentage of the concentrate must be run through the buhr to polish the flake and separate it from the attached mineral particles, which tend to keep down the carbon content of the finished product.

COSTS AND SCHEDULE OF PRICES

The cost of production of graphite has risen greatly since 1913. The costs also vary for the different companies, and for the same company at different times. This is due in no small measure to the loss of time in making repairs and in replacing broken parts, and to the uncertainty of labor. After careful consideration of the cost of production, and allowing for a reasonable profit only, the Graphite Producers' Association of Alabama has suggested the following prices as being just, at this time, both to the producer and to the manufacturer. To this suggestion the Government has consented, although there has been no price fixing:

SCHEDULE OF PRICES ADOPTED BY THE GRAPHITE PRODUCERS' ASSOCIATION OF ALABAMA

Grade	Per Cent. Carbon	Price per lb.
No. 1 Flake	90	20½
No. 1 Flake	85	15½c.(a)
No. 2 Flake	80	10c.(b)

Per Cent Carbon	Price Per Lb.	Per Cent Carbon	Price Per Lb.
25 to 30	1c.	60 to 65	4½c.
30 to 35	1¼c.	65 to 70	5½c.
35 to 40	1½c.	70 to 75	6½c.
40 to 45	2c.	75 to 80	7½c.
45 to 50	3c.	80 to 85	10c.
50 to 55	3½c.	85 to 90	12c.
55 to 60	4c.		

(a) With 1c. added for each per cent. above the 85% carbon.
(b) With ½c. added for each per cent. above the 80% carbon.

TERMS: F.o.b. Ashland, Alabama, or nearest shipping point; 75% of invoice payable upon receipt of bill of lading; balance upon receipt and satisfactory examination of material.

The experience of certain crucible companies with admixtures of domestic flake and foreign graphite has proved so successful that the Government is now requiring all crucible makers to use as much as 20% admixture of domestic flake. It is thought that this requirement will continue at least until the middle of 1919. The Bureau of Mines is now carrying out other experiments in the use of domestic flake, these tests being made both with an admixture of foreign and domestic, and with the domestic alone. Crucibles have already been made with a substantial percentage of American flake, and are giving good results. Dr. Stull, superintendent, Bureau of Mines experiment station, Columbus, Ohio, is also working on a mixture, using 100% domestic graphite and domestic clay in a crucible which he says appears to possess more desirable qualities in the original mixing than when 100% Ceylon graphite is used. The outcome of the experiments at the Bureau of Mines experiment station will be watched with much interest, as the indications are that the domestic flake is going to be more highly esteemed than formerly for crucible making.

The requirement of an admixture of 20% domestic flake has not only temporarily increased the demand for this product, but will doubtless assure an increased demand for the future, as a number of the crucible makers who have previously used foreign flake exclusively are now employing a formula including, in some cases, more domestic flake than the Government requirement.

POSITION OF THE DOMESTIC GRAPHITE INDUSTRY

Since the signing of the armistice, the sales of domestic flake have fallen off considerably. Crucible men are buying as little graphite as possible, and the producers' stocks on hand are getting uncomfortably large. A sudden lifting of the embargo on foreign graphite would at this time be disastrous to Alabama producers, as the industry, developed to a considerable extent as a war measure, is yet in the experimental stage when production is more costly than it should be after a standardization of the processes. If the embargo were slowly lifted, and an import duty was placed on such foreign graphite as is admitted, at first sufficient to maintain approximately the present price, and this duty gradually lowered, the industry would be able to meet the conditions of a lower price and a cheaper foreign-labor product.

If the Government should see fit to protect the graphite industry through this brief critical period of standardization of graphite processes and products, so that a more independent position as regards market is secured, there is reason to believe that the Alabama graphite fields will continue to be an important factor in the world's graphite production.

The Luxemburg Iron-Ore Industry.—In 1917 the Duchy of Luxemburg produced 4,276,550 tons of iron ore, compared with 6,752,207 tons in 1916. The average selling price per ton of ore in 1917 was 4.17 fr. against 5.41 fr. in 1916. The reduced output was due to the fact, says the *Ironmonger*, that the Luxemburg blast furnaces were compelled to restrict their production of pig iron, owing to the inadequate supply of coke. The only available export market was Germany, where the competition of the Lorraine works was keenly felt.

Cuban Manganese in 1918

By John B. Stewart*

The production of manganese ores in Cuba during 1918 amounts to an estimated total of 95,000 tons, as compared with 35,000 tons for 1917. The number of new properties opened up in 1918 was relatively small, although they yielded 40,000 tons in that year. Improved equipment resulted in adding 23,600 tons to the output of washed ores, formerly produced only by Aguilera & Co., Ponupo; and the only concentrating plant installed has placed the Cauto Mining Co. second in the list of producers, with about 12,000 tons shipped. Thus, the total of washed and concentrated ores now amounts to practically 75% of the total output. The importance of this method of treatment should become manifest to those interested in the future of manganese mining in this field. Although the average grade of the washed product has been 4% to 6% lower than that of the shipments of unwashed ores, the benefits to be derived by some form of treatment are obviously those due to the increased production and the corresponding reduction of costs below anything attainable by the smaller operators, who have felt that they could not afford new equipment.

In the purchase of manganese ores in Cuba in 1918 there was practically no competition. The Bethlehem Steel Co. absorbed the output of Aguilera & Co., and the Marshall-Keith interests handled most of the ore produced in scattered localities. Some producers tried direct shipment to consumers by the all-rail route, but the principal movement was by rail to Santiago de Cuba, and thence by ocean freight. A fair tonnage was moved through the port of Antilla, on the north coast, in the cases where that route offered economy in freight costs. Outside of the Province of Oriente, manganese production was negligible in 1918.

Uncertainty of market conditions for Cuban ores has been responsible for the crude methods of sampling and handling of the product. Much money has been spent in futile efforts to reconcile or readjust the discrepancies between the analytical results obtained by itinerant Spanish mining experts and enthusiastic Cuban druggists from samples of ore submitted by the sellers or would-be sellers, and those reported by the experienced chemists acting for the buyers. Probably the real trouble has been due to a complete disregard of the necessity for reducing ore particles to a size bearing a proper relation to the degree of reduction of the sample, without which it is difficult to secure an accurate mixture. Ore has been handled almost exclusively by shovels and wheelbarrows, operated by inefficient laborers. Practically no provisions have been made for sheltering stockpiles, with the result that much water has been shipped at a cost of about $18 per ton.

Future prospects for Cuban manganese depend upon market conditions and local coöperation. With the inevitable drop to a steady price per unit, approaching that of pre-war times, there seem to be but two ways of continuing the production of important tonnages of Cuban manganese ores. One is the complete control of the deposits by a single interest or groups of interests which would be in close touch with the principal consumers. The other is real, effective coöperation among the many Latin-American and peninsular owners and lessees of small and scattered deposits. The question as to whether such coöperation is feasible may be best answered by the operators themselves.

Graphite in Ontario in 1918

By Thomas W. Gibson*

The production of refined graphite in Ontario for 1918 was 3022 tons, as against 3173 tons in 1917, valued at $210,018. Three companies were in operation: The Black Donald Graphite Co., at Calabogie, on the Kingston and Pembroke; the Globe Graphite Mining and Refining Co., at Port Elmsley, on the Rideau Canal, and the Timmins Graphite Co. which was engaged in building a mill and developing a new property on Lot 24 in the fifth concession of North Burgess Township.

The Black Donald mine is an important deposit situated on the shores of Whitefish Lake, and employed about 130 men. The refined products average about 25% flake and 75% intermediate and low grades known as foundry plumbago. At the Globe mine and mill 14 men were employed. The management carried on considerable experimenting with concentration methods during the year, and modified the processes in use so as to obtain a considerably larger recovery. The product is divided into large flake, small flake, and dust. On the property of the Timmins Graphite Co. a vein which varies in width from 25 to 27 ft., has been traced for about a mile and stripped for a short distance. The company has purchased 300 acres of land, and the mineral rights on 400 acres additional. The mill, which is 42 x 72 ft., with a capacity of 200 tons per day, is nearly completed, and the machinery is ready to be installed and is expected to be in operation by Feb. 1, 1919. About 50 men have been employed on the construction work.

Prices for flake graphite averaged from $140 to $320 per short ton, and plumbago sold for from $45 to $80. The demand for flake was dull throughout 1918. There was a fairly satisfactory call for plumbago until November, when business became flat, and it continued so until the end of the year.

Fluorspar

Fluorspar mining in 1918 was exceedingly active, new deposits in Arizona, New Mexico, and Colorado making production. The placing of an embargo, by the War Trade Board, on fluorspar importations, together with the rise in prices and increased demand, greatly stimulated domestic production. The domestic production of 1917 was 218,828 short tons, according to the U. S. Geological Survey, and the production for 1918 probably exceeded that figure.

In 1917, high transportation costs prevented Colorado producers from competing with those of Missouri, Illinois, and Kentucky. Shortage of freight cars during 1918 enabled Colorado producers to supply the local demand, the largest consumer being the Colorado Fuel and Iron Co., at Pueblo. Other Western demands were met by producers of Yuma County, Ariz., and from deposits in New Mexico. In Colorado, the principal producers are the American Fluorspar Mining Co., at

---

*Royal Bank of Canada, Santiago de Cuba, Oriente, Cuba.

*Deputy Minister of Mines for Ontario, Toronto, Canada.

Wagon Wheel Gap, making a production of 50 tons per day, and the National Ore and Metals Co., of Boulder, making a production of 1000 tons per month. Other deposits are at present being mined in Custer and Jefferson counties.

The price of Colorado fluorspar was $22 per long ton, f.o.b. point of shipment, late in 1918. Canada made a small production. The Consolidated Mining and Smelting Co., of Canada, after acquiring a promising British Columbia fluorspar deposit, made tests in the manufacture of hydrofluosilicic acid, with such satisfactory results that it is proceeding to open the deposit on an extensive scale. By the beginning of January, 1919, the company, which already has forwarded several carloads to New York and Philadelphia, expects to be able to begin regular shipments at the rate of from 1200 to 2000 tons per month. To facilitate this an aërial tramway is being constructed for a distance of several miles from the mine to the railway. Thus, the local requirements, which before had to be provided for by shipments from Kentucky, will be cared for, and there will be sufficient surplus to permit the shipment of considerable quantities.

Commercial Grades and Requirements

Fluorspar is placed upon the market in three grades, lump, gravel, and ground. The silica limit for lump and gravel spar is 6%; for spar to be used in the ceramic industry, 3 to 5%, and for spar to be used in the production of hydrofluoric acid, 1%. Lead or zinc compounds are objectionable to ceramic manufacturers, and an excess of 1% calcium carbonate is objectionable to acid makers. Standard specifications for metallurgical fluorspar require that the mineral contain not less than 85% CaF_2 and not more than 5% silica.

Prices during 1918 were erratic, but $25 per long ton would represent the average price for fluxing grade and $40 for ground fluorspar. According to *Mineral Industry* the 1917 prices were: gravel, $9.61; lump, $13.68; ground, $17.59; all grades $10.45 per ton.

The demand for fluorspar is principally for metallurgical purposes in the basic openhearth steel process. There is an increasing use in electric furnace plants and in the electrometallurgical industry. In the chemical industry there is an increasing demand for the higher-grade fluorspars. The demand for optical fluorite is limited, but will increase if sufficient quantities could be produced at reasonable prices. Only perfect crystals are suitable for optical use. The value of optical fluorite is approximately $1 per lb., though large, fine specimens may bring $10 apiece.

The Zinc Problem in Italy*

After reviewing the various processes of zinc production, it is necessary to take into account the special conditions for a production of this metal in Italy, where zinc ores are plentiful.

Coal-Fired Retorts—Fuel consumption in the most improved furnaces is about one ton of good coal in the generators for each ton of ore distilled. Furthermore, it is necessary to mix the mineral with about 40% of clean reducing coal. Extraction of spelter is less than 90%, and consequently, taking 40% as the average of zinc concentrates in Italy, three tons of ore, three tons of heating coal and 1.2 tons of reducing coal are required for the production of one ton of spelter. The consumption of retorts and condensers is also to be taken into account, this item being not less than half a ton for each ton of spelter. These data correspond to what can be obtained only under excellent operating conditions and with the employment of skilled labor. Four tons of fuel and half a ton of refractory material per ton of spelter must be reckoned as a conservative estimate.

The capital investment in such a plant, according to foreign experience, is figured at $200,000 per 1000 tons of spelter per annum. This industry would not be remunerative in Italy without a high protective tariff, to compensate the producer for the higher cost of coal and refractories.

Thermo-electric Process—Consumption of energy for the distillation of one ton of zinc from medium-grade concentrates is estimated at 5000 kw.-hr. The consumption of electrodes and of lining material for the furnace has also to be taken into consideration. In Swedish plants, where the process is considerably developed, the cost of current per kilowatt-hour is about half a centime (0.005) a figure that cannot be reached in Italy. This method also could not thrive there without an adequate protective tariff.

Electrolytic Process—This process cannot be generally applied to all classes of ores. Those with calcareous-dolomitic gangue, such as the Sardinian calamines, are not suitable for electrolysis, on account of the reaction between solvent and gangue. Blende too high in iron does not give good results, and its treatment offers special industrial problems. Only blende with siliceous gangue, low in iron, is treated in America. Italy produces—or rather could produce—in Piedmont as well as Sardinia, blende similar to what is treated in America, and the quantity would be sufficient to supply more than the normal requirement of spelter in the kingdom. It is therefore to be hoped that all Italian blende may be treated electrolytically in Italy.

The consumption of energy for the production of one ton of electrolytic zinc is estimated at 4000 kw.-hr. It is stated in America that 1 hp.-year corresponds to the output of 1 ton-year, this figure including also the requirements in other steps of the process, including grinding of concentrates and purifying of electrolytes. The capital required for the erection of such a plant is considerably higher than for the erection of coal-fired retorts. According to estimates recently drawn for the erection of such a plant in Italy, it appears that the cost would be about three times greater than in the case of coal-fired plants.

---

*Excerpt from a paper by Erminio Ferraris, entitled, "La Metallurgia dello Zinco," published in *L'Industria*, Vol. 32, No. 10, 1918.

Limonite at Alta Lake, B. C.

The deposit of limonite at Alta Lake, British Columbia, which is being developed to supply fluxing material for the smeltery at Irondale, Wash., according to Charles Camsell of the British Columbia Department of Mines, covers an area of 60,000 sq.ft. Analysis has shown 40.98% Fe; 0.2 to 1.80% S; 0.1 to 1.88% P; and 1.24 to 2.2% SiO_2. Other small deposits of similar ore occur in the neighborhood, originating from the decomposition of pyrite-bearing rocks.

Correspondence and Discussion

Replacing Oliver-Filter Shafts

Under "Details of Milling and Smelting" in the *Journal* of Nov. 9, Algernon Del Mar presents a sketch illustrating a method of overcoming the difficulties of re-aligning and removing agitator shafts in the Oliver filter. Inasmuch as Mr. Del Mar has kindly offered this information as a result of my suggestion as to this difficulty, an additional word of information may be of value. If Mr. Del Mar is not mistaken as to the origin of this particular type of shaft, it has already been adopted by the manufacturers. The section as drawn is identical with that of the shafts installed in the Oliver filters over 8 x 8 ft. in size. It is also the same shaft referred to in my article of Aug. 3.

As suggested by him, the short inserts will easily pass through the packing glands after removal of the pins; but it will be observed that the larger section made up of extra heavy pipe can only be removed over the top of the tank, even after taking off the paddles. If, therefore, this part becomes defective, as it did in the case described, there is only the one remedy. I am informed that the Oliver Filter Co. is providing a hand hole in the ends of its newer machines, which is large enough to take care of the entire shaft and overcomes this troublesome feature. F. DEAN BRADLEY.

Pittsburg, Calif., Nov. 30, 1918.

About Spanish

A great deal of piffle is written about Spanish, its importance, and the necessity for its study in schools and colleges. Like Mr. Finlay, I shall begin with a few axioms, and though they may not be so self-evident as his are, they can, nevertheless, be proved, and I am here to do it.

My first axiom is that Spanish is unimportant. The important South Americans speak or at least understand English, and it is not worth while to learn Spanish for the others.

No one can say in Spanish "standard gage," or "standard pipe," or "standard rails," and no language can be important in the commercial and manufacturing world which lacks these phrases. A thing which partly offsets this is the fact that, although the idea of standard is missing, the standard articles themselves are used, quite impartially—all of them. One finds six or seven standard railway gages, four standard pipe threads and a dozen standard rail sections.

My second axiom is that there is no necessity for the study of Spanish in schools and colleges. Many engineers studied Spanish in the university by reading Don Quixote (skipping the worst parts), and though it was interesting and exciting, it was a waste of energy. In one instance, of an entire class of 90 students, only one can now speak Spanish, and he learned this long after reading Don Quixote.

The Mayor of Boston has written a whole column in the *Evening Post* in which he proves that not only Spanish, but also Portuguese, should be taught in all public schools and colleges. Poor little children! What have we done to merit such punishment as this? (He also thinks that we children should study the metric system.) Another contributor suggests the slight addition of Dano-Norwegian, Dutch, Chinese, Japanese, Russian, and Italian, with, of course, French. Sure! He thinks a good scheme would be to teach mathematics in French and geography in Spanish. Quite so!

Another axiom: No one ever learned to speak Spanish in the grammar school or college. He may tell you that he did, but if you will dig deep, you will find that he spent a year or two in Mexico or South America or Spain. What he learned of Spanish at school or college is negligible.

Another axiom: Few persons have any possible use for Spanish. There is the office man who writes the letters and translates the bills of lading for the consular invoice. No American can learn Spanish enough to do this in *correct* Spanish. This man gets $18 per week. If he knows three languages his salary is $17.

Then there is the captain of the Emergency Fleet steamer. If he is like his British brother, he will know about eight words, and I positively decline to say what they are.

Then there is the waiter in the hotel. At least one waiter in every first-class hotel should speak Spanish, because in the hotels here there are occasional visitors who speak that language, and in the hotels in South America many do. This waiter is usually foreign born, so that we American boys and girls who are being trained for this profession need not know Spanish.

We have last, then, only the traveling salesman and the traveling buyer. The former requires a few words at table and in getting his baggage ashore, but if he uses their English equivalent vigorously the results are equally good.

In engineering lines, everybody in South America, of course, speaks English, because most of those who amount to anything in engineering have been educated abroad. Many are English or of English descent.

In agriculture, there are no traveling salesmen.

Most of the shoes are made locally, and the shoe machinery salesman (he is still there, I believe) considered Spanish to be convenient but not necessary.

In selling drygoods, it is advisable to know a few words of Spanish, though all the houses have English-speaking officers. Whatever Spanish is desired can be learned in a few hours a day on the steamer, before you reach the first place where there is a store.

I knew the manager of a huge copper mine who did not know enough Spanish to say "tomorrow," yet he was the best who ever held the position, and was entirely successful in meeting the wishes of the local government. But this manager certainly knew men and mines.

I know an Englishman, manager of a nitrate plant, who speaks Spanish in a way to make one hate the whole human race—yet he has no strikes and his company pays dividends. He says he has been on the pampas 10 years, and the bloody Chileans have not learned English yet!

There is a representative of a well-known American manufacturer in South America. He has been there for several years. He is a young man, and is fond of the Chilean girls, and tries to talk to them. They pretend to understand, though I have been asked confidentially to translate his Spanish. But how that boy can sell his line! If I told what his line was, you would recognize him. He certainly knows his business, and think what a pity it would have been if he had waited to learn Spanish before learning his business!

There is a buyer of casings in the Argentine. He invariably salutes his customers with "*Bonus dias, senor*" (without the ñ, which he considers an affectation), but he could buy casing if he was deaf and dumb. He knew all about casings before he knew where the Argentine was—probably learning about casings while his present competitors were studying Spanish in college.

A friend of my father writes all the copy for a weekly market letter in Spanish. A poor thing, but all his own. The Spanish is not the "pure Castilian" which is studied at college, but rather a Spanish with a piquancy (and sometimes a construction) quite unique.

One Spanish subscriber wrote him, "I am not interested in metals or engineering or the market, but I have seen one copy of your *Revista* and simply must see every issue, though five dollars is a good deal of money to me. I am of a melancholy disposition, and your Spanish affords me great relief." Nevertheless—and this is the point of the whole story—because it offers something of value, his readers *pay* for it, and they will pay *your* salesman for *your* products, whatever his Spanish may be, provided he knows his business.

The *Commerce Reports* of Oct. 5 has an excellent article by C. D. Snow on "Foreign Languages in England and the United States."

Spanish is useful, but not nearly so important as it would appear. Briefly, all the correspondence and office routine *must* be done by those with whom the language is mother-tongue. The salesman must know his business first, last and all the time, and should be chosen on these grounds *alone*. If he is one of the best salesmen in your organization, he will be bright enough to pick up enough Spanish for his business needs.

To produce the hundred or two hundred salesmen who are traveling in Spanish-speaking countries, it is nothing short of a crime to make millions of us children waste time studying *at* Spanish, but never learning it.

GEORGE WASHINGTON.
New York, Dec. 1, 1918. (Aged 10 years)

Grouting in Mine Shafts

I was much interested in the article "The Cementation Process in Mining." by A. H. Krynauw, which appeared in the *Journal* of Dec. 7, 1918. In the United States this process is called grouting, and is extensively employed in shafts or tunnels having a concrete lining. In this country, however, the cement or grout is usually forced into the rock by compressed air. A pump handling grout must give constant trouble, owing to the setting of the cement. Cement sets with annoying rapidity under pressure, frequently clogging the valves.

The method outlined for shutting off water in shafts where the lining is not strong enough to stand high pressure sounds very simple, but in practice it is a long and tedious process. The water must be kept away from the concrete, as it is being poured, before placing the lining. This is done by means of thin steel plates, called pans, placed against the rock. These, in turn, are pierced by enough pipes to allow the water to flow through them freely without damming back. Each "weep" hole should have another hole above it to relieve the pressure. The pipes must be threaded so that a stop cock and connections from the grout machine can be screwed on.

Grouting should be started at the lowest hole when the concrete has sufficiently set. The stop cock is opened and grout forced in until the space between the pan and the rock is completely filled. This must be done at about 100 lb. per sq.in., to avoid putting too much pressure on the lining, as the pressure acts on the entire area that has been "panned" off. Care must be taken to keep the vent holes open so that no air will be imprisoned, and so prevent the complete filling of all adjacent holes. When grout begins to come from the vent holes, or no more can be forced into the hole that is being grouted, the stop cock is closed and the machine moved up to the next ring of holes. As the grouting proceeds up the shaft, there comes a time when it reaches the top of the water, and the water is therefore shut off. This, however, will not invariably give a dry shaft. As the water pressure increases, the water will seep through the lining, sometimes in considerable quantity. The grouting process must be repeated several times.

In the final stage the "weep" holes are drilled out and the drilling is continued deeply into the rock. It may also be necessary to drill additional holes through the lining. Grouting is then resumed at high pressure, 200 to 300 lb. per sq.in., as the water pressure must now be overcome, and the further the grout can be driven into the cracks of the rock the dryer the shaft will be. The idea is to drive the water away from the lining altogether, and here is where the trouble begins. The watercourse may not be deep in the rock, as described in Mr. Krynauw's article, but may be adjacent to the lining, in which case the pressure, instead of being exerted on the rock, will come on the lining, and a cracked lining or a blown-out section will result.

A lining which cracks or otherwise shows signs of weakness is not always hopeless. Sometimes such sections must be cut out and a stronger lining put in, or they may be strengthened by careful grouting until they will stand as much pressure as the remaining sections.

A little sand will often be found beneficial in closing cracks, but it cannot be used where the cracks are very fine, as the sand will not penetrate where the grout alone will. Sand is also beneficial in filling large holes, such as are found in limestone. Large cracks should first be closed with pine wedges, as described by Mr. Krynauw. For very fine cracks the pressure should be such that grout is forced through the crevices, which should then be carefully caulked with lead wool, and the cement given time to set.

A. K. FRIEDRICH,
Shaft Inspector, Buckeye Coal Co.
Nemacolin, Greene County, Penn., Dec. 14, 1918.

Labor and Reconstruction

J. Parke Channing's address at the Reconstruction Conference at Atlantic City on Dec. 4th, which appeared in the Dec. 14 issue of the *Journal*, was particularly timely, pertaining, as it does, not only to mining but to all classes of industry. There can be no doubt that reciprocity on the part of labor is needed to solve the industrial problem. Many employers know this, and the rest will learn it before long. Many laborers do not know it: they neither realize the necessity of it nor know how to reciprocate. The problem of instructing labor in this direction is the difficult task that employers have before them.

This education cannot be given through books or lectures; indeed, it is more a question of alteration of character than education in its commonly accepted significance. It cannot be acquired by the laborer in a short time. It means years of careful handling—the changing of men from ten-day miners to thrifty residents of a permanent, progressive community. It means the careful handling of the younger generation, particularly between the ages of 12 and 25, during the period of character formation. The Bunker Hill & Sullivan Co. has been working along these lines for the last 18 years. The Phelps Dodge Corporation is doing excellent work, and many other younger organizations have started movements in that direction.

Though, as Mr. Channing states, there may have been some ill-advised remarks respecting the reduction of wages and the increase of hours, it is questionable if his statement that there is nothing to justify predictions of such a character is not a little too optimistic. If by wages he refers to the gross amount of money received, he is wrong. There are tangible reasons for believing that these will fall in the course of readjustment. If by wages he means the net return above cost of normal existence, he is more likely to be right, and there is every reason to hope that this will be maintained. The compensation which is represented by those things that make life worth while, a family and a comfortable home, some sane recreation, some wholesome diversion from the monotonies of the work-day life—these are the wages that we would like to see maintained, but, as stated above, labor is not yet prepared to do its part in coöperating. Years must pass before this is possible; and wages will fall in the meantime.

With the normal demand for food in Europe and a shortage in supply which, for the present, must be made up by the United States, there is no immediate prospect of a reduction in the cost of living. For a short time we may be called upon to furnish Europe with even more than we have been sending across the Atlantic recently, but sooner or later Europe will produce again; and, as more shipping becomes available, food will go forward from Australia and South America to relieve the demands on our home markets. The production of wheat in the United States for 1919 promises to create a record. There is also an abundance of grain now awaiting shipment from Australia, and food prices are bound to come down before long.

Assuming that industry will remain practically constant in its activities, and that the demand for labor will hold constant also, wages might be expected to remain constant, and a fall in the price of food would then be equivalent to a rise in wages, and there would certainly be a net gain to the worker. Presuming that industry does not remain constant and that the demand for labor diminishes, as we know that it is diminishing in some lines already, then this surplus labor must find work somewhere; and, if it cannot get it where the demand at high wages exists, it will get it where industry is reviving on a lower scale. Falling food prices will then enable labor to accept the lower gross wages without sacrificing its advantages in net wages.

I hope that in new industrial lines there will be a demand for all the labor that has recently been employed in war work, and that the demand will keep up the standard of wages, but there are reasons to fear that during a period of readjustment a good many men will be looking for employment. The daily press is now reporting that thousands and tens of thousands of men throughout the Central West lack employment. If these reports are correct, then the law of supply and demand will take its normal course, and both prices and wages will fall, in spite of all that will be done in the way of reciprocity.

If one examines the index numbers of commodities for the last century, it will be observed that, coincident with every war of importance, these figures have risen; and, following the declaration of peace, they have gradually fallen again. This war has been different from all other wars in the amount of damage that has been done and in the extent of replacement that must be made when peace is declared, but though this is true it is also true that the world is now better equipped to make good the destruction than it has ever been before. On the whole, the war has been much the same as other wars, except that it was conducted on a magnified scale, and economic conditions may be expected to follow the same sequence as in the past. It is hard to believe that commodity prices and labor will not, if left to take care of themselves, follow the same path that they have in other post-bellum days.

Hence, more than ever should the industry strive for what Mr. Channing advocates—reciprocity on the part of labor—with the hope that it may lose none of its advantages, and that the capital upon which it depends for a living may not be destroyed. F. F. SHARPLESS.

New York, Dec. 31 1918.

Reconstruction Suggestion From Mexico

It would seem to some of us down here that if there was less talk about maintaining high wages, and the President would declare Mar. 17 as "Reconstruction Day," at the same time recommending that the prices of all articles which have risen perceptibly since the beginning of the war be cut, say, 10% on that day, and, furthermore, that everyone receiving high wages brought about by the world war should consent to a cut of 10%, a more healthy situation could be created all around and ultimate good brought to all of the people in the United States. It would give every nationality a chance to show what it is made of.

If employers find that they can secure men for less wages, they may employ more, and thus relieve the situation to some extent. H. C. E.

San Luis Potosí, Mexico, Jan. 8, 1919.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief Bill Altered

After conferring with the Secretary of the Interior, Senator Henderson, of Nevada, has decided to reintroduce his bill for the relief of producers of war minerals as an amendment to the Dent bill. The text has been altered by inserting, after the sentence authorizing the Secretary of the Interior to determine the amount invested looking to the production of war minerals, the following: "The production of which was in pursuance of a request or demand of the War Industries Board, the Shipping Board, the Department of the Interior, or other authorized agency of the Government."

At the close of Section 1 of the old bill, a proviso is inserted as follows: "Provided, however, that the said Secretary shall only ascertain and determine and liquidate such claims arising hereunder as shall have been made and filed with the Department of the Interior on or before three months from and after the approval of this act."

Redfield Takes Conservation Work

The conservation division of the War Industries Board has been taken over by the Department of Commerce. It now will be known as the Industrial Cooperation Service. Conservation of labor, material and capital, through studies of individual industries, will be the object which it is hoped to attain. Secretary Redfield, however, emphasizes the fact that no element of compulsion is to enter into the relation of the service with the industries. "The service," he says, "is promotive purely, depending on consent to methods approved by common council and trade experience. In no sense is it restrictive and in no sense is it a police body." Continuing, Secretary Redfield said further:

> If some particular industry should desire to put into effect within itself such a program as would enable it to simplify manufacturing processes and to eliminate such of its product as was wasteful of material and labor tending to increase general costs of production, such a program would be considered by the Service in conference with members of the industry. If the plan seemed wise and reasonable, it would be indorsed by the Service. It must be understood clearly that the administration of the program, if administration be necessary, lies within the industry itself. It will be impossible to carry this work any further than the spirit of industry itself will carry it.

Seeking Storage for Nitrate of Soda

The War Department is finding considerable difficulty in obtaining storage for its surplus of nitrate of soda. The railroads are lending aid and have agreed to find storage for 153,619 tons at the following points: Galveston, 8500 tons; New Orleans, 5000 tons; Mobile, 21,645 tons; Pensacola, 10,560 tons; Tampa, 6500 tons; Jacksonville, 27,237 tons; Fernandina, 4000 tons; Brunswick, 15,744 tons; Savannah, 36,433 tons; and Wilmington, 18,000 tons. In addition, the War Department has had to contract for expensive space, and a large number of commercial dealers have accepted nitrates for storage.

Engineers To Visit France

A delegation from the U. S. Bureau of Mines will visit France to make a study of the engineering work being done in the recovery of the mines systematically damaged by the Germans. The body will be headed by George S. Rice. The other members are F. G. Cottrell and F. H. Probert. The delegation will sail early in February, to remain in France for three months or possibly for a longer period.

Pyrites May Be Imported Freely

All restrictions upon the importation of iron pyrites were removed as of Jan. 16 by the War Trade Board. In addition, the restrictions have been removed from graphite, graphite crucibles, iron ore, chrome ore, chromite, manganese ore, manganese dioxide, copper ore, copper concentrates, and monazite sand. Licenses will be issued for the importation of ferromanganese from Great Britain to cover shipments which were contracted for by American consumers prior to Apr. 6, 1917. It this case, the affidavit of the importer or a written statement from the consumer of the existence of the contract will be considered sufficient evidence.

The order with regard to iron ore supersedes the order of Nov. 11 affecting low-phosphorus iron ore from Spain, Sweden, Norway, and North Africa, and the order of Dec. 7, affecting calcined spathic iron ore originating in and coming from England.

Urges International Commissions

Permanent international commissions to handle problems concerning raw materials, food, and other questions are being urged by William S. Culbertson, of the U. S. Tariff Commission. He outlines his views as follows:

> In the world out of which the Great War sprang as inevitably as sparks fly upward, a nation aggrieved by shipping, trade, or financial discriminations had only the alternative before it of submitting or retaliating. If it submitted, it nursed its grievance into suspicion and hatred; if it retaliated, the world witnessed a commercial war which increased ill feeling. The need was great, and now, after the war, is even greater for international commissions which will investigate and offer a solution to these commercial rivalries before they result in conflict. The Allied Maritime Transport Council, which has rendered such genuine service during the war, suggests the field for an international shipping commission. The food and raw material executives of the Allies may be regarded as the beginnings of the organization for handling world problems concerning food and raw materials. Anarchy, before the war, reigned almost supreme in international trade relations. Because there were no international standards of competition, the only restraints on unfair practices by great export syndicates were those exercised by nations, and they were ineffective. An international trade commission could be of great service in making competition between nations fair. Investments and concessions in politically backward countries should also be under an advisory commission, which would view the problem in the light of international needs. An international tariff commission, as the discussions in this address indicate, is imperative. It would act as an arbiter in tariff disputes between nations, give publicity to concealed discriminations, investigate and report on the economic phases of any exceptions to the general rule of equality of treatment and opportunity, and at stated times submit, as should the other international commissions, its reports and findings to the reassembled delegates of the nations.

Seek To Establish Potash Industry

WASHINGTON CORRESPONDENCE

A determined attempt is being made to secure legislation favorable to the development of a domestic potash industry. Producers have been in conference with the potash specialists of the U. S. Bureau of Mines and have been able to find some support for legislation to provide that no potash is to be imported without a license showing, among other things, the exact quantity brought into the country. The total imports are not to exceed the difference between domestic production and domestic requirements. It also is suggested that a potash corporation be formed to purchase and sell potash with the object of assisting the industry by carrying such surpluses of stock as will be required. Another function of the company would be to carry on its experimental work with processes which give promise of developing to a commercial basis. The idea is to limit such legislation to a period of a few years.

It is expected that a bill will be evolved in the near future which will meet the approval of the Secretary of the Interior. The foregoing proposals, along with others, have been submitted to Secretary Lane, but as yet he has given none of them his approval.

The Annual Meeting of the A. I. M. E.

International coöperation in mining in North America will be one of the principal topics to be discussed at the 119th meeting of the American Institute of Mining Engineers, to be held in New York, Feb. 17 to 20. In the course of the convention two joint sessions with the Canadian Mining Institute and one joint session with the American Institute of Electrical Engineers will be held. A number of prominent members of the Canadian Institute will be present.

Improving the relations of capital and labor and the possibility of a uniform mining law for North America will be among the principal subjects which the Canadian engineers will discuss with the American Institute. Many of these topics will deal with after-the-war problems of great significance to American business. Three of the four days of the convention will be devoted to business and technical sessions, with entertainment features in the evenings, and the fourth day will be given over to an excursion to the Federal shipyard at Newark Bay, where an electrically welded ship is being built. The subject of electric welding is one of the principal topics to be taken up by the American Institute of Electrical Engineers in joint session with the mining engineers on Wednesday, Feb. 19.

The social features of this year's meetings will include an evening entertainment, a visit to the Metropolitan Museum of Art and Senator Clark's art galleries, a matinee, the reception of the president, and the annual banquet.

The committees in charge include the following:

Arrangements, Allen H. Rogers, chairman; W. S. Dickson, secretary; J. E. Johnson, Jr.; F. T. Rubidge, P. G. Spilsbury, H. C. Parmelee and Forest Rutherford. Committee on annual dinner, F. T. Rubidge and E. B. Sturgis. Committee on luncheon, Forest Rutherford, chairman, and E. Maltby Shipp. Committee on patriotic meetings, H. C. Parmelee, chairman.

Would License Patents

WASHINGTON CORRESPONDENCE

A bill has been introduced in the Senate authorizing the Federal Trade Commission to handle inventions, patents, and patent rights under a licensing system with the idea of being helpful to industry and to the inventors or patentees. Special mention is made in the bill of patents obtained on processes devised by employes of the Government. Provision is made for financial remuneration of those developing meritorious investions.

Perkin Medal Goes to Doctor Cottrell

Dr. Frederick Gardner Cottrell, chief metallurgist of the U. S. Bureau of Mines, was presented with the Perkin medal for chemical discovery by the Society of Chemical Industry at the Chemists' Club, New York, on Jan. 17. The American Chemical Society and the American Electrochemical Society concurred in the decision.

The work of Doctor Cottrell was selected for this honor, says the New York *Sun*, because it is judged to have an important bearing on the development of industry. Doctor Cottrell invented a precipitation process by means of which soot and particles of metals and chemicals are eliminated from smoke before it is discharged into the air. Through its use the noxious and acid fumes from copper smelteries may be kept from vitiating the atmosphere and destroying vegetable and animal life, and valuable metals may be reclaimed.

Doctor Cottrell, in accepting the medal, announced a new process for extracting the gas helium from the atmosphere, which is expected to have a tremendous effect upon aërial navigation. This gas is very buoyant and non-inflammable. Its production was once so expensive that it was regarded as a laboratory experiment, but in the stress of war two processes for developing it cheaply have been found, and Doctor Cottrell's method produces it still more cheaply.

The Perkin medal is named after Sir William Henry Perkin, who discovered the first aniline dye and to whom it was first awarded. Aniline dyes were first developed in England, it was pointed out, thus shattering another popular German myth.

Sweden To Receive Metals

WASHINGTON CORRESPONDENCE

Provisions have been made by the War Trade Board which permit the exportation to Sweden of lead, aluminum, nickel, mica, graphite, metals not worked, crucibles, tin plate, and similar commodities when consigned to the Swedish Metal Import Association. The Swedish Raw Phosphate Import Association will likewise receive phosphates, and the Chemical Industries Import Association will receive sulphur, technical oils, stone rosin, and like materials.

A Large Over-Production of Pig Iron, Chrome Ore, spiegel and ferromanganese faces the iron and steel men of America with a possible lowering of the prices of these products. At a meeting of the Associated Manufacturers of Merchant Pig Iron and the American Association of Pig Iron Manufacturers, the two associations of American producers, this phase of the iron industry was discussed.

Mining and Metallurgical Society

The Mining and Metallurgical Society of America held its annual meeting at the Engineers' Club in New York, on Jan. 14, at which the reports of the officers for the previous year were made.

The tellers reported the result of the ballot for officers for 1919, and the following were declared elected: President, H. H. Knox; vice-president, F. F. Sharpless; secretary and treasurer, Louis D. Huntoon. The following were elected to the Council: W. R. Ingalls, Walter H. Aldridge, J. E. Spurr, Ralph Arnold, and C. W. Goodale.

At the evening session, following the annual dinner, which was attended by about 60 members and their guests, the award of the gold medal of the society to Eugene Schneider, head of the Creusot Works in France, for distinguished service in the metallurgy of iron and steel, was announced. The presentation of this medal will take place later.

The retiring president, W. R. Ingalls, then delivered an address on "The Economic Duties of the Engineer," which was followed by a supplementary address by the incoming president, H. H. Knox.

The meeting was one of the most successful in the history of the society.

Penarroya's New Lead Plant

Bradley, Bruff & Labarthe, San Francisco, have been retained as engineers by the Société Minière et Métallurgique de Penarroya, for the design of a new lead smeltery and refinery to be erected at Penarroya, in Spain. The plant will be thoroughly modern in every way, and special attention will be directed toward the mechanical handling of materials. Manual labor will be dispensed with as far as practicable in the operation of an establishment of this kind. Crushing and sampling machinery, multiple-hearth and Dwight & Lloyd roasting and sintering equipment, four large lead blast furnaces, one copper blast furnace, a lead-copper matte converting plant, complete zinc and desilvering lead refinery, together with lead manufacturing machinery will be provided. The roasting and metallurgical furnaces will be fired with pulverized coal.

"Jack" Clynes

Herbert N. Casson writes in the *Boston News Bureau* that the coming man in Great Britain is John R. Clynes—the ablest labor leader in that country. Clynes is a member of the new Parliament. He was reëlected unopposed. No one dared to run against him. He has been for two years a member of the government. He is the food controller. He is a delegate to the peace conference. He will be the strongest man in the labor party, and may on critical occasions hold the balance of power in the new House of Commons. He is Gompers, Hoover, and Champ Clark all in one. He is in many ways the most influential and pivotal man in British public life.

Clynes is a friend of Lloyd George, but not a follower. He is, above all, the head of the national federation of laborers' unions—a powerful body of 750,000 workers. He is a fighter without enemies—a thinker without theories—a practical, simple, efficient son of Lancashire.

"Jack" Clynes was a child of poverty. He has never had an asset nor an advantage except himself. He was born in 1869—the son of a laborer at Oldham. As there are 13,000,000 spindles in Oldham—more than in Germany and Austria combined—all the small children are needed in the factories; and Jack Clynes went to work at 10 years of age. He was a tiny, frail, shock-headed boy—probably the most insignificant industrial unit in the whole of Lancashire. But he was fond of books—as fond as ever Andrew Carnegie was. He begged, borrowed, and bought as many books as he could. Once he was discharged by a mill manager because he was caught studying a grammar during working hours. At 18 he bought a second-hand dictionary and copied it all out, from A to Z. His favorite book was the Bible; his favorite authors were Carlyle, Mill, and Shakespeare. At 22 he was an orator and a labor leader. He took command of a small, despised trade union and built it up to a membership of 40,000 and an income of $100,000 a year.

There is no class hatred in Clynes. He has no more regard for the I. W. W. than he has for the House of Lords—not as much, in fact, as he has several lords working amicably as his assistants in the food-control department. He is in favor of more machinery and more output. "Anything that machinery can do," he said recently, "to save human hands and to speed up production, should be done." He believes that capitalists and workers are natural friends and that both are becoming more reasonable. He is not in any sense an extremist, yet at the last labor convention he was the most popular of all the delegates and received the highest number of votes.

A man who has this engaging record is bound to excite admiration. A labor leader who wants to mechanicalize everything and speed up production is a wonder. We think we are justified in claiming "Jack" Clynes as an engineer.

Spain's Mineral Output in 1917

According to preliminary statistics just issued, says *Commerce Reports* of Jan. 3, the total value of Spanish mineral products for 1917 was $245,383,732, an increase compared with 1916 of $72,193,244. The value of ores at the pit amounted to $87,923,572, and the value of the mineral products from the smelting works was $157,460,160. The number of concessions in actual operation was 2839, with a superficial area of about 1150 square miles, an increase of 308 concessions and about 63 square miles compared with the year 1916.

Foreign Mining

The administrators of the Compagnie des Mines de Bor have visited the mine in Serbia and have taken steps to estimate the ore that was extracted during the German occupation. The physical condition of the mine was found to be satisfactory, the machinery, furnaces, and other equipment proving to be intact.

The Compagnie Miniere du Congo in its last year, in spite of difficulties, extracted 15,000 tons of ore, averaging 50% copper.

Premier Hughes on Australian Mining

In the *Journal* of June 15, 1918, Premier Hughes of Australia was reported as having made a speech before the Harvard Club in New York, in which he was quoted as saying that the mines of Australia "were entirely under the control of German capital when the war came," and, further, that "to be fair, the German energy and capital were very beneficial to us."

We are in recipt of a communication from the private secretary of the Australian Prime Minister, stating that he "did not address the Harvard Club, New York, and on no occasion while in America or elsewhere has the the Prime Minister given utterance to the statements expressed by you. What he is reported to have said is quite opposed to every view he has ever expressed, and most certainly in direct opposition to all the facts, of which he has complete knowledge. Under the circumstances Mr. Hughes will be glad if you will take an early opportunity of contradicting the report referred to."

We are glad to make the necessary contradiction, not only to correct a misrepresentation of Mr. Hughes, but also to rectify an error in our record of events. It is appropriate to explain, however, how the error occurred.

Our paragraph was taken from the news reports of the day, similar reports appearing in the chief New York morning papers of June 2, 1918. Reference to such contemporaneous evidence causes it to appear that Mr. Hughes did not make a speech before the club, but did talk to representatives of the newspapers in the Harvard Club on June 1. The reporters manifestly misunderstood his remarks. It is possible that Mr. Hughes mentioned the trade in certain Australian ores being controlled by German houses, and the reporters may have misunderstood that to mean the mines being controlled, which, of course, was not so, as Mr. F. A. Govett stated in a communication published in the *Journal* of Sept. 7, 1918.

Of course, the alleged statement was contrary to the facts, which nobody knew any better than ourselves, which facts we have stated editorially many times since August, 1914. We regret that the paragraph published in our issue of June 15 did not pass under the eye of an editor who was familiar with the subject.

Villa Financed by Germans*

The Senate committee which is investigating German propaganda developed an interesting point at its session of Jan. 7. Strong evidence was submitted tending to show that the Villa uprisings of 1915 were financed by Bernstorff and Albert. Drafts drawn on the Mississippi Valley Trust Co. by Felix Somerfield, who was Villa's agent in New York, show that, in eight months, Villa received $367,000 worth of rifle cartridges from his agent. Somerfield was closely connected at that time with Carl Rintelen and Friedrich Stallforth, a prominent German banker in Mexico. Though positive evidence is still lacking that the Somerfield account was fed by Bernstorff, it is a fact that on Apr. 5, 1915, Bernstorff and Albert opened a joint account with the Mississippi company, and on the same day Somerfield opened his account there also. The ammunition sent to Villa was made by the Western Cartridge Co., of Alton, Ill., was paid for by the sight drafts on Somerfield, and shipped to Hippolito Villa at El Paso. Hippolito is a brother of Francisco Villa, the bandit. Major Humes, who submitted these facts, pointed out that the Somerfield account was kept replenished by telegraphic transfers from the Guarantee Trust Co. of New York. The Bernstorff and Albert accounts and the Somerfield account with the trust company were closed at about the same time. Though positive proof is still lacking, the evidence points to the conclusion that Villa was financed by Germany during this period.

---

*Extract from article in New York *Times*, Jan. 8, 1919

A Useful Hint for Mining Men

One way of injecting new life into an old subject is to send in a perfectly new contribution to the 27th Engineers' Comfort Fund. Of course it is needed, with the regiment still on the other side, and once it is given the donor will scarcely feel it. At any rate, he may know that whatever sacrifice he has made in giving it is appreciated by the men of the regiment. We have Colonel Perry's word for this in a recent letter. Many have overlooked the matter. These, especially, are urged to help boost this fund for our mining regiment.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$19,653.56
W. E. Defty	10.00
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
Interest to Jan. 1, 1919	105.30
Total	$19,888.36

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Silver and Zinc in Eastern Siberia

Years ago large and important deposits of lead, zinc, silver, and other minerals were discovered in the vicinity of the Tiutihe River, in eastern Siberia, north of Vladivostok, according to *Commerce Reports* of Jan. 2. J. I. Bryner, owner of many claims, succeeded in interesting Baron Hirsh in these deposits. The country was prospected and opened up in a businesslike manner, and a few years before the war a large amount of German capital was invested in the opening of several silver-zinc mines, in the construction of a railroad about 30 miles long, in dredging the mouth of the river, and in building wharves, houses, and similar accommodations. At present [written Aug. 20, 1918], this mining undertaking, because it represented German interests, has been seized by the Russian government and is for sale.

Distributing Government's Sulphur

The Government's stock of sulphur when the armistice was signed was 90,000 tons, according to L. H. Hartman, one of the directors of the stock division of the War Department. Two of the largest companies that had supplied the Government with sulphur during the war were called in and asked as to the best way to dispose of this accumulation. They suggested that for every 1000 tons they dispose of they would also dispose of 1000 tons for the Government, thus effecting the distribution without disturbing the market price.

Editorials

The Situation in Zinc

IN THE haste of going to press with our annual review number, we were unable to present the zinc statistics for the United States in 1918 with all the detail that the returns of the producers made possible, or with the critical analysis that required careful consideration. Some additional data and comments may now be offered. The accompanying table gives the status of some things at quarterly intervals, the production figures being for the quarters terminating with the dates at the head of the respective columns.

	1917	1918			
	Dec. 31	Mar. 31	June 30	Sept. 30	Dec. 31
No. of smelters operating	26	24	24	24	24
No. of smelteries operated	38	34	31	32	32
No. of retorts in works operated	196,950	198,894	196,580	173.944	176.392
No. of retorts in use	127,193	124,072	110,956	118,008	124.068
Tons of distilled zinc produced	144,906	125,572	117,512	122,130	120,611
Tons of electrolytic zinc produced	5,837	8,096	9,404	11,124	10,568
Tons total zinc produced	150,743	133,668	126,916	133,254	131,179
Tons stock on hand	60,415	64,443	46,081	45.788	40,325

The production of spelter was maintained at a rather uniform rate, quarter by quarter, during the year. When the market was so sick in the early part of the year, and curtailment was the order of the day, production fell off sharply in the second quarter, but with the natural rally in the market producers mistook its meaning and light-heartedly increased their production to about the rate of the first quarter and maintained it during the fourth quarter, although nearly two months of the latter were after the armistice. The statistics make it evident that they overstayed their market, maintained their production when they ought to have been curtailing, and, in general, that they had either a misconception of the true state of affairs or were buoyed up by false hopes.

The statistics of exports of spelter in the first 10 months of 1918 show that 70,000 tons went out. If we estimate the exportation in the last two months at the same rate, and compare with stocks at beginning and end of the year and production during the year, we arrive at domestic deliveries by the smelters of about 460,000 tons. It is incredible that domestic consumption was really so large as that, and the obvious inference is that spelter passed into invisible stock. Indeed, we know that the Government accumulated a good deal and that many private manufacturers have large piles in their yards. The publication by the Government of weekly stocks in the hands of smelters was deceptive and mischievous.

A common idea among producers soon after the armistice was that we should be able to sell a good deal of spelter to England, France, and Italy. Some high-grade spelter was, indeed, sold thither in the early days, but when exporting houses began to "feel" the foreign markets, which they did as soon as possible, they found not only absence of interest, but also obstruction, and it became known later that both France and Great Britain had large stocks of spelter that they purposed using up before they bought any more. On Jan. 1 the British Ministry of Munitions reported 34,000 short tons of spelter in its possession in Great Britain. How much that ministry owns that is not yet in its possession in Great Britain, and how much private parties have in Great Britain, are unknown. In France there is, according to our private advices, a stock of 45,000 short tons, enough to keep her going for a long time. The Japanese statistics of exports for nine months indicate the existence of a considerable stock there. Australia is reported to have 300,000 long tons of blende concentrates in stock, equivalent to a production of about 130,000 short tons of spelter. Freight rates, especially in British ships for purposes of British needs, are coming down rapidly, and the British increase in zinc-smelting capacity is on the eve of becoming available. In this country there is a surplus of zinc ore. Oklahoma producers are willing to sell it for low prices, and western producers find difficulty in selling it at all.

These are facts that have got to be looked squarely in the face. They relate to the immediate situation and offer an adequate explanation of why the spelter market has been declining steadily during the last three months and has now gone below 7c. for common spelter, while it is doubtful if high-grade commands a premium of any more than 1c. These prices may be below the cost of production in many cases, perhaps below the cost of a large part of the production; but there exists a situation in which cost of production has nothing to do with the immediate market. Besides the things that everybody can see plainly, organic factors are developing that will be of increasing potency. It is time for the American zinc industry to examine its position, revise its views, and give serious consideration to the future.

Price-Fixing

ABOUT 18 months ago the price-fixers were rampant and were talking about the law of supply and demand as being an antiquated theory of economics that probably never was sound. The Administration proceeded to act in accordance with that belief. There were some immediate consequences. The coal famine of 1917-18 was one of them, probably the most serious. In other cases the manifestations of trouble were delayed. We are beginning now to face the results. Among the metal industries we see copper confronted with prostration. Lead, which experienced less interference, is in a much better way. It may be said that zinc has a gloomy outlook and suffered no interference at all. That is true, but zinc has organic troubles peculiar to itself.

The greatest menace to the business of the country now is that which results from fixing a minimum price for wheat. This is the greatest obstacle to the resumption of normal industry, for it tends to maintain the cost of living when wages have got to come down. It is clear enough that wages have got to come down or industries will have to shut down. There are two horns of dilemma with food continuing costly. The Government will have to keep its promise to the farmers. This may cost it a billion dollars or so. Whence will come the money? From taxation, of course; but there are not going to be any war profits in 1919. Indeed, the objurgated "profiteers" of 1917-18 were to a large extent putting profits into plant which really were not profits at all, as they see now when they are writing them off. Even the Government sees that it has got to write down its ship-building investment by some billions. When it comes to paying taxes this year people will think more about how money was squandered.

People at large will soon begin to see the truth of what the unpopular, old-fashioned economists told them. The laws of nature cannot be repealed. Interference with them inevitably produces a train of worse evils than the temporary one that it is sought to remedy. So intricate are the workings of nature, as exemplified in the laws of trade, that no one could have reasoned out all of the ramifications of peril that are now becoming plain. Danger was foreseen and warnings were given. Every real student of economics knew that price-fixing in any form was an economic sin that would bring its own penalty.

The Problem of the Mine Foreman

AMONG the changes from the old order is the greater attention that is being paid to the duties and personality of the mine foreman. True, the transition is not entirely complete, but, in the process of developing and perfecting the mine organization of today, mine operators realize that attention must be given to adequate and proper supervision, to complete the coöperative scheme upon which rests the success or failure of the enterprise. Under the earlier arrangement of things, where a small organization could be managed by a few, the process of supervision was a fairly simple problem, but today, with single operations demanding a large number of men widely distributed, it is essential that every effort should be made to produce a smoothly working machine.

The successful foreman is now judged by his ability to get results, and though this particular qualification does not differ from what was demanded 10 or 20 years ago, the manner by which such results are obtained requires a different method than that under which our predecessors worked.

The old type of foreman or "boss" was in a sense the master of his particular domain. His was the power to hire or fire; his word was the law; his way of doing things absolute; and, right or wrong, the management stood behind him so long as he produced results. But with a gradual advance of methods and ideas, mine labor has demanded more, and the result is that "the day of conscripted brutality has passed." The inference conveyed by the phrase may perhaps be unfair, for there were to be found, among the older types, many men of ability who possessed an excellent sense of fairness and executive acumen, and it is those examples that the foreman of today may well follow.

Various factors have contributed to bring about this change: the rapid increase of wages, the development of the welfare movement, a growing confidence in the mine organization, and a demand for superior knowledge have all served to strengthen the desire of the men that the "boss" or foreman should be worthy of the position which he holds.

The development of elaborate systems of cost analysis has made possible much progress in determining the actual worth of men in the various mine occupations; a correct proportion of wages for mine work is probably as well established in underground operations as in any other industry, and the expense of training each unit of the organization is fairly well known. Considering these factors, and assuming that a satisfactory basis has been reached, there remains the need of completing the system whereby the organization may continue in successful operation.

The link in the chain is the foreman. First of all, he must be a diplomat, for it is not only in mining that he must be trained, but in the study of human nature, and it is the lack of this trait that has been the downfall of many otherwise efficient men. The mere transmission of knowledge, as expressed in an order, is one thing; the correct execution of that order is another; and it depends almost entirely upon the "contact" that exists between the men and the foreman, which is obtainable, as before stated, only by study and an appreciation of the variables in human nature.

Several of the larger mining companies have adopted coöperative plans which aim to bring about a more thorough understanding between the mine workers and the management, and to adjust certain differences that may occur. This form of arbitration is undoubtedly effective, and goes far, but does not lessen the responsibility which should rest on the mine foreman or boss. His work is the daily contact with the men, not the occasional one, and his greatest value to the company lies in his ability to insure coöperative effort.

The following rules for foremen, reprinted from a bulletin recently issued by the National Safety Council, are of interest in this connection:

> Be fair. Have no favorites and no scapegoats. A foreman has to act as judge many times every day; therefore, he must be just.
>
> Make few promises, and keep them. A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a high standard of truth and honor.
>
> Don't waste anger—use it. Anger is valuable and should not be used carelessly. Keep your most forceful language for special occasions.
>
> Always hear the other side. Never blame a worker until he has been given a chance to give his point of view.
>
> Don't hold spite—forgive. When you have had to scold a worker, go to him later and show him his faults in a friendly way.
>
> Never show discouragement. Never let yourself be beaten. A foreman must have perseverance and the "never-say-die" spirit.
>
> Notice good work as well as bad. Let the workers see that you can appreciate as well as condemn.
>
> Watch for special ability. Take a keen human interest in your workers. Put each one where he can do his best.
>
> Take your full share of blame. This is the most difficult of all. The foreman who can share both blame and praise with his workers has discovered the secret of managing men.
>
> Prevent accidents. Educate or eliminate the careless man. The good foreman is known by his men.

The situation demands big men, men who can secure "team work," and, together with the routine duties, carry the idea to the men that by serving the interests of the company they are working to their own advantage. The problem is one of system combined with good understanding and common sense.

Held for Ransom in Mexico

ANOTHER letter from Mexico lies before us. A paragraph, after judicious censoring, would read as follows:

> Everything is just about the same down here in Mexico—no better or no worse. I have just returned from a trip to ——, and while in that place the startling intelligence was brought in that Mr. ——, of the —— mining company, was captured by bandits operating in that state and has been held for 10,000 pesos ransom. Steps were taken immediately to secure this sum, and I do not doubt but that Mr. —— is at liberty at the present writing.

American citizens in that distressful country are apparently ceasing to remember that they have a right to expect aid and assistance from the United States; and, failing this, have no course but to acquiesce to the outrageous demands of the bandits and those super-bandits with whom the former work in harmony.

Without official protest from this side of the border there is every prospect of an immediate expansion of similar outrages. The method described by our correspondent indicates an absurdly simple way for Mexicans to raise almost unlimited funds from American citizens and American companies.

BY THE WAY

A recent bulletin says: "The War Trade Board announces the removal of the following commodities from the Export Conservation List, effective Jan. 6, 1919: Arsenic and compounds thereof; arsenate of lead; arsenate of soda; arsenite of soda; lead, arsenate of; sodium compounds, as follows: Arsenate, arsenite." We are almost certain that the writer of the foregoing, when he salts his matutinal eggs, uses not only salt but sodium chloride, chloride of sodium, and the sodium salt of chlorine.

An investigation by the Providence Mining and Engineering Co. of Charleroi, Belgium, shows that for the three months of the last year of the war, without any epidemic, the mortality rate among its 2000 men was 3.5 times as great as that for the corresponding period in 1913; that the physical resistance to sickness had been reduced to a third of the normal resistance, that is, three times as many men were on the sick and disabled list, and that the average weight of its workers, except 5%, made up of young men, had fallen greatly. Since the beginning of the war, 35% of the company's men show losses in weight of from 10 to 40 lb. each.

"One often finds at the bottom of the water pieces of pure copper of 10 and 20 lb. weight," wrote Father Allouez of his journey to Lake Superior in 1665-67. "I have several times seen such pieces in the savages' hands; and since they are superstitious they keep them as so many divinities, or as presents which the gods dwelling beneath the water have given them, and on which their welfare is to depend. For this reason they preserve these pieces of copper, wrapped up, among their most precious possessions. Some have kept them for more than 50 years; others have had them in their families from time immemorial and treasure them as household gods. . . . For some time, there had been seen a sort of great rock, all of copper, the point of which projected from the water. This gave passers-by the opportunity to go and cut off pieces from it. When, however, I passed that spot, nothing more was seen of it; and I think that the storms—which here are very frequent, and like those at sea—have covered the rock with sand. Our savages tried to persuade me that it was a divinity, who had disappeared for some reason."

The principal lead mine in China is the Shuikoushan, in Hunan, owned by the provincial government, according to *Commerce Reports*. The official records of the output of this mine over a period of 20 years show that it produced 50,000 tons of lead and 126,000 tons of zinc concentrates. It employs 5000 laborers, who receive from 12 to 30c. (Mexican silver) per day. The Kungshan mine in Tungchwan, Yunnan, is the only other large lead mine in operation in China.

On one occasion a Virginian was coming up over the divide from Gold Hill late at night, wrote Dan De Quille in the "Big Bonanza." He had three $20 gold pieces in his breeches pockets and was sauntering along with his hands in his pockets. Suddenly a masked man stepped before him, and, thrusting a pistol in his face, cried, "Hold up your hands, sir!" The footpad searched his pockets and found nothing. The Virginian had closed his hand upon the three "twenties" and held them above his head, while submitting to the search. The footpad was evidently much disappointed, as he said, "If you ever come along here again without any money, I'll take you a lick under the butt of the ear. That's what I'll do with you."

A well-known consulting mining engineer, who is also the president of a large company operating near but on the wrong side of the Mexican border, started from the vicinity of Bisbee on a trip elsewhere. Arriving at Benson, he employed the moments during which his private car was being switched about here and there, preparatory to being attached to No. 9 on the main line of the Southern Pacific, by strolling over to the Benson House and exchanging views on various topics with some of the many friends always encountered in the Southwest. Meanwhile the chargé d'affaires of the car decided to visit around a little on his own account, prevailing upon a dusky brother from an adjacent sleeper to mount guard and discourage any trespassing. The substitute tyler of the establishment was a person of much experience in attending to the wants of well-to-do tourists, and in the course of years had acquired a supercilious contempt for what he chose to consider "po' white trash." In fact, good clothes and an air of ready money served for him as a sort of rapid colorimetric assay of gentility. So that, when the rightful occupant of the car returned in advance of his customary servitor, he was greeted with "Look-a-yere, now; is yo' aimin' to git abo'd dis car?" A curious twinkle played about the eyes of the one addressed, and with a good-natured grin he planted a dusty shoe on the lower step and felt for the latch of the ornamental gate. Nonplussed for a moment, the Ethiopian's authority asserted itself as he exclaimed, "Hol' on dere. Yo' go 'long up in one ob dem day coaches forward where yo' belongs, w'ite man; dis yere am Doctor Ricketts' car."

NEW PUBLICATIONS

Handbook of Mineralogy, Blowpipe Analysis and Geometrical Crystallography. By G. Montague Butler. Pp. 155; 4 x 7; illus.; leather; $3.50. John Wiley & Sons, New York.

Practical Surveying and Field Work, Including the Mechanical Forms of Office Calculations, With Examples Completely Worked Out. By Victor G. Salmon. 5 x 7½; pp. 204; illus. J. B. Lippincott Co., Philadelphia, Penn.

Oxwelding and Cutting. A Manual of Instruction. 5 x 8: pp. 124; illus.; paper. Murray Howe & Co., New York.

An illustrated pamphlet giving in detail the solution of 60 welding problems.

Bibliography of North American Geology for 1917, With Subject Index. By John M. Nickels. Pp. 154. Bull. 684, U. S. Geological Survey, Washington, D. C.

Quarry Safety Rules. Issued by the Industrial Accident Commission of the State of California. Pp. 57; 4½ x 6: paper. Industrial Accident Commission of California, San Francisco, Calif.

A pamphlet containing accident-prevention rules, for quarrying, similar in outline to state laws for the operation of factories and steam-boiler plants.

The Rustler Springs Sulphur Deposits. By E. L. Porch, Jr. Pp. 71; illus. Bull. 1722, University of Texas, Austin, Texas.

A pamphlet outlining the results of investigations on the sulphur deposits at Rustler Springs, Texas, with special reference to their physical characteristics and geologic relations.

The Safety Movement in the Iron and Steel Industry, 1907 to 1917. By Lucian W. Chaney and Hugh S. Hanna. Pp. 299; illus. Bureau of Labor Statistics, Industrial Accident and Hygiene Series No. 18. U. S. Department of Labor, Washington,. D. C.

The results of a study of accidents in the iron and steel industry are given, together with the accumulated knowledge of recent years in the field of accident prevention.

Methods of Shutting Off Water in Oil and Gas Wells. By F. B. Tough. Pp. 122; illus. Bull. 163, U. S. Bureau of Mines, Washington, D. C.

This bulletin deals with a topic that is exceedingly wide, and will doubtless be under consideration and discussion so long as there are enough known deposits of oil and gas remaining in the earth to make their development profitable. The Bureau of Mines has repeatedly called attention to the importance of protecting oil or gas sands from the encroachment of water, and the purpose of this paper is to summarize existing knowledge of methods and devices.

Mill and Cyanide Handbook. By A. W. Allen. Pp. 128, with diagrams and charts. $2. J. B. Lippincott Co., Philadelphia, Penn.

In some respects this is a unique book. It contains no written description, but consists of a series of tables, formulæ, diagrams, report forms and a glossary logically arranged to suit the convenience of the metallurigst and millman. The book has been compiled in response to the everyday needs of those engaged or interested in the planning, management or operation of metallurgical plants, and is bound in convenient form. It should be useful to those engaged in the same or similar lines of work. As a contribution to metallurgical technology it should find a welcome place upon the bookshelf of every cyanider and millman.

Mine Tracks; Their Location and Construction. By J. McCrystle. 5 x 7½, pp. 105; illus. $1.50. McGraw-Hill Book Co., New York.

A handy little book dealing with practical details of the location and construction of mine tracks. The author remarks in his introduction that: "With many mining companies, I have found that, after they are satisfied as to the merit of the equipment, the subject of trackwork is neglected, and the manner of installation and the specific application, the selection of the frogs, switches, etc., go by default to the fireman or trackman. Generally speaking, no efficient trackwork can be accomplished without prescribed rules to govern this work." The author gives a number of such rules. Though the book deals more particularly with colliery operations, it should be of considerable service to the foremen of metal mines.

The Production of the Precious Metals During the Year 1917. Annual report of the Director of the Mint for the year ended June 30, 1918. Pp. 259; 6 x 9¼. Office of the Director of the Mint, Washington, D. C.

The book contains a great deal of interesting information on the operation of United States mints during 1918. The domestic coinage for the year amounted to 714 million pieces, compared with 406½ million in 1917, and 155 million in 1916. In addition, 52 million pieces of coins and blanks were issued for foreign governments. Sixty-eight million silver dollars were also converted into bullion during the period and interesting data are given as to the operation of the new Rennerfelt electric furnace at the Philadelphia mint. Statistics are also presented indicating the production and consumption of gold and silver in the United States in 1917. An appendix contains a large amount of related information, culled from various sources.

Innovations in the Metallurgy of Lead. By Dorsey A. Lyon and Oliver C. Ralston. Pp. 176, illus. Bull. 157, U. S. Bureau of Mines, Washington, D. C.

The data reported in this bulletin are largely the result of experiments conducted by the Salt Lake City station of the U. S. Bureau of Mines, in coöperation with the department of metallurgical research of the University of Utah. The work on lead is only one of the phases of the investigations carried on at that station during the years 1914 to 1916. The results of similar work with zinc ores and with copper and other ores will be published in future reports of the bureau.

The application of new hydrometallurgical and other methods has been made to the following ore types: (a) oxidized lead ores; (b) oxidized lead ores containing precious metals; (c) oxidized lead-zinc ores: (d) simple sulphide ores of lead; (e) leady zinc concentrates; (f) lead-iron sulphide middlings; and (g) complex sulphide ores of lead, zinc, iron, and copper, with or without precious metals. It has been found that a saturated solution of common salt is a good solvent for lead chloride and lead sulphate; and, in all leaching tests reported herein, brine leaches, with or without the addition of sulphuric acid, were used. The lead may be precipitated with lime from solutions that are not contaminated with other elements, and by electrolysis when the solutions are contaminated.

Three alternative methods have been tested in the treatment of materials containing oxidized lead, as follows: Sulphidizing and flotation, acid-brine leaching of the raw material, and volatilization of the lead with the recovery of lead chloride fume. All ores do not yield to flotation, and only those that do not contain excessive proportions of acid-consuming constitutents yield to acid-brine leaching, whereas nearly all the materials tested have yielded to the volatilization method, irrespective of the kind of gangue.

The oxidized ores of lead are usually argentiferous, but occasionally some gold is also present. Silver is often present, in considerable amounts, as the chloride, which is soluble in acid brine. The sulphide of silver is only slightly soluble in acid brine, so that the acid-brine method of treating oxidized lead ores usually fails to give good extractions of the silver. Sulphidizing and flotation, where applicable, usually extracts the precious metals together with the oxidized lead minerals. However, the experiments described have shown that the precious-metal minerals are not necessarily intercrystallized with the lead minerals, and usually will be extracted in smaller proportions than is the lead. Chloridizing roasting and leaching give better results, although the best conditions seem to be those where only part of the lead chloride is volatilized, the rest of the lead being leached with the silver and the gold. By raising the temperature of the roast to 900° C. or more, the silver and the gold will be volatilized with the lead, making leaching unnecessary.

Treatment of the oxidized zinc-lead ores is more difficult. Sulphidizing and flotation will often remove the lead minerals, together with any silver that might be present, but much of this ore contains sulphur-consuming constituents that make sulphidizing difficult. The lead can be removed by the chloridizing and volatilization method, although some of the zinc tends to accompany it, using up salt and lowering the extraction of lead.

The simple sulphide ores of lead may be treated by the volatilization method, or by chloridizing or sulphating roasting followed by brine leaching. Chloridizing roasting and leaching seems to be the most successful method where silver is present, and promises to compete with gravity concentration and flotation, followed by smelting.

Lead can be removed from leady zinc sulphide concentrates without affecting the zinc sulphide, by a quick chloridizing and volatilization. The lead chloride fumes can be caught in an electrical precipitator, and converted into metallic lead by fusion with lime and carbon, yielding a calcium chloride slag which is a desirable substitute for salt in chloridizing and volatilization. Lead may be extracted almost completely from lead-iron sulphide middlings by the volatilization method. Silver, if present, usually does not chloridize well and does not volatilize. Brine leaching gives low extractions of silver. Extraction of the lead from the complex mixed sulphides of lead, zinc, copper, iron, and the precious metals by the volatilization method is likewise possible. Very little of the copper, silver, or gold is chloridized in this method, and, therefore, even after chloridizing leaching, these metals remain with the zinc sulphide. The iron sulphide is generally converted to ferric oxide in roasting, giving the material the appearance of having been thoroughly roasted. However, the unaltered sulphides of zinc and copper, and any residual lead sulphide, can usually be removed from the roasted material by fine-grinding and flotation, the iron being left in the residue.

The methods mentioned cover most of the important places in which lead losses occur. Possibly certain flue dusts from lead smelteries could be advantageously treated by brine leaching, because the lead in the flue dust usually consists of basic lead sulphate and lead oxide, which are soluble in such a solution. However, no experiments were made with such dusts.

Some of the proposed processes, from a study of their probable costs, deserve serious consideration, as they promise to be cheap, and usually give higher extractions of metal than are possible by the usual methods. The fact that most of them produce metal, not concentrate, will particularly recommend them to operations conducted at a point distant from smelting or transportation facilities. Also, methods adapted to arid conditions in arid regions are presented that should be of importance in the exploitation of the low-grade lead ores in some Western districts.

Everyman's Chemistry. By Ellwood Hendrick. 5½ x 8 in.; $2. Harper & Bros., New York.

In an introductory chapter the author states that the book is written for the man who shakes his head and exclaims that he knows nothing about chemistry whenever the subject is mentioned. A difficult task has therefore been attempted. The layman in chemical matters, whose interest is sought, looks for the reverse of heavy reading. Not only should such a treatise be free from unintelligible technicalities, but it must be written in that easy style that one is accustomed to meet in the editorial columns of a daily paper. Withal, the book must carry the hallmark of accuracy.

Mr. Hendrick has done remarkably well. "Everyman's Chemistry" is characterized by a fluent ease of diction; and the reader will find no stumbling blocks to progress in the form of involved phraseology such as often detracts from the value of more technical treatises. None but a carping critic would do more than draw attention to the very few errors which are noticeable.

Although the intended scope of the volume, according to the author, is limited, it may be safely predicted that it will have a wider audience than was originally expected. In addition to those who shake their heads and disclaim any knowledge of the subject, there is a large group of technical men, many of whom are specialists in some particular branch of chemical industry, to which Mr. Hendrick's book will appeal. For chemistry is so vast a subject, and its ramifications are so varied, that the majority will agree with him when he says that the man who knows all about chemistry is a poor creature and bereft of imagination. It is the busy specialist who will appreciate an opportunity to learn of other branches of technical endeavor, and who will be glad to do so in so pleasant a manner. For the book under review contains such a mass of interesting information, presented in so charming a style, that no one could read it without pleasure, and exceedingly few could do so without profit.

Much of the book is written in lighter vein, which does much to sustain interest. As an example, we are told, in an introductory chapter, that the elements "are given to polygamy and polyandry as matters of entire propriety; and, if it were not for the fact that we cannot imagine atoms as having sex, the way they shift about in their matings would scandalize any community." Passing from "the heart of the thing" to "phases of matter," the author expounds first principles in an altogether delightful manner. The final lines of a jingle on the Brownian movements are an indication of his versatility:

"The source of most colloidal fright
Is found in the electrolyte.
Its advent, though it be disguised,
Will stop the dance. They're paralyzed,
The particles. The dance will stop
And down the particles will drop.
Well, we're like that. Though young or old,
We imitate colloidal gold.
And when the grim electrolyte
Grips us in his unconquered might
With skull and crossbones, then we shout,
As we fall down: 'The light is out!'"

Occasionally Mr. Hendrick adopts the rôle of critic. In connection with the waste of coke byproducts, for instance, he says: "Some day, unless we go to pieces and lose our arts and sciences and take to the woods again like Indians, we shall have a sense of the fact that future generations have rights, and that these precious hydrocarbons, that it has taken nature hundreds of thousands of years to produce, should not be idly destroyed as though we were a nation of drunken sailors. There is no use in growing angry and blaming anybody for this cataclysmic waste; but now that we know better, it is time to stop it."

It is difficult to select any particular section of the book for special mention. Purely technical matter can usually be condensed without damage. To attempt to give a résumé of Mr. Hendrick's book would be to invite disaster because nothing of this kind could convey an adequate impression of its charm. It should be read by all, even those who maintain that they know all about the subject. It will appeal especially to the layman, who will probably learn for the first time that "chemistry washes us, launders our clothes, and bleaches and dyes them; it provides us with metals, with our morning paper and with books; it helps the farmer to grow our food; and when all is over, whether we be burned to ashes or buried in the ground, it is by chemical processes that our bodies go back into the great order of things."

Personals

Have You Contributed to the Association of the 27th Engineers?

N. O. Bagge, mining engineer, of New York, has returned from a trip to Arizona.

Capt. H. W. Edmondson, of the 28th Engineers, recently returned from France and is now in New York.

H. B. Johnson, mining engineer, has completed his professional work in Texas and has returned to Boston.

J. W. Bennie, general manager of the Shannon Copper Co., Clifton, Ariz., has been on a visit to El Paso, Texas.

C. A. Lanigan, formerly general manager of the Onahman Iron Co., of Duluth, Minn., has resigned. **W. H. Squier** is his successor.

A. P. Watt, consulting engineer, of New York, has opened an office in Boston, where he will continue to specialize on ore concentration.

W. Earl Greenough, mining engineer, of Spokane, Wash., recently completed an extended professional trip through Baker County, Oregon.

J. P. Gordon, government engineer for Manitoba, has begun a reconnaissance survey of the proposed railway from The Pas to the Flin Flon copper field.

Herbert A. Megraw, metallurgical engineer, is now with the Kennedy-Van Saun Manufacturing and Engineering Corporation, 120 Broadway, New York.

F. H. Andrews, construction engineer for the Huff Electrostatic Separator Co., is doing professional work in Texas, where he will remain for about two months.

Nathaniel Herz was at the headquarters of the American Institute of Mining Engineers, New York, during the last week. Others who registered were **H. D. Trounce** and **John T. Fuller**.

Irwin H. Cornell has been released from duty by the Non-ferrous Metals Section of the War Industries Board, and has resumed his position as sales manager of the St. Joseph Lead Company.

Frederick Burbidge, mining engineer, general manager of the Federal Mining and Smelting Co., of Wallace, Idaho, is in the Miami district, Oklahoma, where the company is operating zinc mines.

Joseph Clendenin, vice-president of the American Smelting and Refining Co., in charge of copper sales, has been made a chevalier of the Legion of Honor in recognition of his valuable services to the French government.

Francis N. Flynn, manager of the Consolidated Mining and Smelting Co. of Canada, at Trail, B. C., has resigned to become assistant general superintendent of the Balbach Smelting and Refining Co., Newark, New Jersey.

J. Leonard Replogle has been elected chairman of the board of directors of the Wharton Steel Co He left the company some time ago to become director of steel supply for the War Industries Board, and has now returned to regular business. It is expected he will resume his former activities.

Walter K. Mallette, having completed the construction of the Bunker Hill smeltery at Kellogg, Idaho, has removed to San Francisco, where he will have charge of designing a modern lead smeltery, to be built at Penarroya, Spain. He will be associated with Bradley, Bruff & Labarthe, engineers.

Simon Guggenheim, present chairman of the Board of Directors of the American Smelting and Refining Co., has been elected president to succeed his brother, Daniel Guggenheim, who will remain in the directorate of the company Murry Guggenheim will also remain as a director.

F. S. Peters is in charge of the Rossland mine of the Consolidated Mining and Smelting Co., of Canada. Other mine superintendents are given in the company's annual report as follows: E. G. Montgomery, Sullivan and St. Eugene mines; L. W. Oughtred, Highland mine; John Cannon, Number One mine; Ronald Stonier, Molly Gibson mine; Dan Matheson, Ottawa and Rock Candy mines; Edward Nordman, Emma mine; **D. M. Taitrie**, Lucky Thought mine; William Clancy, Coast Copper Co.; and G. H. Kilburn, Blue Grouse mine. The field operations are under the direction of M. E. Purcell, R. M. Macaulay, J. K. Cram, and G. H. Kilburn.

Obituary

Roy Crump, mining engineer, of Tonopah, Nev., died recently of pneumonia, following an attack of influenza.

Ernest H. Simonds, metallurgical engineer, died at Oakland, Calif., Dec. 26, of influenza. Mr. Simonds was a graduate of the University of California and for a long time was instructor of assaying at that institution. Many of the California graduates will hear of his death with keen regret. After leaving the University of California, Mr. Simonds opened an assay office in San Francisco. The business was successfully established and was continued until the San Francisco earthquake and fire wiped it out. Simonds went next into metallurgical engineering, and established himself in a good practice.

Logan Waller Page, director of the U. S. Office of Public Roads and Rural Engineering, died in Chicago, Dec. 9. He was born in Richmond, Va., in 1870, and was a student in engineering at Virginia Polytechnic Institute for two years and at Harvard University for six years. Later, at Harvard, he was in charge of tests of all materials used by the Massachusetts Highway Commission and some for other states and Canada. In 1899 he made a study of road-building in Europe. A year later, he became chief of the road-material laboratory, U. S. Government, afterward reorganized as the division of tests. In 1904 he became director of the Office of Public Roads, and was largely instrumental in formulating a comprehensive scheme for the testing of rocks, which is now being adopted in the mineral industry to prove the suitability of local stone for tube-milling.

Robert Lee Whitehead died at the Boothby Hospital, Boston, on Jan. 9, of pneumonia, aged 53 years. He was born in Amherst Courthouse, Va., and was a graduate of Lehigh University. His first work was with the Crozier Steel and Iron Co., of Roanoke, Va., of which he later became superintendent. In 1891 he went with the Baltimore Copper Smelting and Refining Co., to take charge of that company's silver refinery, and while there successfully worked out the process invented by his brother, Caleb Whitehead, for treating slime from the electrolytic copper refinery, a most difficult proposition at that time. He also devised other important chemical processes. About 1902, Mr. Whitehead went to Trail, B. C., where he installed processes for refining electrolytic slime for the Consolidated Mining and Smelting Co. of Canada. Later he was instrumental in installing parting processes in the mints at Denver and San Francisco, using his own ideas in both places. About 1909, he went to Perth Amboy, N. J., to take charge of the copper refinery at the American Smelting and Refining Co.'s plant. While there he invented the knife edge contact rod used in electrolytic tanks, and designed the plant for separating platinum from gold. He invented the process which formed the basis of the electrolytic tin plant, of which he also had charge and which has been a most successful installation. He left the American Smelting and Refining Co. last autumn and, at the time of his death, was engaged in the erection of an electrolytic tin refinery near Boston, where he intended to use an entirely new process of his own. Mr. Whitehead had arranged to sail for France in February and later go to England for the purpose of erecting electrolytic tin refineries.

Societies

American Mining Congress, Arizona chapter, has elected Norman Carmichael, general manager of the Arizona Copper Co., for president. Other directors are: Robert E. Tally, superintendent of mines for the United Verde Copper Co.; W. B. Gohring, superintendent of mines for the Calumet & Arizona Mining Co.; and B. H. Dowell, of Bisbee, Ariz. J. E. Curry, of Bisbee, is secretary of the chapter.

Duluth Engineers' Club, has unanimously passed a resolution favoring the creation of an organization for improving the status of the engineer, and has appointed the following committee to further that end and to compile complete data regarding the sentiment of the profession on the subject: O. H. Dickerson, member of the American Society of Civil Engineers; W. S. Heald, American Institute of Electrical Engineers; C. A. Graves, American Chemical Society; F. H. Linley, American Society of Mechanical Engineers, and D. E. Woodbridge, American Institute of Mining Engineers.

Industrial News

"The American Mineralogist," of Philadelphia, has announced the reorganization of its staff. Owing to the retirement of Wallace Goold Levison, Dr. Edgar T. Wherry, of the Bureau of Chemistry, Washington, D. C., will assume the duties of editor-in-chief, with the following associate editors: George F. Kunz, president, New York Mineralogical Club; Herbert P. Whitlock, American Museum of Natural History; Alexander H. Phillips, Princeton University; Waldemar T. Schaller, U. S. Geological Survey; Edward H. Kraus, University of Michigan; Austin F. Rogers, Leland Stanford Junior University; Thomas L. Walker, University of Toronto, Canada; and Samuel G. Gordon, Academy of Natural Sciences, Philadelphia.

Electric Furnace Co., Alliance Ohio, has just closed a contract with the Braeburn Steel Co., Braeburn, Penn., for a large continuous recuperative annealing furnace, for annealing alloy-steel bars and wire. This furnace will have a capacity for annealing 75 tons per day, and an electrical capacity of 600 kw. One of the special features is that the material is heated and cooled slowly, and, because it is a special alloy steel, must be soaked for considerable time at maximum temperature without scaling and without use of the usual annealing box covers. Another feature is that provision is made for cooling at a very slow rate for the first 200 to 300° from the maximum temperature. This type of furnace is meeting with favor among steel mills, on account of its many advantages over the old practice where hoods are required, and where it is difficult to get uniform annealing.

Trade Catalogs

Incandescent Headlights. Electric Service Supplies Co., Philadelphia, Penn. Sheet 96 H-6, Feb. 10, 1918; 9 x 9; illustrated. Describes mine type MLC-96 Golden Glow incandescent headlights and price lists of equipments.

Steam Mine Hoists. Lidgerwood Manufacturing Co., 96 Liberty St., New York. Bull. No. 19; 9 x 12, pp. 32; illustrated. Descriptive of steam mine hoists, electric mine hoists, steam and electric hoists for all purposes, cableways and cableway elevators for open-pit mining and stripping.

Gears. Philadelphia Gear Works, 1120-1128 Vine St., Philadelphia, Penn. Catalog, 1919; pp. 84; 5½ x 8½; illustrated. Describes fully generated spur, bevel, and spiral gears, rawhide and micarta pinions, worms and worm gears, racks, lead screws, sprockets, and "Diamond" chains. Copy free on request.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Furnace, Metallurgical. Bruno Zobel, Philadelphia, Penn. (U. S. No. 1,285,883; Nov. 26, 1918.)

Gold Concentrator Comprising a Series of Screens, etc. Alfred R. Mackie, Lander, Wyo. (U. S. No. 1,286,185; Nov. 26, 1918.)

Hoisting Hook, Safety. Lewis P. Thestrup, Seattle, Wash. (U. S. No. 1,285,466; Nov. 19, 1918.)

Lead Bullion, Process of Treating. George P. Hulst, Hammond, Ind. (U. S. No. 1,285,714. Nov. 26, 1918.)

Lead, Method of Refining. Phillip Werner, Philadelphia, Penn., assignor of one-half to Russell Spicer, Willmar, Minn. (U. S. No. 1,285,511; Nov. 19, 1918.)

Magnesite—Process of Manufacturing Magnesium Carbonate. Bertrand B. Grunwald, Redwood City, Calif., assignor to National Magnesia Manufacturing Co. (U. S. No. 1,285,683; Nov. 26, 1918.)

Metal Nitrates, Preparation of. Walter O. Snelling, Long Island City, N. Y. (U. S. No. 1,285,824; Nov. 26, 1918.)

Ore Dressing—Machine for Separating Ores. John M. Stadel, Philadelphia, Penn., assignor of one-half to John Cunningham, one-eighth to Peter P. Conway, and one-eighth to Patrick P. Conway, Philadelphia, Penn. (U. S. No. 1,286,136; Nov. 26, 1918.)

Editorial Correspondence

NEW YORK—Jan. 18

The Unevida Gold Mining Co. has begun action in New York State Supreme Court against William C. Ralston, George H. Morrill, James L. Dowsey, William A. Slayback, Hamilton J. Combes, Adolph S. Lowenthal, Erastus S. Parson, Meyer Frank, C. E. George, the Unevida Gold Dredging Co. of Nevada, Comstock Lode Recovery Corporation, and others to recover leases, alleged to belong to plaintiff, but which have been transferred to Comstock Lode Recovery Corporation. Suit also calls for accounting. Temporary injunction granted preventing defendants from selling stock of Comstock Lode Recovery Corporation and also preventing defendants from disposing of leases pending settlement of action. According to papers in action, William C. Ralston and George H. Morrill were formerly directors of the Unevida Gold Mining Co. Ralston, aside from being director, was chief engineer, managing director, secretary, and member of executive committee of company. Complaint charges that defendants, two of whom were directors of Unevida Gold Mining Co., induced owners of leases, under which company operated, to cancel and transfer them to Comstock Lode Recovery Corporation, which, it is claimed, was formed by Ralston and associates to take over leases of these gold mining properties.

SAN FRANCISCO—Jan. 17

The Mining Division of the Industrial Accident Commission of California, according to the last annual report, considered the safety of 17,000 employees during the year. Special attention was given to advancing safety work among operators and miners by means of safety bulletins and letters. A first-aid instructor was added to the division, who trained 31 classes in first aid, which work was done at 20 places, from Shasta to Riverside counties. In all, 407 persons took the complete course and 300 part of it. Arrangements were made with the University of California extension division for a course in English for foreigners. The U. S. Bureau of Mines Car No. 1 visited 11 different mining sections, giving training to 86 employees in mine rescue and to 425 employees and citizens in first-aid work. The mining division inspected mines, mills, smelteries, gold dredges, quarries, and tunnels. Fatal injuries at quarries were reduced by the activity of the division. Safety rules for gold dredges as well as for quarries were prepared during the year. Merit rating of mines received the attention of the mining division. An electrically operated gold dredge has been added to the Safety Museum at 529 Market St., San Francisco. The museum now occupies about 3000 sq. ft. of floor space and contains hundreds of exhibits. H. M. Wolflin is chief mine inspector.

SPOKANE, WASH.—Jan. 16

Regulation of Mining Companies, while avoiding the features of "blue-sky" laws, is the object of a plan now being worked out by the Northwest Mining Association, which discussed the problem at a recent session in Spokane. A committee, appointed to draft a proposed law, recommended that companies be required to file with the Secretary of State and the auditor of the county in which the company is organized a verified statement giving the number of shares of stock in the treasury, the situation and description of the property, the nature of title held, the amount paid for the claims, and the terms and amounts of any deferred payments. If it issues a prospectus or literature concerning the property, copies shall be filed in the same way, with a statement of the development, if any, that has been done on the property. When these statements are filed with the Secretary of State he shall issue a permit authorizing the sale of stock. In addition, it is recommended that similar statements shall be filed the first of each year; also a statement of the amount of treasury stock sold, the amount obtained from sales, the commissions paid, the amount of development work done, and the equipment purchased. The committee will later submit the draft of a bill to be presented to the State Legislature

SALT LAKE CITY—Jan. 16

Two Power Companies in Southern Utah, the Beaver River Power Co. and the Southern Utah Power Co., have passed under control of the Telluride Power Co., recently organized under the laws of Delaware to take over the merged companies. The Telluride company is controlled by L. L. Nunn and the Telluride Association, which is extensively interested in power operations in Wyoming. The new company is capitalized at $1,000,000 and has authorized a bond issue for this amount. With nine generating stations on Beaver River in Beaver County and elsewhere, 250 miles of high-tension transmission lines and systems supplying electric service to towns in southern Utah, the Telluride company has holdings stated to represent about $2,000,000. The new company will supply power to mines in Beaver County and in the Marysvale section in Piute County.

The Question of Apex Rights between the Utah Consolidated and Utah Metal and Tunnel companies in Bingham has been settled by granting reciprocal rights and privileges, without monetary consideration. The Utah Consolidated is to receive the two limestone bed formations, east of a certain fault known as the Highland Boy and Yampa, for which the Utah Metal in return will have unlimited and perpetual right to follow any limestone-bed formations or ore fissures in the western part of its ground down into the Utah Consolidated, regardless of the question of apex. The Utah Metal may also mine a strip of ground, 2000 ft. long and averaging 300 ft. in width (approximately 14 acres in all), marking the southerly workings and boundary of the Utah Consolidated. The Utah Metal has developed a body of copper ore of shipping grade in this ground, and has the right to use the Utah Consolidated workings in developing territory in this section.

The Judge Mining and Smelting Co., or its subsidiary, the Snake Creek Mining and Tunnel Co., of Park City, has won a water suit against the Midway Irrigation Co. The hearing was in the Federal Court, in Salt Lake City, before Judge Tillman D. Johnson. This suit has been in progress for some time, and was first tried four years ago. The water rights were of great value, and the suit was of particular interest as being between mining and agricultural undertakings. The court held that the water from the Snake Creek tunnel was percolating water, and hence belonged to the land, and that it made no difference whether or not the farmer's water was decreased because the water from the tunnel, though coming from fissures cut by the tunnel, was fed into the fissures by percolation. The fissures themselves are not regular water channels, but act as reservoirs. This decision is of interest to all mining companies whose tunnels have developed water in localities where water is used for irrigation purposes. In this suit the irrigation company contended that the Snake Creek tunnel decreased its water supply, that the fissures were water channels, and that, even if they were not, the water would reach them by seepage. The percolating waters, however, as held by the court, belong to the land and to the Snake Creek Tunnel Company.

WALLACE, IDAHO—Jan. 16 . . .

Mines of the Coeur d'Alene District have continued in operation, with two exceptions, since the price of lead dropped. They have curtailed production, as far as possible, without disorganizing their forces, and no men have been laid off. If a man quits, no one is put on in his place. Sunday work has been discontinued, and it is probable that a five-day week may be adopted, this being more desirable than throwing a large number of men out of work altogether. The two exceptions are the Hercules and Tamarack & Custer, both controlled by the Days, the ores from which are treated by the Northport smeltery, also controlled by the same interests. The closing of the two mines just before Christmas threw about 700 men out of employment. The management announced that the shut-down would be for 10 days and possibly longer. Men who showed up at the end of this period were told that it might be several months before resumption. In the absence of any announcement by the Days regarding the affairs of their companies, the public is left to speculate why it was that the Day mines promptly quit and give no indication of early resumption, though other lead mines in the district are still running.

BUTTE, MONT.—Jan. 16

The Anaconda Copper Mining Co., the largest employer of labor in Montana, has announced that in respect to employment during the present period of curtailment, when many of the company mines are closed, it will give preference to men with families and to returned soldiers in the following order: First, married men and single men with dependents; second, demobilized soldiers and sailors who were in the employ of the company at the time of their induction into the Army or Navy; third, demobilized soldiers and sailors who were not employed by the company before such induction. Single men without dependents and who were not inducted into service must give up their jobs to those mentioned.

MORENCI, ARIZ.—Jan. 16

The Clifton-Morenci-Metcalf District is now undergoing curtailment of operations. The Shannon Copper Co., of Clifton, with mines at Metcalf, has closed down the whole property, and only "clean-up" work is going on. Over 300 men have been laid off in the mines alone, more than a third of whom have left the district to date. The Phelps Dodge Corporation, Morenci branch, has also begun curtailment. On Jan. 11, about 100 men were dropped from the payroll. The Ryerson mine the largest producer for Phelps Dodge in the Morenci district, will be practically closed down soon. As far as possible, the married men are being transferred to other mines instead of being discharged. The Arizona Copper Co., Ltd., has not as yet decreased operations, but it is expected that such action is imminent.

DENVER—Jan. 15

Colorado Metal Mining Association and the Colorado chapter of the American Mining Congress held their joint annual meeting at the Brown Palace Hotel, Denver, on Jan. 2, 3, and 4, 1919. The resolutions committee was appointed as follows: Harry W. Robinson, of Denver; George C. Manley, of Denver; A. E. Moynahan, of Alma; M. T. Chestnut, of Dolores; John A. Traylor, of Breckenridge; J. C. Roberts, of Golden; W. O. Reynolds, of Leadville; E. D. Payne, of Empire, and Kenneth McKenzie, of Colorado Springs. Following these appointments, directors were elected from the various metal-mining counties. New officers for the ensuing year were then chosen as follows: Robert S. Ellison, governor; J. F. Welborn and Samuel D. Nicholson, vice-governors; George E. Collins, treasurer; and M. B. Tomblin, secretary. The meeting was addressed by George M. Vallery, assistant director, U. S. Public Service Reserve, on "Advantages of Coöperation with the U. S. Employment Service." J. C. Bailey then spoke on "Colorado Freight Rates", and a lively discussion ensued led by George E. Collins. It appears that Colorado operators have protested repeatedly against unjust freight rates, particularly as applied to narrow-gage lines, without relief or even satisfactory notice on the part of Government officials. Rate rulings were applied to narrow-gage the same as to broad-gage lines, despite the fact that narrow-gage cars cannot be used on broad-gage tracks. Unjust demurrage charges have been made on narrow-gage lines without any possibility of benefit from such practice. George Quigley, manager of the State Insurance Fund, pointed out the relation between the state fund and the mining industry. W. B. Lewis, secretary of the Boulder County Metal Mining Association, described his organization, and illustrated how coöperation had resulted from regular meetings and discussions of the leaders of various industries in a mining community. W. M. Porter read a paper on "Modern Mine Promotion," wherein he made a plea for honest and businesslike promotion of worthy mining enterprises, and pointed out the ill effects of unrestricted wildcatting. During the evening session, Senator Siewers Fincher addressed the assembly on the subject of "State Legislation and the Mining Industry," and Arthur H. Bosworth spoke on the proposed " 'Blue Sky' Legislation." During the morning session of Jan. 3, James F. Callbreath, secretary of the American Mining Congress, delivered an address on "National Legislation and the American Mining Congress." In the afternoon, Bulkeley Wells, president of the congress, spoke on the gold situation. He read the resolutions passed by the American Gold Conference in August, 1918, as to the necessity for a Government bonus on gold. It was predicted that the committee of the Treasury Department would soon recommend that the bonus be offered. Senator-elect Lawrence C. Phipps pledged himself while in the Senate to consider the needs of the mining industry and work for an adequate tariff. He thought that tariff revision would solve many of the difficulties confronting the mining industry at this time. Governor-elect Oliver H. Shoup made a short address, in which he referred to general legislation in favor of the metal producers. Congressman-elect William N. Vaile spoke of the need of a protective tariff on tungsten and other rare metals. Nelson Franklin talked on "Relief for Producers of War Minerals," and pointed out the desirability of a protective tariff on these metals, referring to the so-called "chrome scandal." To those directly concerned the discussions on tariff were interesting, but others were inclined to reflect upon the law of "supply and demand" and the theory of "the greatest good to the greatest number," and to regard the advocators of tariff on war metals with that kind of sympathy that might be bestowed upon one who is crying for the moon. W. J. Candlish, speaking on Colorado war minerals, outlined the position of local producers. Among the more interesting resolutions introduced was that in which the association demanded immediate relief from the now useless Federal regulations and restrictions and petitioned Congress to remove the extraordinary powers temporarily conferred upon the Executive Department and to resume its legislative powers. The resolution pointed out that the war-time expedient of price fixing, administration of industrial matters by bureaus, and other species of Federal control should be speedily abandoned, that private initiative again may be the order of the day. It was demanded that the flat increase of 25% in freight rates and onerous demurrage and loading regulations established by the Director General of Railroads be abrogated. A guarantee was demanded that full prospecting and mining privileges be assured in the bill creating a national park of the Mount Evans region. Senate Bill 5234, to reimburse and settle losses incurred and investments made for supplying war minerals, was commended. It was also recommended that the Colorado Legislature appropriate $40,000 for completing a state survey, and for publication of reports by the State Geologist. Liberal state and national appropriations were asked for to investigate the possibilities of oil shale. The administration of the state compensation fund was commended. A law was asked for creating the Colorado Metal Mining Survey, to be formed of the directors of the Colorado Metal Mining Association, and supported by a state tax levy of one-twentieth of 1%, on the output of all metal mines in the state. It was suggested that an ore-sales committee be formed to investigate grievances reported by ore sellers against ore buyers.

HOUGHTON, MICH.—Jan. 18

The Calumet & Hecla-Isle Royale Injunction has been dissolved by the U. S. District Court of Sault Ste Marie on the announcement of the plaintiff, Godfrey M. Hyams, that he had severed connection with the Isle Royale. This marks the culmination of a legal contest between the Calumet & Hecla and the Bigelow interests which had its inception more than 10 years ago over the purchase of control of the Osceola Consolidated Mining Co. by Calumet & Hecla. By dissolution of the injunction, Calumet & Hecla will again have full control of the Isle Royale, and directors of the former are assured a place on the Isle Royale board at the next annual meeting.

Curtailment of Copper Production was recently decided on by Calumet & Hecla. Stocks of metal are accumulating on the lake docks. However, such a condition exists in normal times, and with a falling off in demand there is no occasion to ship by freight, as was the case during the last three or four winters. In the meantime, the mines are hiring a few men and building their forces up to normal. Attention will now be devoted to neglected development work, and openings that have been abandoned for three years or more will again be the center of important operations. Hardly a mine in the district did any sinking while there was such a big demand for the metal. Some of the mines speeded up to such an extent that they have reached the boundaries, and it is now necessary to make new openings. One of these mines is the Champion, of the Copper Range group, in which sinking has been under way for nearly a month. Baltic also is sinking again, after a lapse of three years, and the same holds true in some of Quincy's shafts. The Calumet & Hecla already has begun to sink at the old mine, and the subsidiaries likewise are directing attention to lower levels.

BATESVILLE, ARK.—Jan. 17

Statistics of Zinc Ore Produced in 1918 in the north Arkansas field have been completed by J. H. Hand, special agent of the Department of Mines. A total of 4,000,000 lb. was produced and sold, against 50,000,000 lb. in 1917. Practically all was calamine ore. Few mines were active in the field during 1918, and none of the big producers of former years, the operators being content to sit tight until either a better market materialized or overhead expenses went down. There is a general disposition, however, to start operations this year if conditions warrant, and some of the larger properties are making ready.

The Batesville Manganese Field is exhibiting little activity. Operators hope for a price of ore after the reconstruction period is over which will allow profitable operation. Ore can be produced in the district at a much lower figure than that set by the Government and which was paid in 1918. A limited tonnage was mined at different times before the war in competition with foreign ores. Owing to the fact that washing plants have been built and other machinery installed which will cut pre-war costs, it is thought that, when a market is established again, many properties will be able to produce. Walter Denison and associates have a 2000-ton contract at present and are producing ore to fill it. They cannot ship on the contract, however, until April 1.

JOPLIN, MO.—Jan. 19

Organization of Local Chapters of the American Mining Congress and the American Zinc Institute will be considered at a meeting of those interested to be held in Joplin Jan. 28 to 30. The movement is an outgrowth of the High-Grade Ore Producers' Association, which has virtually been put out of business, with money in its treasury, by the ending of the war. It is understood that funds of this organization will be used in putting the proposed chapters on their feet. The meeting has been called by a committee from the High Grade association, headed by Victor Rakowsky.

The Edwards Mining Co. has purchased the McBride mine and mill near Joplin, also the Joe-Bob and two other newer properties, and expects to mill the combined output at the McBride concentrator. It is one of the developments that has marked a seeming turn toward the older camps of the district from the Oklahoma field. At one of the Joplin soft-ground mines, now being operated steadily, the concentrates are put in the bins for less than $30 a ton, which is not possible in the Oklahoma field at any property with a recovery less than 20% (in local parlance), and there are few as rich as that.

VICTORIA, B. C.—Jan. 17

The Committee Named to Investigate Smelting Rates charged mine operators of British Columbia by the Consolidated Mining and Smelting Co. of Canada consists of S. S. Fowler, Riondel, B. C.; Ivan de Lashmutt, Silverton, B. C.; and James Anderson, Kaslo, B. C. The British Columbia government will be represented by A. G. Langley, resident engineer with headquarters at Revelstoke, B. C. The first session of this committee was announced for Jan. 21 at Nelson, British Columbia.

The Imperial Munitions Board has arranged for exporting the large quantity of lead on hand, recently said to be "hanging over the Canadian market," with the idea of relieving the market from embarrassment. F. A. Starkey, of the Associated Boards of Trade of Eastern British Columbia, expresses himself as highly gratified with the latter development, saying: "The sum and substance of the whole thing is that we will now have a clean sheet to start off with. The action of the board is timely. On Dec. 9, while in Spokane, I sent a wire to the board, pointing out that the dumping of the lead bought for munitions on the commercial market at this time would mean a glutting of the market, and that would be disastrous to the lead-mining districts. But the difficulty is now settled." Mr. Starkey's wire to Sir Thomas White, acting Premier, read: "During war, shippers did not have benefit of Canadian duty, but sold Imperial Munitions Board at practically United States prices. Now that the war is over, shippers expect that Canada will not be made a dumping ground for Mexican and United States surplus and scrap metal." Whether the action taken by the board with reference to the stock referred to will have the effect which Mr. Starkey looks for is doubted by some, who point out that Canada's biggest market is not local and that the placing of munition lead elsewhere will have the result of reducing the demand for the Canadian production at least for a time, and that, at the best, the prospect is that there are a few dull months to meet.

TORONTO—Jan. 17

Newman Erb, president of the Canada Copper Corporation, of British Columbia, at present visiting eastern Canada, states that the work of the company is being rapidly pushed on the Copper Mountain property, on which it is expending about $2,500,000. Approximately 12,000,000 tons of ore is blocked out carrying about 1½% copper. The company will be ready by July to carry out its contracts with several companies as follows: With the Canadian Pacific Ry. for extension of its branch 13 miles to the mine; with the West Kootenay Power and Light Co. for power; and with the Consolidated Mining and Smelting Co. for the treatment of ores.

Land Grants by the Canadian Government of large areas in the West to a private corporation for the exploitation of oil and minerals have been widely rumored. These rumors are unfounded so far as any definite action is concerned, but it has transpired that a proposition of this sort has been before the government for some time. The Shell Transport and Trading Co., of London, England, capitalized at $50,000,000, the head of which is Sir Marcus Samuels, has asked for exclusive rights to survey and exploit for oil all the country lying north of the Athabasca River, in Alberta, for five years, existing holdings excepted. The proposal was made to Premier Sir Robert Borden and his colleagues on the occasion of their last visit to England, and is understood to have the backing of the British government, on the ground that it is in the interests of the empire that a British company should develop the oil resources of Canada. The whole question was discussed by representatives of the Shell company and the Canadian and Imperial governments last year.

The Canadian Advisory Council for Scientific and Industrial Research is negotiating with the governing bodies of Toronto and McGill universities with a view of increasing the supply of trained research workers and technologists. It is urging that prompt measures be taken for extending university facilities for training and laboratory work. A recent inventory of the men available in Canada adequately equipped for grappling with problems of research work showed that the supply is hardly equal to five per cent. of the demands that Canadian industry must make, if it is to keep pace with what the United States, Great Britain, and other trade competitors are doing. There are fewer than 300 men, including those in government and university positions, to whom the research council or big industrial firms can turn for assistance in solving scientific problems bearing on industrial development. Chemists, physicists, metallurgists, electrical and chemical engineers are needed, and at present only Toronto and McGill universities have suitable graduate courses. The council has already provided for 20 studentships and fellowships to be awarded annually to science graduates in connection with some specified research, but so far the number of men available for such studentships and fellowships has limited the awards to less than half the total number provided for.

ARICA, CHILE—Nov. 17

The Smeltery in Arica, Chile, was blown in early in 1918, and produced around 70 tons of pig tin of 98.8%. There was some trouble with the furnaces afterward and through this reason and lack of capital the plant was shut down after a few feeks' operation. Since then the capital has been increased from $250,000 to $1,000,000 and operations were again started a few months ago, but it is not known with what results. The plant uses reverberatory furnaces fired with fuel oil.

The Mining News

ALASKA

DECEMBER SHIPMENTS of domestic copper ore, matte, etc., from Alaska to United States were 24,872 gross tons. The copper content was 16,407,461 lb., valued at $4,263,992.

ARIZONA

Pima County

GUNSIGHT GOLD AND TUNGSTEN (Ajo)—Five-stamp mill and concentrator, with laboratory, installed two months ago to test district. Since then mill has run steadily making test runs on 20- to 50-ton lots of gold and scheelite ores from Black Bess, Bullion Bar, and Yellow Aster mines; also silver-lead ores from old Gunsight mine. All tests satisfactory. Will install during January ball mill of at least 40 tons' capacity. Mines of district, known as Scheelite district, well developed, and ample tonnage of good milling ore in sight. Test runs have yielded $2000 worth of amalgam and 500 lb. tungsten concentrates.

RAY BROKEN HILLS (Ray)—New tunnel advanced about 300 ft. Messrs. Erskine and Stanton, of New York, recently visited property.

LAVELLE GOLD (Winkleman)—Will deepen main shaft from 250 to 350 ft. Construction work on mill delayed two weeks by snow.

Yavapai County

KAY COPPER (Canyon)—Shaft down 600 ft. Will start crosscut at 650 level. Work begun at North shaft about 2000 ft. from main shaft. Similar orebody hoped for at new shaft.

CONGRESS (Congress Junction)—Congress, Alvarado, and Rincon mills, with all mining equipment and six-mile standard-gage railway, sold to Rosenburg & Co., of Los Angeles, who will dismantle property and sell equipment.

ARIZONA COPPER BELT (Constellation)—A 6000-ft. pipe line completed for camp's water supply. Fairbanks-Morse oil engine, compressor, and drills installed. Machine shop enlarged, and new bunk house and mess hall built. Development work continued in 300 level crosscut, which recently cut 20-ft. vein 350 ft. from shaft.

UNITED ARIZONA (Cordes) — Shaft down 835 ft. with 400 ft. to go. Crosscuts at 42 and 150 ft. disclosed 20 ft. of vein. Mill planned. Officers are C. H. Dunlap, president; R. C. Baker, treasurer, and C. W. Stott, secretary, all of Phoenix. C. J. Bendewald manager.

UNITED VERDE (Jerome)—Will decrease metal output 20%. Has dropped 130 single men and shut down one blast furnace at Clarkdale.

UNITED VERDE EXTENSION (Jerome)—Cutting production by sending 15% ore to Verde smeltery, drop of about 5%. Small cut made in mine force.

COPPER QUEEN GOLD (Mayer)—At coming annual meeting company expects to provide for 250-ton flotation plant. Property adjoins Arizona-Binghamton.

ARKANSAS

Baxter County

BALD DAVE (Mountain Home)—Prospect work with small force begun on property north of Mountain Home by Long Shot Mining Co. Outcrops carry carbonates of zinc and lead.

Independence County

BALL (Batesville)—Washing plant at Ball manganese mine, construction of which was begun several weeks ago, will be completed.

Marion County

EDITH (Rush)—Operation recently begun. Now producing. First ore being hauled to Yellville, shipping point. Influenza in camp caused labor shortage.

MATTIE MAY (Rush)—Full force at work. New concentrator nearing completion. Headings in good bodies of zinc carbonate.

NORTH STAR (Yellville)—Operations temporarily suspended on account of death of C. P. Pierce, of Kansas City, a large stockholder.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Mill tailings being retreated by Darrow concentration method. Sixty-stamp mill running at capacity.

CENTRAL EUREKA (Sutter Creek)—Development at 3500 level encouraging. Ore reserves expanded. Labor available for increased operation.

OLD EUREKA (Sutter Creek)—Expect to reach 3150-ft. depth in deepening shaft about middle of February. Shaft has three-compartments. Extensive development at depth will follow.

Butte County

DENVER (Forbestown) — Property changed hands. Unwatering and development to start immediately.

Nevada County

BENTON G. (Nevada City)—Cleaning out old tunnel to resume development after several years' idleness.

Placer County

FOUR CHROME MINES operating near Newcastle closed down and 300 men out of employment on account of short demand for chromite. Companies are Holmes, Steel Chrome, Noble Steel, and Placer Chrome.

San Bernardino County

NEVADA MINE LEASING AND HOLDING (Cima) — Has acquired Piute and Blackfoot silver-lead mines. Rights to property forfeited by former owners, and new operators resuming operation free from financial embarrassment. Development consists of shaft with 2000 ft. of workings. J. R. Comerford in charge.

COLORADO

Boulder County

BELCHER (Caribou)—High-grade silver ore opened, and two shipments made. E. E. Dunston manager.

CARIBOU (Caribou)—McKenzie Bros. & Co., lessees, developing. Crosscuts driven into hanging wall on 600, 680, and 740 levels, and parallel vein opened with high silver contents. Drifting on new vein. Development also in progress on 300 level, where crosscut is being driven into hanging wall.

COLORADO PITCHBLEND (Jamestown)—Properties examined by committee composed of J. W. McClave, M. S. McCarthy, G. L. Sheldon and O. E. Fisher. Report available in near future. J. F. Barnhill is manager.

SMUGGLER (Lyons)—Sinking of main shaft resumed. Crosscut driven to open parallel veins west of main vein. New compressor and machine drills installed. Mine buildings repaired. New development planned.

Clear Creek County

CLEAR CREEK & GILPIN ORE (Idaho Springs)—Community sampler now in operation. New machinery and automatic sampling device installed. W. E. Pasmore is manager and Ralph Chase assayer.

San Juan County

LACKAWANNA (Silverton)—Raise completed between tunnels No. 1 and No. 2. On second level orebody, 8 ft. wide and running well in lead, opened on Lackawanna vein. George W. Harris is president and H. R. Dealy secretary and general manager.

San Miguel County

STANDARD CHEMICAL (Nucla)—Reduction plant shut down to remain closed until about Mar. 1. Will retain small force on development. During 1918 company mined 7000 tons of radium-bearing ore. Reason stated for shut-down, is that company's Pittsburgh works have five-months' ore supply on hand; also said there is water shortage in San Miguel River.

Summit County

BROOKS-SNYDER (Breckenridge)—Lessees shipping from narrow, flat vein of high-grade silver ore.

WELLINGTON (Breckenridge)—During 1918, produced 39,295 tons milling-grade ore; 947 tons crude ore, assaying 45.7% zinc, was also shipped. Development work for year consisted of 2365 ft. drifts and 975 ft. raises. New development planned includes opening of Siam and other veins from Oro shaft.

FRENCH LEASING (Montezuma)—Reopening old Philadelphia mine.

LIBERTY M. AND R. (Montezuma)—Developing Pennsylvania mine. Production will be made when snow permits next spring.

Teller County

CRIPPLE CREEK OUTPUT for December was $826,021, increase of $131,057 over November. During month, 87,160 tons of ore was shipped as follows: To Golden Cycle at Colorado Springs, 30,000 tons, having average value of $20; to smelteries at Denver and Pueblo, 2000 tons, average value $55; to Independence mill, 36,200 tons, average value $2.04; to Vindicator Consolidated District mill, 17,960 tons, average value $2.17; and 1000 tons to Big Toad mill, average value $2.20 a ton.

AMERICAN BEAUTY (Cripple Creek)—Leased for two years by Charles E. Schermer, who has option to purchase.

OSTON LEASING (Cripple Creek)—Equipment being installed at Keener tunnel dump, latter to be shipped to Golden Cycle mill at Colorado Springs for treatment. Estimated dump will average $4 a ton.

IDAHO

Boundary County

IDAHO - CONTINENTAL (Porthill) — Recently shipping 25 tons concentrates weekly. Completion of tramway across Kootenay River will permit much larger shipments. About 250 men employed. Property 26 miles from transportation. Grading for narrow-gage road completed.

Shoshone County

NATIONAL COPPER (Mullan)—One unit, or half, of National mill now running full time and handling 300 tons of ore daily. Good ore encountered in crosscut from winze from 1500 level; also new shoot of better ore found on 800 level.

ANCHOR (Murray)—Contract let to drive lower crosscut 700 ft. to intersect vein 200 ft. below present tunnel. Shoot of lead-silver ore 200 ft. long in upper tunnel, much of it shipping grade. Compressor driven by electric power recently installed. Financed by the Days.

MICHIGAN

Copper District

MOHAWK-WOLVERINE SAND SHAFT at Gay mills, to be used in connection with new water supply, sunk 125 ft. Tunnel under Lake Superior advanced about 100 ; will be 2000 ft. long.

CALUMET & HECLA (Calumet)—Copper production in December was 10,539,706 lb. Producers were: Ahmeek, 1,761,823 lb.; Allouez, 543,988; Calumet & Hecla, 5,533,690; Centennial, 195,021; Isle Royale, 1,601,244; La Salle, 130,670; Osceola, 253,254; Superior, 109,875; and White Pine, 410,141 pounds.

SENECA (Calumet)—Shaft in Kearsarge lode 24 ft. Sinking slowed down on cutting lode by difficulty of removing water with temporary bailers being used. Water thought to be coming from No. 1 Mohawk, as latter shaft has become dry. Sinking now in turned section of shaft, and will be in lode for nearly 100 ft., as angle of shaft is a little steeper than angle of lode, which at this point is 36 degrees.

HANCOCK (Hancock)—Influenza offset increase in working force. Operating only No. 2 shaft.

MINNESOTA

Cuyuna Range

MERRIMAC MINING (Crosby)—This John A. Savage company has taken option for lease on 180 acres near Croft mine, namely, the N½ of SW¼, the S½ of NW¼, and the N½ of SW¼ of SW¼ of Section 1-46-29. Fee owners are A. M. Chisholm and

John G. Williams, of Duluth, and B. McGoffin, of Deerwood, Minn. Tract said to contain large body of iron ore.

ROWE (Riverton)—Deal closed whereby operation of this property, belonging to Pittsburgh Steel and Ore Co., will be taken over by Pickands, Mather & Company.

CLARK (Trommald)—Drop shaft sunk successfully to ledge.

MISSOURI

Joplin District

WARING & WILLIAMS LABORATORIES have purchased E. W. Buskirk's assay laboratories at Joplin, Mo., and Tar River, Okla.; also those of O. K. Engineers Co. at Baxter Springs, Kan., and Picher, Oklahoma.

MONTANA

Silver Bow County

BOSTON & MONTANA DEVELOPMENT (Butte)—W. R. Allen, president, announced sale of $400,000 bond issue on Jan. 17. Railroad will be in operation within few months; rails being laid, work having started Jan. 9. Material ordered for mill.

TUOLUMNE COPPER (Butte)—Development progressing on 800 level of Butte Main Range. Ore shipments appreciating in grade. Preparations completed for deepening shaft.

NEVADA

Esmeralda County

GREAT BEND (Goldfield)—Shipping smelting-grade ore regularly, chiefly from 160 level. Lateral development extended 1100 ft., blocking out milling-grade ore in addition to shipping-grade. Company will remodel mill when tonnage is sufficient.

Humboldt County

NEVADA PACKARD (Rochester)—Judgment given in company's favor in suit against William Keyworth to regain title to valuable real property.

Lander County

COPPER CANYON (Battle Mountain)—Operations stopped until price of copper settled. Many lessees in district have also stopped. Considerable milling-grade ore developed in district.

NICKLAS (Battle Mountain)—Test plant 30 tons' daily capacity completed; if tests are successful, will be used as nucleus of larger plant. Ore mixed sulphides, containing gold, silver, lead, and zinc. Good tonnage developed. Property at Galena, 20 miles southwest. H B. Menardi in charge of milling experiments.

Lincoln County

PIOCHE DISTRICT ore shipments for week ended Jan. 14 were: Prince Consolidated, 42 cars, and Virginia-Louise, 9 cars.

COMBINED METALS (Pioche)—Operations temporarily reduced, owing to influenza.

PIOCHE MINES (Pioche)—Concentrating and cyanide mill completed, but operation deferred because of shortage of water.

VIRGINIA-LOUISE (Pioche) — High-grade silver-lead ore struck on fourth level. Preparing to raise headframe and enlarge ore bins.

Lyon County

MASON VALLEY MINES (Thompson)—December production of copper was 1,273,176 pounds.

Mineral County

CANDELARIA (Candelaria)—Lucky Hill shipments in second half of December were 203 tons of silver ore, running over 40 oz. Operations begun August, 1918. Will increase January shipments from Argentum and Mount Diablo properties.

WALL STREET COPPER (Luning)—Suspended operations last month, preliminary smelter settlement being insufficient to warrant running under present cost of transportation and treatment. Final settlement doubtful, depending on the future market.

NEVADA RAND (Rand)—William V Rudderow general manager, states preparations are being made at property, 17 miles northeast of Walker Lake, for resuming shipments of high-grade silver-gold ore and for further prospecting orebodies. Mine opened to 150 level, and large tonnage of good milling ore developed. William H. Bray, superintendent

Nye County

MONITOR BELMONT (Belmont)—Nevada Wonder reopening and retimbering old workings on 200 level Unwatering through Belmont and Highbridge shafts continuing. Expected that 300 level will soon be reached where most early work was done

CONSOLIDATED MAYFLOWER (Pioneer)—Surface mine plant consists of 90-hp. distillate engine, and 15-drill air compressor. New Denver Rock Drill "Turbo" drills installed throughout mine for drifting. Milling plant to be remodeled and enlarged; plans not yet complete.

CASH BOY (Tonopah)—Crosscut from 1550-ft. point in winze has reached foot wall of vein, exposing considerable mineral.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—Morris Brooks mine and Kimberly mill shut down owing to market conditions. Company has large stock of copper on hand. Alpha mine, producing direct-smelting ore, will keep running, producing 700,000 lb. copper monthly. Development program of Alpha to continue, and work on lower levels pushed. Largest continuous orebody opened on 1200 level for length of 350 ft., averaging better than 8% copper; 1300-level crosscut has cut 12% copper ore.

OKLAHOMA

Joplin District

ANNA BEAVER (Tar River)—Address changed as follows on Jan. 1: Mail and express, Tar River, Okla.; freight, Anna Beaver Switch, Tar River, Okla.; telegrams, Picher, Oklahoma.

UTAH

Juab County

CHIEF CONSOLIDATED (Eureka)—Shipping 750 to 1000 tons of ore weekly.

COPPER LEAF (Eureka)—Drifting begun on 1000 level for ore streak continuing from 900. Property about one mile north of Tintic Standard working shaft.

IRON KING (Euréka)—Shaft down 1300 ft. Increasing temperature in bottom regarded as favorable sign. Property near Tintic Standard, where ore opened at depth in connection with warm gases and vapors.

TINTIC DRAIN TUNNEL (Eureka)—In 1800 ft. in harder ground than heretofore. Better progress expected in future.

TINTIC STANDARD (Eureka)—Shipping at rate of 2500 to 3500 tons monthly, most of ore coming from five stopes on 1250 level. Drift from new station on 1350 level continuing in ore to north and east. Shaft down 1475 ft., where station will be cut later. Ore at this property three kinds, dry silver, silver-copper, and silver-lead; some of it very rich.

Salt Lake County

COLUMBUS REXALL (Alta) — First dividend of $14,659 paid Jan 14, after being held up two weeks by temporary restraining order granted Monetaire Mining Co. in litigation with Columbus. Has 500 tons of ore ready for market.

WASHINGTON

Ferry County

QUILP GOLD (Republic) — Resumed after several years' idleness. First car of ore shipped from upper workings. Will work lower levels when unwatered.

Okanogan County

GOLD-SILVER-COPPER DISCOVERY near Nespelem reported by A. A. Kimball, timber cruiser.

Stevens County

UNITED COPPER (Chewelah)—Wages cut as follows: Miners, skip tenders, timber men and hoist men, from $5 a day to $4.25; muckers and motormen, from $4.50 to $3.75; blacksmiths, from $5.50 to $4.75; blacksmith helpers, from $4.50 to $3.75; and mill men and carpenters, from $4.50 to $4 Conrad Wolfle, president, states company worked in 1918 for its men and Government, but will operate this year for benefit of stockholders; only five men left out of 75 employed

CANADA

British Columbia

CAMP WELCOME CLAIM NO. 1 staked on Columbia River opposite Trail, B. C., by "Sandy" McDonald, an old Caribou placer miner.

CONSOLIDATED M. AND S. OF CANADA directors have decided to extend power development of West Kootenay Power and Light Co. and to increase Trail copper refinery's capacity from 20 tons to 50 tons per day. Capital expenditures for these purposes to total $1,150,000. At Princeton, preparing to accommodate about 150 men preliminary to developing recently acquired Voight claims on Copper Mountain

INDEPENDENCE AND IMPERIAL CLAIMS on Proserpine Mountain south of Parkerville, B. C., in Caribou district, undergoing development. Apparently two large main veins about 300 ft. apart; continuity proved for about 8000 ft. Outlook said to be promising.

BOWENA COPPER (Bowen Island, Howe Sound)—T. A. Walsh & Co., Vancouver, B. C., erecting 100-ton concentrator.

LANARK (Illecillewaet)—New strike of galena reported in No. 2 tunnel. Several good orebodies blocked out last few months. W. B. Dornberg, president and manager.

SILVER STANDARD (New Hazelton)—Temporarily shut down; 100 tons zinc concentrates and 72 tons lead concentrates on hand; mine in good condition; mill operation has been satisfactory. Shut down because change in freight rates has delayed smelter settlement, not a dollar having been received on shipments made to United States. Has been shipping high-grade lead concentrates to Trail smeltery and silver-zinc concentrates to U. S. Zinc Co., Sand Springs, Oklahoma.

CASSIAR CROWN COPPER (Omineca Division)—Short tunnel run on Ruby claim last summer opened 14 ft. vein with 10 ft. clean ore. I. W. Anderson, Tacoma, Wash., president.

MOUNTAIN CHIEF (Renata)—Gold-silver property bonded to J. W. Evans, of Revelstoke, who plans to build aërial tramway from mine to Arrow Lake. Present output 200 tons ore monthly.

METEOR (Slocan City) — Silver-gold property bonded to J. C. and W. A. Buchanan. Latter will manage mine. Will install compressor. Property recently shipped 22 tons high grade to Trail smeltery.

Manitoba

LULEO (Rice Lake)—Main shaft down 60 ft. Ten-stamp battery and other machinery received, with another 10-stamp battery on the way. Total cost of equipment, including electrical installation, to be about $80,000. Force numbers 29.

Ontario

CULLEN-RENAUD (Boston Creek)—Shaft down 50 ft. on continuation of vein coming from Miller Independence.

KERR LAKE (Cobalt)—December production was 102,289 oz. of silver, against 169,481 oz. in November.

NIPISSING (Cobalt)—New slope 125 ft in length being started on vein at fourth level near 98 shaft.

KIRKLAND PORPHYRY (Kirkland Lake)—Drift at 400 level opened about 100 ft. showing good-grade ore with free gold in places.

DOME MINES (Porcupine) — General manager C. D. Keading states in report present conditions do not warrant planning immediate resumption of milling. Recommends diamond-drilling campaign be continued, together with drifting west and south on eighth level. About 800,000 tons of ore below present crusher station. Estimated ore reserves 1,950,000 tons.

PLENAURUM (Porcupine) — McIntyre option on this property extended for 12 months.

LAKE SUPERIOR CORP. (Sault Ste Marie)—Output during last six months of 1918 was: iron ore, 100,213 tons; coke, 222,428 tons; pig iron, 207,552 tons; and steel ingots, 264,905 tons.

MEXICO

Sonora

CÃNANEA CONSOLIDATED COPPER (La Cananea)—Working on low-grade treatment problems, but has no plans for further extension at present. Development plans being carried on in same way as during 1918. Company does not purpose to double its operating force, in spite of newspaper reports to the contrary

PERU

Junin

CERRO DE PASCO (Morococha)—Morococha workmen struck Jan 13 and rioted before presenting demands. On Jan. 15 power lines dynamited Mines flooded to Carlos Renaldo tunnel level. Part of Central Railway system tied up Morococha Prefect powerless to control situation, and upon his advice Americans abandoned camp, turning same over in custody of authorities This refers to Morococha only All quiet at Cerro de Pasco and at smeltery Peruvian cabinet has agreed to eight-hour law throughout country.

BELGIAN CONGO

UNION MINIERE DE HAUT KATANGA (Elisabethville)—December production of copper was 2,513,241 pounds.

The Market Report

SILVER AND STERLING EXCHANGE

Jan.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Jan.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
16	4.7575	101⅛	48$\frac{7}{16}$	20	4 7580	101⅛	48$\frac{7}{16}$
17	4 7580	101⅛	48$\frac{7}{16}$	21	4 7580	101⅛	48$\frac{7}{16}$
18	4.7580	101⅛	48$\frac{7}{16}$	22	4 7580	101⅛	48$\frac{7}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Copper Electrolytic	Tin Spot.†	Lead N. Y.	Lead St. L.	Zinc St. L.
16	*	67¾	5 35 @5 40	5 35 @5.40	6¾ @7
17	*	67¾	5.30 @5.35	5.20 @5 30	6¾ @6⅞
18	*	67½	5.30 @5 35	5 20 @5 30	6¾ @6⅞
20	*	67¼	5.35 @5.40	5 15 @5 20	6.75 @6.80
21	*	67¼	5 35 @5.40	5.15 @5.20	6.70 @6.75
22	*	67	5.30 @5.35	5.15 @5.20	6.70 @6.75

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

* Undetermined.

† For American tin of 99% grade.

LONDON

Jan.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
16	90	80	105	250½	245½	40	32½	56
17	92	83	105	250	245½	35	30	56
18	...	...	.	...	...	....	...	..
20	93	83	105	251	247	35	30	56
21	91	84	105	250	245	35	30	56
22	91	84	105	247¼	244	35	30	56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Jan. 22, 1919

There was very little business done in any of the markets this week, but such as there was reflected further weakness. Lead is distinctly in the best position of all of the major metals, the lead producers having looked things squarely in the face and having displayed good judgment in their handling of difficult problems.

The British Minister of Munitions gave notice of the following stocks in his possession in Great Britain on Jan. 1, 1919: Copper, 36,000 long tons; spelter, gob, 22,273; spelter, refined, 8017; aluminum, 11,957; soft pig lead, 62,852; nickel, 2096; and antimony, 3508 tons."

According to our own advices, the stock of spelter in France amounts to 45,000 short tons. The French government is refusing all licenses to import metals until the stock in the hands of the government is exhausted.

Copper—The large producers did no business this week. Indeed, we have had no reports of any transactions by producers large or small. The air has been full of vague rumors respecting what consumers would pay or terms that had been offered to them, but these rumors reflect wide variations. There is no doubt that copper has been offered during the week by small producers at 19c., but how much could be obtained at that figure or how much could be placed are both uncertain.

There can be no real market in copper until some one of the large producers, who has plenty of copper to sell, undertakes to make a market. In its initial stages such a market would naturally be convulsive and would, no doubt, go lower temporarily than the economic level. The idea that there would be no substantial buying at any price, under present conditions, is fallacious. Delay has already produced a bad situation, and every day's further delay makes things worse. The markets are going to be righted only by letting nature take its course. There might be a temporary palliative if some large buyer should come in.

When copper buying begins, as it will some day, it is likely to occur first in a demand for wire-bars. The greatest part of the present stocks of refined copper everywhere is in ingots and ingot bars. Conversion of these into other forms would be costly.

Copper Sheets—The base price of copper sheets is 29c. per lb. Copper wire is quoted at 22½@23c. per lb. f.o.b. mill, carload lots. Unchanged.

Tin—Scarcely any business was done. The stock in the hands of the Steel Products Co. hangs over the market like a pall. Efforts are being made to persuade, or compel, consumers to take it over, but many consumers are already provided with their own stocks for a long time to come. There is no business in imported tin, for restrictions of one kind or another still prevent it. The market in American tin shows a little more weakness.

Lead—On the secondary decline a little more business has been done, the sales reported to us this week amounting to about 1500 tons, besides the business ordinarily done on average-price contracts and some arrangements for new business on the same basis. The major part of the business done this week was with consumers, showing that, although some of the latter are well stocked ahead, there are some who need supplies or are willing to anticipate future requirements. The market was more or less irregular, as any developing market at the present time is likely to be. The A. S. & R. Co. on Monday afternoon reduced its price to 5½c., New York, but that was only a step in following the market down. Since then small business has been done in St. Louis as low as 5.15 cents.

London reduced its quotation to £35 for spot on Jan. 17. Apparently, that was to meet the competition of some foreign lead that crept in, with the prospect that more would follow.

Zinc—The crumbling away in this market continued, on small business, from day to to day, and on Jan. 21 there were transactions at 6.72½c., with sellers over at that price. The situation in zinc is discussed at length elsewhere in this issue.

Zinc Sheets—Unchanged at $13 per 100 lb.

Other Metals

Aluminum—Ingot aluminum has been sold for 31c. during the last week.

Antimony—But very little business was done. A lot was sold at auction during the week at 7.05c. The markets everywhere are suffering from overproduction, and this market, along with the French and British markets, is overstocked. We quote spot at 7¼@7½c. Futures for February-March shipment from the Orient were offered at 7¼@7⅜ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.35 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50 per lb. in lots of 100 to 500 lb.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The market was weak at $105 for California virgin, while Mexican was quoted nominally at $100. San Francisco reported, by telegraph, $105.

Silver and Platinum

Silver—No shipments to London the past week, owing to lack of steamers, and the absence of any fresh items in regard to the movement of silver makes the market quiet but steady. The following extract from a letter of Pixley & Abell to their New York correspondent is of interest:

"It seems to us that for the present the position of India is the crux of the situation. Unable to secure gold, India has to balance her trade by imports of silver. With the poor harvests of this year, the position is not so acute as it would have been, and the future will depend largely upon the yield of her harvests. Still, with peace in sight, the volume of imports into India should grow, and so reduce the amount of silver required.

"When the control of the silver market is relaxed, silver should, in our opinion, rise above the present level. China and the Continent should be good buyers, while the demand for trade purposes all over the world, for medals, and for coinage in many countries which have been starved of silver of late should be good. If prices do rule high when the control is removed, the Indian government will probably find it necessary to again raise the exchange value of the rupee, and this, by tending to restrict exports and to stimulate imports, should in time ease the position by reducing the favorable trade balance."

Mexican dollars at New York: Jan. 16, 77½; Jan. 17, 77½; Jan. 18, 77½; Jan. 20, 77½; Jan. 21, 77½; Jan. 22, 77½.

Platinum—Refined ingot was in fair demand. We quote the market unchanged at $105.

Palladium—Unchanged at $125.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 18—Blende, per ton, high, $52.55; basis 60% zinc, premium, $50; Class B and Prime Western, $45@42.50; sludge and flotation, $40@37.50; calamine, basis 40% zinc, $35@30. Average selling prices: Blende, $43; calamine, $34.67; all zinc ores, $42.85.

Lead, high, $76.10; basis 80% lead, $75@60; average selling prices, all grades of lead, $60.72 per ton.

Shipments the week: Blende 11,917; calamine, 227; lead, 1691 tons. Value, all ores the week, $623,060.

Every mine that can afford to operate is working to full day capacity. This means that all the larger mines are producing heavily. Many good mines are idle, because they are not rich enough to continue with the present prices for zinc and lead ores.

Platteville, Wis., Jan. 18—Blende, basis 60% zinc, $50 per ton base for premium grades; $45 per ton for high-lead blende.

Lead ore, basis 80% lead, $56@60 per ton.

Shipments reported for the week were 1536 tons blende, 199 tons galena, and no sulphur ore. For the year to date, the totals are 3916 tons blende, 273 tons galena. During the week, 3535 tons of blende was shipped to separating plants.

Other Ores

Tungsten Ore—Conditions were unchanged. No business was reported.

Molybdenum Ore—Further business was done at 75@85c., but transactions came to a standstill owing to sellers raising their prices, while buyers were unwilling to go any higher.

Pyrites—Spanish pyrites is quoted at 16½c. on the basis of 10s. ocean freight. Restrictions have been removed, but importers must still obtain licenses. Ocean freight is now 25s. per long ton.

Iron Trade Review

PITTSBURGH—Jan. 21

The lapse of a week has not brought fresh market developments of importance, but has served to emphasize the prevailing dullness and bring out still more clearly the necessity of radical changes in fundamental conditions needed to produce a demand for steel at all commensurate with the existing productive capacity.

In finished-steel products there is an extreme dearth of new buying, orders being scattered and amounting usually to no more than a few hundred tons individually, and specifying against contracts involves only moderate tonnages. All the steel taken, either on fresh purchases or against old contracts, is for immediate use, and prompt shipment is insisted upon, the buyer showing strong unwillingness to take any chances against a market decline. Mills are continually asked to guarantee prices against decline to date of shipment. The mills would be relatively safe in doing this, on account of the short time involved, but they refuse, as a matter of principle, to give such a guarantee.

Steel mill outputs are averaging between 60% and 70% of capacity, the rate of production having declined continuously since late in December, and the rate at which new orders and specifications are being received is such as to promise still lighter operations in future, until there is a general change in the situation. A rate of production below 50% of capacity is likely.

The steel trade now realizes more clearly than ever before how dependent it is for its activity upon new construction work, of which there is practically none either in progress or definitely planned. The ordinary every-day activities of the people, even if pursued freely, are entirely insufficient to produce demand equal to one-half the productive capacity.

Prices of unfinished and finished steel products are being held firmly all along the line.

Pig Iron—Last Wednesday a meeting of merchant blast-furnace interests from all over the country was held in Pittsburgh. An effort was made to modify the schedule of price differentials between different descriptions of pig iron, as formulated for Government control, so that there might be a recognized standard, but the discussion developed so many differences of opinion that nothing could be done. There was only one dissenting voice to the opinion expressed that pig iron is marked for considerable declines eventually, though no one would venture a prediction as to when the next decline will occur. It was the general feeling, plainly expressed, that on account of high costs no furnace should pile iron, but should go out of blast in preference, and a number of furnaces are likely to go out. The market is altogether inactive, and shipments against contracts are slightly decreased. We quote: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—There is no interest in ordinary soft steel. Quotations are rigidly maintained: Billets, $43.50; sheet bars and small billets, $47; slabs, $46; rods, $57. Large rounds of shell steel in short lengths are being offered by the British government at $21. There is practically no demand for this steel for rolling purposes, as the sizes are inconvenient, and though the material is good for forging, the tonnage demand for that purpose is limited. On the other hand, it is too dear for scrap, as heavy melting steel can be bought at $20 or less. The Government is holding back a large tonnage of steel, awaiting a market with more absorbing power.

Ferromanganese—Makers continue to quote $225, delivered, for 70% ferromanganese, and $65, furnace, for 16% spiegeleisen, but such quotations are not representative of market values, as sales could not be effected even at lower figures.

Coke—The Fuel Administration announced late last week that its control of coke and bituminous coal, as to price and the zone system of distribution, will come to an end Feb. 1. A few days prior to the announcement, Connellsville furnace coke sold at $5.50, or 50c. under the Government limit. Consumers are well covered by contract, so that there is little demand. Some of the contracts provide, in the event of Government control ceasing, that prices for deliveries shall be subject to negotiation, whereas others provide for "last Government price" to control. Some holders of such contracts have already notified producers that they wish to discuss this matter, evidently with the intention of representing that if they have to pay $6 for coke consumed it will be necessary to blow out.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75 630	88 702	26 960	36 682	44 356
Feb.	56.755	77.585	85 716	26 975	37 742	42 792
Mar.	57.935	73 861	88 082	27 597	36 410	43 620
April	64 415	73.875	95 346	30 662	36 963	47 215
May	74 269	74 745	99 505	35 477	37 940	48 980
June	65.024	76.971	99.500	31.060	39 065	48 875
July	62.940	79.010	99.625	30 000	40.110	48 813
Aug.	66.083	85 407	100.292	31 498	43.418	49.077
Sept.	68.515	100.740	101.125	32.584	50.920	49.500
Oct.	67 855	87.332	101.125	32.361	44 324	49.500
Nov.	71 604	85.891	101.125	34 192	43.584	48 969
Dec.	75.765	85.960	101.125	36.410	43.052	48.492
Year	65.661	81.417	96 772	31 315	40.851	47.516

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28 673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137 895	110 000	148 100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	23.500	133.842	110 000	147.158	125.000
May	28.788	23.500	130 000	110 000	142.000	125.000
June	29.962	23.500	130.000	110.000	142.000	125 000
July	26 620	25.904	128.409	119 913	140.409	134 913
Aug.	25.380	26.000	122.391	122.000	137.000	137.000
Sept.	25 073	26.000	117.500	122.000	135.250	137.000
Oct.	23.500	26 000	110.000	122.000	125.000	137.000
Nov.	23.500	26.000	110 000	122 000	125.000	137.000
Dec.	23.500	(a)	110.000	118.447	125.000	133 167
Year	27.180	24.628	124 892	115 530	138 401	130 507

(a) No Market.

Tin	New York		London	
	1917	1918	1917	1918
January	44 175	85.500	185 813	293.227
February	51 420	92.000	198.974	311.525
March	54 388	(a)	207 443	318 875
April	55 910	(a)	220.171	329 905
May	63.173	(a)	245.114	364 217
June	62 053	(a)	242 083	331.925
July	62 570	(a)	242 181	360.347
August	62.681	(a)	243.978	380 900
September	61 542	(a)	244 038	343 905
October	61 851	(a)	247 467	335.543
November	74 740	(a)	274 943	323.550
December	87.120	(a)	298.556	267.736
Av. year	61 802	88.750	237.563	330 138

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7 626	6 782	7 530	6 684	30 500	29 00
February	8 636	6 973	8 595	6.899	30 500	29 00
March	9 199	7 201	9.120	7 091	30 500	29 00
April	9 288	6 772	9.158	6 701	30 500	29 00
May	10 207	6 818	10 202	6 704	30 500	29 00
June	11 171	7 611	11 123	7 511	30 500	29 00
July	10 710	8 033	10 644	7 750	30 500	29 00
August	10 594	8 050	10 518	7 750	30 500	29 00
September	8 680	8 050	8.611	7 750	30 500	29 00
October	6 710	8 050	6 650	7 750	30 500	29 00
November	6 249	8.050	6 187	7 750	30 500	31 20
December	6 375	6.564	6.312	6.324	30 500	40 00
Year	8 787	7 413	8 721	7.222	30 500	30 10

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9 619	7 836	9 449	7 661	48 329	54 000
February	10 045	7 814	9 875	7 639	47 000	54 000
March	10 300	7 461	10 130	7 286	47 000	54 000
April	9 459	6 890	9 289	6 715	54 632	54 000
May	9 362	7 314	9 192	7 114	54 000	54 000
June	9 371	8 021	9 201	7 791	54 000	54 000
July	8 643	8 688	8 473	8 338	54 000	54 000
August	8 360	8 985	8 190	8 635	54 000	54 000
September	8 136	9 442	7 966	9 092	54 000	54 000
October	7 983	8 801	7 813	8 451	54 000	54 000
November	7 847	8.491	7 672	8 141	54 000	54 100
December	7 685	8.163	7 510	7 813	54 000	56 050
Year	8 901	8.159	8 813	7.890	52 413	54 180

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35 95	$37 25	$30 95	$33 95	$30 95	$33 95
February	36 37	37 25	30 95	33 95	30 95	33 95
March	37 37	37 25	33 49	33 95	35 91	33 95
April	42 23	36 15	38 90	32 95	40 06	33 95
May	46 94	36 20	42 84	33 00	43 60	34 00
June	54 22	36 30	50 05	33 10	50 14	34 10
July	57 45	36 60	54 80	33 40	54 95	34 40
August	54 17	36 60	50 37	33 40	53 95	34 40
September	46 40	36 60	42 21	34 40	48 58	34 40
October	37 25	36 60	33 95	34 40	33 95	35 40
November	37 25	36 60	33 95	34 40	33 95	35 40
December	37 25	36 60	33 95	34 40	33 95	35 40
Year	$43 57	36 67	$39 62	33 70	$40 83	34 45

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Jan. 21
Alaska Gold M.	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	68
Am.Sm.&Ref.,pf.	106
Am.Sm.Sec.,pf.,A	91
Am. Zinc	11
Am. Zinc, pf	40
Anaconda	57
Batopilas Min	1
Bethlehem Steel	55
Butte & Superior	17
Butte Cop. & Zinc	6
Cerro de Pasco	31
Chile Cop.	17
Chino	33
Colo. Fuel & Iron	35
Crucible Steel	53
Crucible Steel, pf	91
Dome Mines	12
Federal M. & S.	9
Federal M. & S., pf	33
Greater Nor., ore ctf	36
Greene Cananea	43
Gulf States Steel	51
Homestake	94
Inspiration Con	43
International Nickel	27
Kennecott	32
Lackawanna Steel	63
Mexican Petrol.	167
Miami Copper	2
Nat'l Lead, com.	68
National Lead, pf	108
Nev. Consol	16
Ontario Min	6
Ray Con	20
Republic I & S., com.	72
Republic I & S., pf	100
Sloss-Sheffield	50
Tennessee C. & C.	13
U. S. Steel, com.	89
U. S. Steel, pf.	114
Utah Copper	71
Va. Iron C. & C.	57

BOSTON CURB*	Jan. 21
Alaska Mines Corp.	‡.12
Boston Ely	98
Boston & Mont.	.49
Butte & Lon'n Dev.	.14
Calaveras	1
Chief Con	3
Contact	.05
Corbin	‡ 25
Cortez	12
Crown Reserve	44
Crystal Cop	.20
Eagle & Blue Bell	2
First Nat Cop.	1
Houghton Copper	30
Intermountain	‡ 05
Iron Blossom	45
Iron Cap	15
Majestic	.22
Mexican Metals	25
Mines of America	.75
Mojave Tungsten	05
Nat. Zinc & Lead	08
Nevada-Douglas	.30
New Baltic	1
New Cornelia	‡16
Oneco	20
Pacific Mines	‡ 35
Rex Cons	05
Yukon Gold	75

SAN FRAN.*	Jan. 21
Alta	02
Andes	04
Best & Belcher	01
Caledonia	02
Challenge Con.	03
Confidence	04
Con Virginia	04
Gould & Curry	‡ 01
Hale & Norcross	01
Jacket-Cr. Pt	‡ 06
Mexican	08
Occidental	40
Ophir	01
Overman	01
Savage	03
Sierra Nevada	03
Union Con	08
Utah Con	‡ 01
Belmont	‡ 60
Jim Butler	33
MacNamara	28
Midway	29
Mont.-Tonopah	14
North Star	06
Rescue Eula	07
West End Con	1 27
Atlanta	04
Booth	13
Comb. Frac	‡ 02
Florence	12
Jumbo Extension	13
Kewanas	06
Nevada Hills	03
Nevada Packard	25
Round Mountain	30
Silver Pick	04
White Caps	15

COLO SPRINGS*	Jan. 21
Cresson Con	‡ [illegible]
Doctor Jack Pot	04
Elkton Con	14
El Paso	‡ 14
Gold Sovereign	02
Golden Cycle	76
Granite	18
Isabella	05
Mary McKinney	07
Portland	1 00
United Gold M.	14
Vindicator	41

BOSTON EXCH.†	Jan. 21
Adventure	‡ 60
Ahmeek	7
Algomah	‡ 30
Allouez	43
Ariz. Com.	11
Arnold	‡ 20
Bingham Mines	‡9
Bonanza	‡ 10
Butte-Balaklava	‡ 21
Calumet & Ariz	59
Calumet & Hecla	430
Centennial	12
Copper Range	42
Daly West	2
Davis-Daly	5
East Butte	9
Franklin	3
Granby	‡79
Hancock	5
Hedley	‡12
Helvetia	‡ 20
Indiana	‡ 80
Isle Royale	24
Keweenaw	‡1
Lake	4
La Salle	2
Mason Valley	‡2
Mass	4
Mayflower	2
Michigan	‡3
Mohawk	51
New Arcadian	1
New Idria	‡10
North Butte	10
North Lake	‡ 55
Ojibway	1
Old Dominion	34
Osceola	‡52
Quincy	59
St. Mary's M. L.	42
Santa Fe	‡ 25
Seneca	13
Shannon	2
Shattuck-Ariz	‡14
So. Lake	‡1
So. Utah	‡ 10
Superior	4
Superior & Bost.	2
Trinity	2
Tuolumne	‡ 77
U. S. Smelting	43
U. S. Smelting, pf	45
Utah Apex	2
Utah Con.	8
Utah Metal	1
Victoria	2
Winona	90
Wolverine	18
Wyandot	‡.50

N. Y. CURB†	Jan. 21
Big Ledge	[illegible]
Butte & N. Y.	[illegible]
Butte Detroit	01
Caledonia	.31
Calumet & Jerome	.50
Can Cop. Corpn	2
Carlisle	‡2
Cashboy	.07
Con. Ariz Sm	1
Con Coppermines	6
Goldfield Con	21
Goldfield Merger	.06
Greenmonster	[illegible]
Hecla Min	4
Howe Sound	3
Jerome Verde	‡ 50
Louisiana	[illegible]
Magma	26
Marsh	03
McKinley-Dar-Sa.	‡ 47
Milford	‡ 75
Mother Lode	33
Nixon Nevada	43
Ohio Cop.	[illegible]
Rawley	12
Ray Hercules	2
Richmond	‡ 56
Rochester Mines	27
St. Joseph Lead	12
Standard S. L.	[illegible]
Stewart	‡ 16
Success	05
Tonopah	‡3
Tonopah Ex	2
Tribullion	[illegible]
Troy Arizona	‡ 10
United Eastern	4
United Verde Ext.	‡35
United Zinc	1
Utica Mines	‡ 08

TORONTO*	Jan. 21
Adanac	12
Bailey	04
Beaver Con	.41
Chambers Ferland	08
Coniagas	2 00
Hargraves	02
Kerr Lake	‡5 37
La Rose	31
Lake Shore	90
Min Corp of Can	2 00
Nipissing	‡8 75
Peterson Lake	10
Temiskaming	31
Wettlaufer-Lor	03
Davidson	1 60
Dome Exten	22
Dome Lake	15
Hollinger	6 12
McIntyre	1 75
Newray	12
Porcu. Crown	30
Teck-Hughes	25
Vipond	22
West Dome	14

* Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

February 1, 1919

Volume 107 Number 5

OIL-SHALE DEPOSITS NEAR GRAND RIVER VALLEY, COLORADO

Commercial Possibilities of Oil Shale

BY HARRY J. WOLF*

The development of an additional oil supply is an economic necessity. The oil-shale deposits of Western States hold the promise of a future supply of petroleum. Comparatively little progress has been made toward the exploitation of these deposits, and what has been done is largely of an experimental nature. In this paper the oil-bearing shales in Colorado and Utah are described, together with the present development. The writer warns persons of moderate means and without technical experience against engaging in the exploitation of these deposits.

IN THE last few years much has been written about oil shale in the United States, and particular reference has been made to the extensive deposits in Colorado and Utah. Valuable statistical information has been published in Government bulletins and technical articles, but a great quantity of the oil-shale promotion literature is of extremely doubtful utility. Though serving a legitimate purpose in some cases, much of the promotion publicity has had the general tendency to convey the impression to the casual reader that the commercial possibilities of oil shale have been favorably and definitely established, whereas the truth of the matter is that, with a few exceptions, comparatively little has been done in actual development of an oil-shale industry. Conservative investigators realize that the exploitation of oil shale involves large capital expenditure and requires, to be successful, the highest type of technical chemical ability and resourcefulness.

Government geologists have been to a considerable degree especially instrumental in drawing attention to the importance of oil shale. Most of the large deposits in the United States have been surveyed, mapped, and described in detail. Deposits worthy of attention have been reported in many states, but those in Colorado and Utah are the most extensive, and have received greater attention than those in other states. Statisticians have called attention to the increasing consumption of crude oil in the United States, and have presented data indicating that the older oil fields are approaching exhaustion, pointing out that the discovery of new oil fields is not keeping pace with the ever-increasing requirements. It has been estimated that the present rate of consumption will exhaust the known oil fields of the United States in about 20 years. As a consequence, oil shale is being hailed as a possible source of petroleum to meet future requirements.

---

*Professor of mining, Colorado School of Mines, Golden, Colo.

Oil shale is not greasy or oily, and does not appear to contain free oil, but, upon the application of heat, the organic materials contained are broken up, yielding oil and gas among the resulting products. Tests on oil shale indicate a yield from 6 to 90 gal. of crude oil per ton of shale. Distillation tests on the crude oil indicate a possible recovery of 7 to 12% gasoline, 28 to 49% kerosene, and 39 to 62% residuum. Analyses of typical shales indicate one-half of 1% to 3% moisture, 20 to 52% volatile matter, and 45 to 80% ash. The asphalt varies from 0.5 to 4%, and paraffin from 2 to 9%. Chemists have isolated about 20 different products from oil shale.

The byproduct field in connection with an oil-shale industry will present innumerable problems and opportunities for oil-refining experts, manufacturing chemists, and chemical engineers. It is estimated that approximately 50 products of commercial value can be obtained from the reduction of oil shale. Included in these are gasoline, kerosene, light and heavy lubricants, gas oils, chemically solidified oils, carbon blacks, water-proof, acid-proof, and heat-proof enamels; varnishes for smokestacks, ropes, ore cars, and iron work; paints that prevent corrosion, resist great heat, and are weather proof; substitutes for hard rubber; products used in the manufacture of fine glass, pottery, and ornamental tile; different forms of dyestuffs heretofore made in Germany; ammonium sulphate, flotation oils, and producer gas.

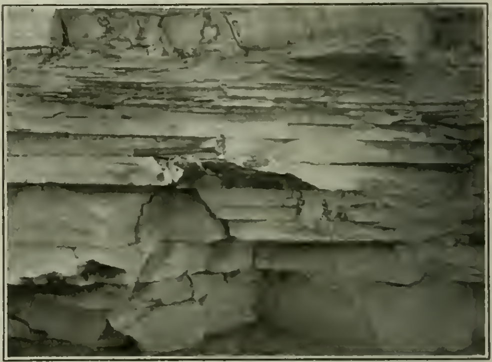
IMPORTANT SHALE DEPOSITS

The most extensive shale areas are those of Garfield and Rio Blanco counties, in Colorado, and Uinta, Grand, Wasatch, and Carbon counties, in Utah. The oil shale occurs in the upper half of the Green River formation in what is known as the Uinta Basin. In Utah the shales are exposed in the valleys of the Uinta, Green, and White rivers, and several of their tributaries. The northwestern part of the Colorado shale area, in Rio Blanco County, is exposed along the White River, west of Meeker, and its tributary, the Piceance Creek. The southern exposure, known as Book Cliffs, is exposed along the north side of the Grand River Valley between Rifle and De Beque, and is cut by the gulches of Roan Creek, Conn Creek, and Parachute Creek, which flow southward into the Grand River.

The most prominent centers of activity in connection with the development of oil shale are Grand Valley and De Beque, in Colorado, both on the Denver & Rio Grande R.R., and Watson and Dragon, in Utah, on the Uinta R.R. The Colorado shale area covers more than 2500 square miles, and the Utah area over 3000 square miles. Bands, or strata, of shale vary in thickness from a few inches to 80 feet.

RECENT DEVELOPMENT

The most important step in the development of oil shale so far recorded is being taken by the Ute Oil Co., of St. Louis, Mo. This company is erecting a 400-ton shale-oil plant about eight miles from Watson, Utah, on the White River. This is the largest shale-retorting plant under construction in this country. The Wallace process is to be used. The decision to erect the new plant was based on the results of extensive testing of many samples of shale. The site of the new plant was carefully considered with regard to the availability and the delivery of the shale, and the disposal of the residue. The deposit is in the form of a long, high bluff, with no overburden.



CLOSE VIEW OF TYPICAL OIL-SHALE FORMATION NEAR WATSON, UTAH

METHODS OF MINING AND MILLING

The mining consists of drilling and blasting down a supply of shale once or twice a week. The shale is then broken by hand to 10 by 15-in. size, and delivered to a 48-in. American pulverizer of ring-and-hammer type, capable of receiving a piece as large as 15 by 45 in., and crushing to ½ in., with 20% fines and 10% over ½ in., with a capacity of 50 tons per hour. The crushed material will be delivered, by an endless belt conveyor, to shale storage bins. From the bins the material will be received by larries, three in number, running on separate monorails. Each larry will serve six retorts. The oil from the retorts will be conducted through condensers and washers into a large crude-oil storage tank. Each retort holds one ton of shale. It is claimed that the process will extract 90% of the total available oil in one hour. Shale from this locality yields an average of 54 gal. of oil per ton of shale retorted. The lowest yield is 31.5 gal. and the highest is 80.5 gal. per ton. It is estimated that the shale, retorted, will yield about one barrel of oil per ton.

In Colorado the oil-shale retorting plants installed to date, or in process of erection, are in the vicinity of De Beque. The American Shale Refining Co. is developing oil-shale properties on Conn Creek, about 12 miles from De Beque. This company plans to install several 150-ton Wingett retorts. One of these retorts has been made by the McFarlane-Eggers Machinery Co., of Denver, and has been shipped to the property. A 3000-ft. tramway, with a capacity of 900 tons per day, is to be installed to deliver shale from the mine to the retorting plant. The company's property has an area of 12,000 acres. The shale cliffs rise to a height of 2500 ft. There are five different strata of oil shale. The highest and richest stratum is 60 ft. thick. Extensive tests indicate a yield of 60 gal. of crude oil per ton. A second stratum 200 ft. below the first is 75 ft. thick and is expected to yield 50 gal. per ton. The available oil in these two strata is estimated at about 20,000,000 bbl., and the ammonium sulphate at approximately 20,000 tons.

The Oil Shale Mining Co. is developing property on Dry Creek 20 miles northwest of De Beque. It has erected six retorts of the Henderson type, each with a daily capacity of 6 tons. This is the first plant of its kind in the United States. The seam of oil shale is 10 to 20 ft. thick, and averages 75 gal. of oil per ton. The Mount Logan Oil Shale Mining and Refining Co. is developing property on Mount Logan, four miles from De Beque. It has three 20-ton retorts. Samples of shale have yielded as high as 100 gal. of oil per ton. The Colorado Carbon Co. is developing property on Kimball Creek, 27 miles from De Beque. Its main seam of shale is 60 ft. thick. Samples indicate a yield of 70 gal. of oil per ton. Many small companies have been formed with the view of exploiting oil-shale deposits in a limited way, but most of these organizations are not supplied with adequate capital for the work they have undertaken.

Comparison With Scottish Shale Deposits

In discussing the commercial possibilities of the shale-oil deposits in the West, reference is usually made to the shale-oil industry in Scotland, established in 1850, where the technical problems of the industry have been carefully worked out and over 3,000,000 tons of shale is profitably treated annually. It is true that these shale beds are comparatively thin, irregular, steeply inclined, deep, and expensive to work, whereas the deposits in Colorado and Utah are relatively thick, are located at elevations well above suitable sites for distillation plants, so that in most cases the crude shale can be transported with the assistance of gravity; have in many places little or no overburden, and in some cases can be mined with a steam shovel. Further, it is pointed out that Scottish shales average a little over 20 gal. per ton, and that Colorado and Utah shales with averages of 40 to 50 gal. per ton are common.

Commercial possibilities of Western oil shales are attractive and promising when it is considered that the difficulties of mining are less than, and the oil content is double, that of Scotland. However, it should be pointed out at the same time that the production of crude oil alone from shale probably cannot now compete commercially with oil from wells, and that the Scottish oil could not be worked profitably were it not for the ammonium sulphate produced as a byproduct.

It is reasonable to suppose that until the demand for oil has increased and the production from wells has decreased, the larger profits from oil shale will be in the refining of the oil and the recovery of byproducts, rather than in the production of crude oil alone. All of this suggests that in the consideration of projects for the development of an oil shale, not only the usual caution must be exercised in determining the average oil content of the raw material, but, also, ample capital must be provided for proper development and expensive equipment, and the highest type of technical and chemical ability must be secured. The mining or business man with limited capital at his disposal cannot hope to engage in the exploitation of oil shale with any chance of success.

The accompanying illustrations were courteously supplied by the Denver & Rio Grande Railroad Company.

Mineral Land Classified in Wisconsin

In 1918, the Wisconsin Geological Survey examined 14 townships in central Wisconsin, making a study of the geology, with the idea of determining what indications there are of economic minerals, especially iron formation. Blueprints have been prepared showing each of the 14 townships with the pre-Cambrian rock outcrops, magnetic lines, roads, streams, and general topographical features. These blueprints will be ready for distribution during this month.

The townships covered lie in Wood and Clark counties, and include the following: Township 24 N, Ranges 1 and 2 E; 1, 2, 3, and 4 W; and township 25 N, ranges 1, 2, 3, and 4 E; 1, 2, 3, and 4 W. These blueprints may be obtained at cost, 10c. a copy, or the entire set for $1, upon application to W. O. Hotchkiss, state geologist, at Madison.

Anarchy in Mexico*

In spite of the policy of silence and suppression of news, reports of the actual conditions of things in Mexico continue to leak out. Washington dispatches go so far as to say that even the State Department and the President have heard disquieting tales of anarchy, and that the cables are carrying frequent reports even to Paris.

Thus, in the Tampico oil region there have been over 90 hold-ups and robberies of company paymasters by bandits during the last year. The total stolen is not known, but one gang got away with $40,000. These involved some killing, not a few of the victims being American citizens. Many oil wells have been sealed up in the hope of saving them when a greater conflagration starts.

Oaxaca, which is a mining state, has never been really controlled by the Carranza faction. Its condition is now undiluted anarchy. Many of its mines and smelteries are owned, and used to be worked, by Americans, who bought and developed them 20 or more years ago. Now there is no law or order or real government in the district.

What are we going to do about it? Is it profitable, or even safe, to limit our interest in the situation to mere language?

---

*From the *Evening Sun*, New York, Jan. 14, 1919.

Standardization of Mine Cars in Metal Mines*

BY R. M. RAYMOND†

Metal-mine accidents which are classified as being due to transportation may be reduced through the use of properly proportioned cars that are equipped in accordance with the best safety practice. Owing to the varying conditions involved, it is difficult to select a standard car which will be suitable for the requisite purposes, but, by means of a classification that groups according to size and method of locomotion, certain practices in the making of cars can be established and a uniformity agreed upon which will attain safe and economical results.

NEXT to casualties and fatalities by explosions, and those due to falls of ground and similar causes, occur those accidents resulting from transportation, either in loading cars, or in hauling and in dumping them. In 1916, accidents from these causes were as follows: Loading, 1.43% killed, 12.34% injured; hauling, 4.74% killed, 10.83% injured. At Anaconda, where special attention is paid to safety measures, 8.8% of all accidents and 14.8% of the fatal and serious accidents are caused by mine cars. Many of these injuries are the result of the car falling back on men while in the act of dumping.

TRANSPORTATION ACCIDENTS MAY BE REDUCED BY BETTER-DESIGNED CARS

One striking point in these figures is the proportion of fatal accidents classified under haulage. The figures no doubt include injuries to men walking on the track as well as accidents to trammers and to trainmen. Also, the fact that in minor accidents the proportion considered as being due to the loading of cars is greater than minor accidents which occur in the operation of hauling. Accidents from transportation are due not alone to the cars themselves, their structure, defects and other features, but to the condition of drifts and roadways, to inferior track; steep grades, sharp curves, and lack of warning of moving cars and trains, all of which cover probably the greater proportion of casualties. However, the present article deals entirely with the structure of cars. There is no question that a large number of accidents can be prevented by better-designed cars, and by providing arrangements for handling cars singly or in numbers.

VARYING CONDITIONS NECESSITATE CAR CLASSIFICATION

Standardization of metal-mine cars is difficult, for the varying sizes and conditions of drifts present a diversified problem. Drifts range from those of large size and having no timber, as in limestone deposits and in those driven at great depth, to drifts necessarily small on account of a broken, faulted formation and heavy orebodies, such as occur in Butte. Cars in metal mines consequently may be divided into three sizes and classes: (1) Cars operated by man-power, with capacity of 18 to 30 cu.ft. and holding from ¾ to 1½ tons, which may have end doors, dump forward, or may swing and dump to one side; (2) cars operated by mule haulage or storage battery, of 1½ to 2½ tons each, or a number of the smaller man-size cars handled in trains; (3) cars operated by electric motors of 3-, 4- or 5-ton capacity, flat-bottomed side-dump, gable-bottomed side-dump cars, or solid body dumped by a revolving cradle. Special cars for handling men in and out of mines, both in tunnels and in drifts, will also be considered.

SMALL MAN-OPERATED CARS REQUIRE LOW CENTER OF GRAVITY

In the use of small cars operated by men, it is essential, both when loading at faces and when drawing ore from chutes, as well as in the handling of the car, to have the center of gravity of the load as low as possible. Another point is to have a car of such ample capacity that material loaded at the face or from chutes does not fall over the sides. Wheels and axles, though flexible, should be firmly placed in good bearings to preserve good alignment on the track and protect the flanges of the wheels. Lubrication of journals and wheels should be effective for long periods. No projecting parts or sharp corners should be permitted. The car should have sufficient strength to preserve its form and good condition at all times and even withstand the accidents of derailing. The fastenings of doors, couplings, and brakes should be such that they will be secure, and without dangerous features of construction.

A truck made of 4-in. or 5-in. pressed steel or channel iron, formed to shape in one piece, with a low dumping ring and bar for dumping straight ahead and when dumping at the side, a flat turntable of malleable steel rings or central plates, tends to keep the car body low. Such construction, compared with the old style of pivoting the body on a yoke or heavy cast dumping iron, has considerable advantage. Wheels of 12-in. diameter, and of solid web, are the most satisfactory in size for the smaller cars. The steel used in the tread should be from 2¾ in. to 3 in. wide and chilled. Wheels of manganese steel are found economical in some siliceous mines, but a wheel made of good gray iron and operating on clean tracks should wear for several years without grooving. Loose boxes or bearings are fortunately seldom used, and a solid saddle provided with Anaconda or McCaskell axles has great advantage. Better still are roller bearings of Hyatt or Whitney type, both of which are now being applied to man-size cars, and are of advantage in the use of a larger car body and provide ease of manipulation, with cheaper and better lubrication, than is possible on the usual small-sized car.

Roller bearings are advantageous even for man cars, as well as for motor haulage, and are economical in the long run. In addition to ease of operation, they have the great advantage of preserving the alignment of the axles, protecting flanges of the wheels and giving the best of lubrication, with reduced quantity, for long periods. If roller bearings are not used on man cars, solid bearings with tight and loose wheels on the axles, provided with dust-proof receptacles, should be used.

---

*Paper read at Seventh Annual Safety Congress of National Safety Council, St. Louis, Mo., Sept. 18, 1918.

†Professor of mining, Columbia University, New York

WHEEL BASE, DUMPING DEVICE, AND TRACKS

The wheel base should be one-third the length of the car body. To preserve good balance, the dumping hinge should be placed far enough ahead of the middle half of the car to prevent it from tipping when an obstacle on the track is encountered, or when the car leaves the rail, and four to five inches is usually satisfactory for the smaller car. For man-handled cars of 24- to 30-cu.ft. capacity. there is no reason why wider gage tracks cannot be used, and a 20-in. gage, instead of the usual 18-in., would give better bearing and less danger on curves.

INCREASE IN SIZE OF SMALL CARS ADVANTAGEOUS

Until recently, car bodies have been small in area and rather narrow in width. Providing better track of 16-lb. rail and larger drifts for improved ventilation and drainage permits the use of 20- to 25-cu.ft. cars, and on good grades of 0.4% as well as a good track, even a 30-cu.ft. car can be handled by one man. This requires a car of from 10 to 12 sq.ft. in area, in place of 8 sq.ft. or under. The larger area is of importance in reducing accidents due to material falling over the sides. The width of the body is limited by the size of the drift in order to secure clearance; but, in most mines, drifts are more frequently six feet wide in the clear and seldom under that, so that a car 30 in. wide is entirely feasible, and even 32 in. to 34 in. may be allowed for man-size cars.

The height of the car above the track should be, if possible, not over 44 in. when shoveling at the face. Cars of 24-cu.ft. capacity can be made of good shape within that height; those used for loading from chutes can be larger—48 in. to 50 in. in height, with a capacity of from 26 to 30 cu.ft. These sizes can be easily operated by one man on good tracks and easy grades. Figs. 1 and 2 show, respectively, typical cars of 22- and 26-cu.ft. capacity.

For man-size cars, side sheets of $\frac{1}{8}$ in. need little reinforcement, and flat bands at the top are sufficient, with angle-iron inside at the bottom. When absolutely necessary for heavy ores, angle-iron, if used at the top, should be placed inside.

SUSPENSION OF DOORS AND METHODS OF FASTENING

Doors are usually hung from a bar at the extreme end and outside of the body. As cars become used and worn, leakage of material occurs and fines run out on the track. The door hinged from the top strap a short distance back from the front gives a tighter fit at all times than if hung from a rod at the outer end of the body. If the front edge be sloped slightly forward, instead of perpendicular, a still better fit results.

The fastening of the car is also important. The usual lever, with a hook on the lower end engaging a socket at the back end of the car, and a catch at the forward end, is not sufficient to prevent the body from becoming loose on the turntable when the hook and latch become worn. Designs of spring attachment for closing the door become defective in time. One improvement is to have the body engage a small pin on the truck, and this, in addition to the usual latch, keeps the body firmly in place. The pin may be a fixed vertical pin for forward-dumping cars, and either a fixed or removable side pin for use on side-dumping cars, such as is shown in Fig. 3.

OTHER CONSTRUCTION OF CAR SHOULD BE SUCH AS TO AVOID POSSIBLE ACCIDENT

The handle of the lever should miss the top of the car by three or four inches, the side by six inches, and it should be placed at least three inches from the body of the car. The ring securing the handle should allow at least five inches clearance between the handle and the small bar holding the ring, and the latter should be placed at the back of the car, rather than at the side.

For dumping, the car should be so hung that a man can easily lift the car body without moving the truck or forcing it backward. Handles placed at a height of 28 in. or 30 in. above the ground give the car better control when dumping than when placed nearer the top of the body. The handles should be fastened entirely on the back sheet of the car and should not project or be fastened on the sides.

USE OF GUARD BOARDS ON CARS

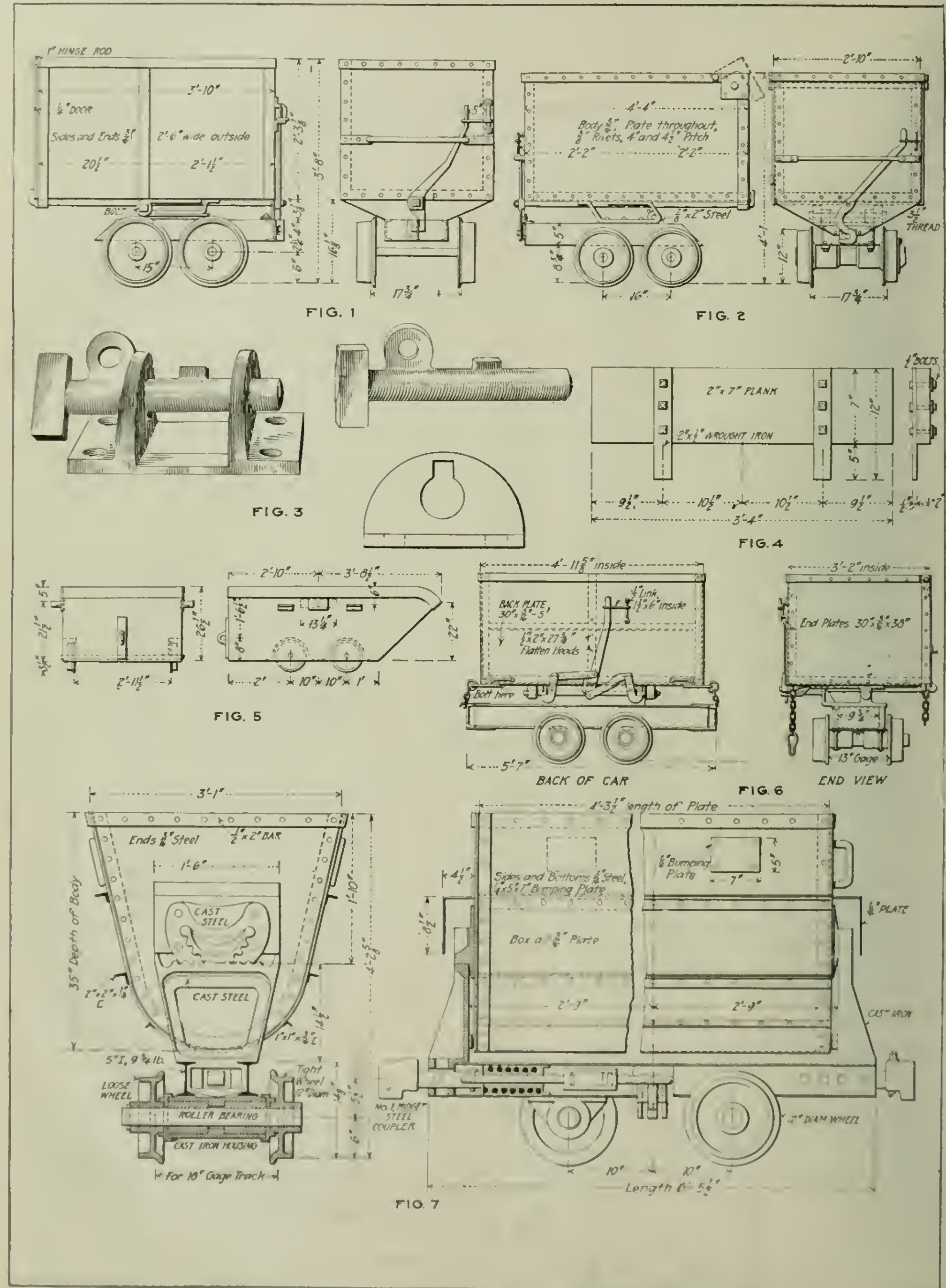
In loading a car, one of the greatest dangers and causes of accidents is the dropping of material between the chute and car, or overrunning the car on the side opposite the chute. This is due largely to the small area of cars and to the size and weight of material loaded. A special guard board placed on the car opposite the chute while loading will prevent large pieces running over and injuring a man's limbs. Guard boards, similar to the one shown in Fig. 4, have been found effective at the Copper Queen mine and at the Sudbury nickel mines.

NEW YORK CAR HAS LOW CENTER OF GRAVITY

Fig. 5 shows a special type of car which has a low center of gravity and is used to advantage on the New York subways. It embodies convenience in shoveling and for handling large rock, offers advantages in hoisting, and has been found useful for preventing accidents both in loading and in moving short distances along rough rails. This type is known as the Stuebner car, has a capacity of 40 cu.ft., and is usually handled by two men.

CARS OPERATED IN TRAINS REQUIRE SPECIAL ATTENTION TO COUPLINGS

Cars operated by mule haulage or storage battery are generally a combination of the larger-sized man cars operated in trains of four, six, or twelve cars, dumped by man-power and similar in most points to the usual man car. The coupling and buffer usually differ. On smaller cars a slight projection on the end plate is frequently used, but this offers harsh treatment to the door of the following car. A better buffer is formed by the extension of the frame of the truck or with the regular spring drawhead, with curved buffer and link and pin coupling, such as is used in coal mines. Both of these are of advantage in convenience and



FIGS. 1 TO 7. TYPES AND ACCESSORIES OF UNDERGROUND MINE CARS

economy. Instead of using a link and pin, chains at the side or just under the body at the sides may be used on a straight track, but they are a disadvantage on a curved track. When chains are so used, rings should be substituted for hooks, and caught into properly shaped rings on the forward car. It is important and necessary on cars of this size that roller bearings be used, as they make it possible to handle larger cars with greater ease, particularly on long hauls.

ADVANTAGES OF SIDE-DUMP CAR

Another form of car which eliminates the troubles often met in the use of end-dump cars and of turntables is the side-dump car with a rectangular body, illustrated in Fig. 6. This car, which has a capacity of 40 cu.ft., can be made smaller, but in this size can be handled for short distances by a man and for longer distances by animals or by electric power in trains. It has the advantage of being easily dumped by means of lever on the opposite side of the door. The truck is arranged to extend beyond the body of the car, so that it acts as a buffer; and the couplings, placed at the side and provided with ring catches, are convenient, and obviate any possibility of catching clothes or fingers.

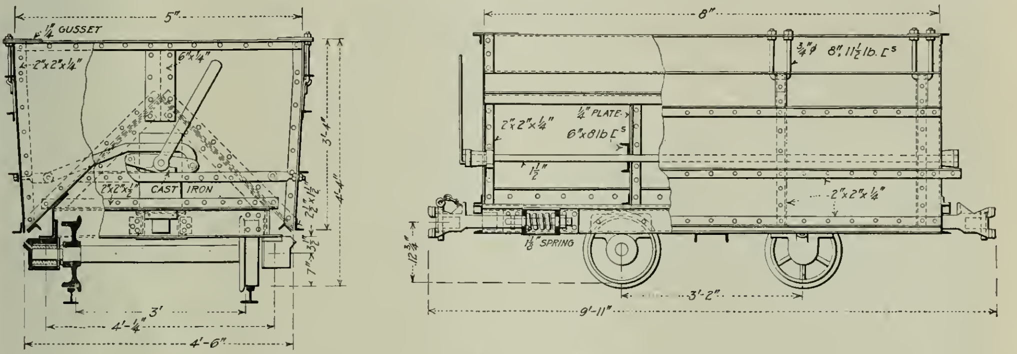


FIG. 8. GABLE-BOTTOM CAR FOR MOTOR HAULAGE

ROLLING DUMP CAR OFFERS LARGE CLEARANCE

The rocker car, or rolling dump car, as shown in Fig. 7, is becoming popular for underground use and offers the advantage of having no doors or catches excepting those that are necessary to hold the body erect. One disadvantage of these cars hitherto has been the high center of gravity, but they are now being made lower, and are useful on track wider than 18 in. They have the further advantage of allowing large clearance between car bodies, offering opportunity for easy manipulation of coupling, and can be further improved by installing automatic couplings. When brakes are used, the brake lever should be placed at the side of the car, and the handle of the lever should be a closed ring.

CARS OPERATED BY MOTOR HAULAGE

Comparatively speaking, the center of gravity and the area of cars operated by motor haulage are much better taken care of than in the small man-size cars, and the fewer accidents in loading and dumping with such cars are features for consideration in the structure and build of the smaller-sized car. These cars are made either with gable bottom and side doors, as shown in Fig. 8; flat bottom, with special attachment for dumping, as the Granby car, or with a solid body for dumping by means of a cradle. Though the former construction is more frequently used, the latter is preferable when the tonnage is sufficiently large or can be handled only from a few levels at a time. The extra expenditure for cradle, and for operating by power, with the cheaper solid-body car, is less than the greater expense of the gable-bottom car and the necessary hinges and levers.

FEATURES OF GABLE-BOTTOM CARS

The larger-sized car used for such transportation requires special features, both for strength of car, method of operation, and additional provisions for safety. The truck, made usually of channel iron, or, better still, pressed and curved channel iron, should have a spring drawhead and coupling, either with link and pin—the latter caught by chain—or, for the larger-sized cars, the M. C. B. Midget couplers. These are more expensive, but for rapidity and safety are to be preferred, and pay in the end. Wheels and axles should be of first-class materials, with roller bearings in the boxes and not in the wheels.

ELIMINATION OF PROJECTIONS IS ADVANTAGEOUS IN SAFE-CAR CONSTRUCTION

The structure of the body, which is necessarily reinforced by angle-irons, can be improved upon if pressed forms, or any form of brace giving both strength and little projection on corners of cars and on doors, are used. Levers and toggles holding doors are important features, and are arranged to give easy and quick operation. However, projecting points and angles for handling levers should be done away with, and, instead, curved, ring-closed handles, which prevent catching of clothes and are more easily operated, should be used.

Expense is curtailed by the adoption of the solid car, and danger prevented while doors are being shut or opened, or when cars are being dumped; and by running two or three cars into a cradle of sufficient length, the tonnage handled in the same period of time will be as great as or greater than by the use of the flat bottom car. Also, the solid car obviates delays and accidents which may attend use of the gable-bottomed car.

There is little danger or opportunity for accident in the revolving cradle, which eliminates nearly all accidents attendant on the dumping of cars at the hoisting shaft.

Transportation of men underground for long distances has become an important item in mine operation. An excellent example and type of car for handling men safely is that in use at the Inspiration Copper mine and shown in Fig. 9. These are made from timber trucks 9 ft. long, covered with 2-in. flooring, with seats on each side. A frame of strap iron covered with chicken wire, formed into prairie wagon shape, permits the men to sit erect but not to stand. Bumpers provide a sufficient space to allow men to enter the car, and steel plates extend from the frame above the bumpers. Each car seats 12 men, and 10 cars are operated in a train, which has right-of-way over other traffic. These cars are not only a convenience but reduce the number of men traveling on foot on the main roadways.

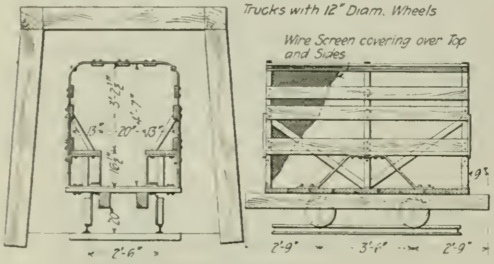

Trucks with 12" Diam. Wheels
Wire Screen covering over Top and Sides
3'-2½"
4'-7"
13"
20"
13"
16½"
20"
9½"
2'-6"
2'-9"
3'-6"
2'-9"

FIG. 9. UNDERGROUND MAN CAR

Feasibility of Electric Smelting of Iron Ores in British Columbia

A report on "The Commercial Feasibility of the Electric Smelting of Iron Ores in British Columbia" has recently been completed by Dr. Alfred Stansfield, professor of metallurgy at McGill University and consulting metallurgist. This report deals with the subject in a complete and detailed manner and draws the following conclusions: Electric smelting of iron ores in British Columbia is feasible from a metallurgical point of view. There is a sufficient supply of ores of a quality suited to the process and capable of being converted into a high quality of iron or steel, and there also are available all the requisite fluxes required to carry out the process completely. However, two difficulties are made clear. The one which is most emphasized is the question of the cost of electric power under existing conditions. Doctor Stansfield finds that, with power companies demanding the rates which were quoted by the largest concerns in the province, the profitable production of pig iron by means of electric smelting would not be feasible.

The reports states that the iron orebodies of British Columbia have not been opened to any extent, but the reserves are ample and of fair grade, although chiefly magnetites, and so undesirable for use in the blast furnace excepting when mixed with other ores. The magnetite ores are not of high grade, but contain from 50% to 55% Fe, are practically free from phosphorus, titanium, and copper, and the proportion of sulphur can probably be kept as low as 0.1%. It is estimated that 50,000 tons a year can be delivered at a suitable smeltery site, at a cost, under present conditions, of about $4 per net ton.

Doctor Stansfield says that British Columbia is well supplied with water power, and many sources can be developed chiefly for the use of electric smelting and similar industries. The consumption of power, under conditions obtaining in British Columbia, would be between 0.4 and 0.5 horsepower-year per ton of iron produced, so that the cost for power should be between $4 and $5 per long ton of pig iron. In view of the desirability of producing pig iron at the earliest possible time, and of the difficulty and expense attending the development of water power under present conditions, it is highly desirable, if not imperative, that an electric smelting industry shall be supplied, in the first place, from sources of power that are already developed.

It is explained that the British Columbia Electric Railway Co. has surplus power, but the charge would amount to $27.80 per horsepower-year, which would represent a charge of from $11 to $14 per ton of iron. The latter would be the rate in the British Columbia mainland, but on Vancouver Island 2000 kw. of power was to be available for a short period, subject to peak load restrictions, at $15 per horsepower-year. The increase, it is maintained, makes the cost too high to allow of commercial production of pig iron by present methods at or near Vancouver City.

Doctor Stansfield states further that 20 to 25 tons of charcoal would be needed daily for an output of 50 tons of pig, and, though no considerable charcoal industry exists at present, there is in the coast district of British Columbia an abundant supply of timber from which suitable charcoal can be made for use in electric smelting, which could be delivered at the smeltery at a charge of between $2.40 and $4 per ton of iron.

The cost of labor would probably be from $4 to $5 per ton of iron, although in the initial stages of the industry it might run as high as $7 per ton.

As to cost of production, it is stated that a simple plant, assumed for purposes of calculation only, would consist of three electric furnaces of 3000 kw. each, producing altogether about 80 tons of pig iron daily, and would cost from $350,000 to $400,000 to erect in British Columbia. The cost of making a long ton of foundry pig iron in such a plant would be estimated as follows, assuming that power can be obtained at $15 per horsepower-year:

ESTIMATED COST OF ONE TON OF FOUNDRY PIG IRON MADE IN BRITISH COLUMBIA

Iron ore, 2 net tons @ $4	$8.00
Electric power, 0.45 hp-year @ $15	6.75
Charcoal, 0.4 net ton @ $8	3.20
Electrodes, 15 lb @ 8c	1.20
Repairs and maintenance	1.00
Labor	4.50
Management	2.00
Interest, 6% on total capital; and depreciation, 10% on cost of plant	2.60
Royalty	0.50
Total	$29.75

The situation of a smeltery should be convenient with respect to the supplies of ore, charcoal, and other requirements, and should also permit of the cheap delivery of the iron and other products to the market. With reference to the market, it is stated that the consumption of pig iron in British Columbia now is only about 10 tons daily, but, with more moderate prices, this consumption, it is thought, might be raised to 20 or 30 tons daily.

Technicians in Government Service

IN JULY, 1917, the War-Minerals Investigation Committee was established to undertake a coöperative study of the problems connected with the war minerals. This committee was composed of William Young Westervelt, representing the American Institute of Mining Engineers and the Mining and Metallurgical Society of America; W. O. Hotchkiss, representing the Association of State Geologists; David White, of the U. S. Geological Survey, and A. G. White, of the Bureau of Mines. Later H. S. Mudd became assistant secretary of the committee. This committee coöperated with the different agencies interested in developing domestic mineral resources, and promoted the utilization of volunteer services and the most capable engineers for work of special importance.

Another organization, the Joint Information Board on Minerals and Derivatives, was organized to act as a clearing house of information for all of the Government departments interested in mineral problems. Mr. Mudd acted as the representative of the Bureau of Mines on this board.

The Bureau of Mines endeavored to aid producers of war minerals in regard to matters of priority in transportation, fuel, and equipment, in the construction of highways and roads, in the problem of labor supply, and in a study of mining and milling methods. Summarized reports were furnished to the War Industries Board and the Shipping Board, and the Bureau's engineers were at all times ready to take up any mineral problems confronting the various Government agencies connected with the conduct of the war.

At the close of the fiscal year, the War-Minerals Investigation Committee comprised about 100 persons, of whom about 90 were mining engineers, metallurgists, or chemists. Of these, about two-thirds were engaged in staff and field work; the remainder, consulting engineers, were employed only for short periods and on special problems. The larger part of this organization was formed during the last three months of the year. Parts of the work had been carried out previously under the mining, metallurgical, and mineral technology divisions of the Bureau. The investigation was temporarily under the direction of D. A. Lyon, superintendent of stations, assisted by H. S. Mudd and A. G. White. Now it is in charge of J. E. Spurr, as chief executive.

TECHNICIANS ON WAR-MINERALS INVESTIGATION COMMITTEE

Most of the experimental work of the War-Minerals Investigation Committee was done at the mining experiment stations of the Bureau. The investigations cover the concentration and metallurgy of manganese ores at the Minneapolis station; special high-grade clay products, at the ceramics station at Columbus, Ohio; the recovery and use of pyrite from coal mines, at the station at Urbana, Ill.; potash, tungsten, molybdenum, and rare metals, at the station at Golden, Colo.; concentration and hydrometallurgy of low-grade copper

---

*Partly abstracted from the eighth annual report by the Director of the Bureau of Mines.

ores, and field investigations of manganese, at the station at Tucson, Ariz.; graphite milling, at the station at Salt Lake City; work relating to the production of sulphur, quicksilver, and chromium, at the station at Berkeley, Calif., and concentration tests of chromium, manganese, quicksilver, and tin ores, at the northwest station, at Seattle, Washington. Practically all the work of the Minneapolis station has been in connection with the concentration of manganese ores.

NUMBER OF ENGINEERS ENGAGED IN WAR-MINERALS INVESTIGATIONS INDICATES EXTENT OF OPERATIONS

A few of the technicians connected with the investigation of war minerals appear in the accompanying halftone. Reading from left to right they are: A. G. White—In charge of the sulphur resources, also administrative assistant to the executive of the War-Minerals Investigation Committee; secretary of the War-Minerals Committee; mine economist for the Bureau of Mines. J. E. McGuire—In charge of the investigations on chrome and tungsten. J. C. Orchard—Assistant mine economist for the Bureau of Mines; in charge of the editing and publication of a series of confidential reports on the political and commercial control of the mineral resources of the world. W. C. Phalen—Mineral technologist for the Bureau of Mines; field work on manganese for the War-Minerals Investigation Committee. G. J. Salmon—In charge of labor problems connected with the metal and non-metalliferous mining industry; member of Committee on Mechanical Labor-Saving Devices as applied to mining, also in charge of matters related to industrial furlough from the Army in coöperation with the War Department. A. W. Stockett—In charge of the investigations on potash resources; and a member of the committee of the Bureau of Mines appointed to advise the Capital Issues Committee on mining and related applications. J. E. Spurr—Executive of the War-Minerals Investigation Committee of the Bureau of Mines, and former member of the Committee on Mineral Imports of the Shipping Board. H. S. Mudd—In charge of the investigation on graphite, antimony, and bismuth; assistant secretary of the War-Minerals Investigation Committee; member of the Committee of the Bureau of Mines appointed to advise the Capital Issues Committee on mining and related applications; representative of the Bureau of Mines on Joint Information Board and General Contact for the minerals and their derivatives. A. E. Wells—In charge of sulphuric acid work for the Bureau of Mines in coöperation with the War Industries Board and the Chemical Alliance. H. C. Morris—In charge of investigations on various metals; also a member of the committee of the Bureau of Mines appointed to advise the Capital Issues Committee on mining and related applications. C. M. Weld—In charge of investigations on manganese iron ore, ferrosilicon and chrome; representative of the Bureau of Mines on Ferrous Section of the War Industries Board; now assistant executive of the War-Minerals Investigation Committee. F. H. Probert—Engaged in special field work for the War Minerals Investigation Committee; dean of the mining department of the University of California; consulting engineer of the Bureau of Mines. H. A. Buehler—In charge of the investigations on pyrite; also state geologist of Missouri.

Cheap Leaching of Gold-Ore Tailings

A method of cyaniding tailings in vats the sides of which are formed by the separated slime has been patented (N. 6516, of 1918) in Australia by John Nicholson. As the conditions which led to the adoption of this method at the Dustholes (Myrtle) gold mine, in South Australia, are found on many other small properties, the details are of more than local interest. The following notes have been compiled from information given in the *Mining Review* of the Department of Mines of South Australia, for the half year ended June 30, 1918.

When previously worked, the method used was to follow the various gold-bearing seams and to mine them selectively. As the seams are, comparatively, of small size and occur irregularly, and, so far as the assays have shown, are not of exceptional richness, this method was not successful. The present owner purposes adopting a different method, and to mine the ore, together with the intervening country in a face of suitable width, by means of an open cutting. The ground broken will then be roughly sorted by screening and hand dressing, the waste dumped, and the remainder sent for treatment. This means that, instead of a small quantity of rich ore as obtained by the former method, there will result a larger tonnage of lower-grade ore; and it is hoped that the cheaper method of mining and the larger tonnage treated will help to show a profit. Reliance is also placed on a method of handling the sands for cyaniding to reduce costs.

The proposed scheme of treatment is as follows: The ore is first broken in open cutting and the waste hand-picked, the remaining portion being then sent on to a 5-ft. Chilean mill for coarse crushing. The ironstone carrying the gold is expected to pass off from the mill for the most part in a comparatively fine state of division, owing to its original soft and friable nature. The discharge from the mill is over copper amalgamating plates, where the amalgamable gold will be retained.

A separation into slime and sand will be made by spitzkasten. It is then intended to neglect any gold in the slime, as the amount is not expected to be of any consequence, and to utilize the slime to form the walls of a vat or dam in which the sand will be cyanided. For this purpose a concrete floor will be laid on the ground, on which a filter bed will be formed, and the walls or sides of the vats will be made around this bottom by running the slime into a double wall of hessian, supported by rough timber framing. The idea is that the moisture from the slime will filter off to a certain extent through the hessian, leaving the slime, which will gradually build up to form the walls of the vat and will retain the sand and solutions while cyaniding is being carried out, suitable provision having been made for drawing off the solutions.

The idea underlying this scheme is to avoid the cost entailed in emptying ordinary iron or wooden vats when extraction is completed, as in this case it is not planned to remove the sands, but simply to build out fresh cyaniding inclosures as the work progresses, leaving the old one as it stands.

[It would seem probable that the use of hessian, as described, will be found impracticable. The walls could be built of partly dried slime, as is customary in the case of settlement dams.—Editor.]

Foreign Zinc-Smelting Capacities and Prospects

By W. R. INGALLS

A CORRESPONDENT has requested me to communicate to him such information as I might have relative to the zinc-smelting capacity of the world, other than in the United States, and particularly in England, Australia, Belgium, and Silesia, and to give a general statement as to the condition of these different producing centers and the prospects for future increased capacity.

As my reply will probably be of general interest to those engaged in the zinc industry, I publish it as follows:

Germany.—The largest production on record was in 1913, when Rheinland-Westphalia produced 92,852 metric tons, and Upper Silesia 170,119. Probably the smelting capacity was more or less in excess of those figures. The Rhenish-Westphalian smelters depended on Australian ore to a considerable extent. The Silesian smelters received some Australian ore, but in the main depended upon the local ore deposits, which are extensive.

Belgium.—Maximum production, 200,198 metric tons (in 1912), entirely dependent on imported ore. Some of the Belgian smelteries, especially those in the Campine, were operated during the war. With regard to the others, especially those in the valley of the Meuse, my information is that the damage is not much, but that it will be an indeterminate time before smelting can be resumed.

Holland.—Maximum production, 24,323 (in 1913). Operations continued during the war.

Great Britain.—According to my recent advices, smelting capacity at the end of 1918 is sufficient to make 55,000 tons of spelter per annum. With the completion of the new plants now being erected, it is expected that the smelting capacity at the end of 1919 will be 130,000 tons.

France.—Pre-war production was about 60,000 tons per annum. Some of the French plants, especially St. Amand and Auby, are situated in the north, and, being right in the zone of entrenchments, it is not improbable that they have been destroyed. The important works at Mortagne, near Givet, were in the zone of occupation, but, being German owned, they were not damaged. The chief smelteries of France, viz., Noyelles-Godault and Viviez, were out of danger and presumably were in regular operation. It is not unlikely that the French will now take steps to increase their zinc-smelting capacity. Indeed, plans are already being drawn for an electrolytic plant to make about 10,000 tons of spelter per annum in the Pyrenees, but production from that source is not to be expected until 1920 is well along.

Austria.—There are a few zinc smelteries in Austria, but their capacity is small. I know nothing about their present situation.

Italy.—The Societa di Monteponi has a smeltery at Vado Ligure, but its production is small. However, a considerable production of electrolytic spelter is to be expected in Italy in the course of time. I understand that plans are already being made for an electrolytic plant to be erected at Vallauria (San Dalmazzo di Tenda) by the Societa Anonima Elettromineraria of Savona. Other interests are making studies.

Poland.—Three small plants near the Silesian border have a capacity of producing about 10,000 tons per annum. I have no information respecting their present condition.

Norway and Sweden.—Several plants engaged in electrothermic smelting do a considerable business in refining crude spelter, waste products, etc., but do not figure importantly as ore smelters.

Siberia.—A fairly large plant exists at Ekibastus, but having been completed only at about the beginning of evil days in that country, it has not yet made much more than experimental production, and during the last year or two has been idle. However, this plant will probably be a considerable source of spelter some day.

India.—The Burma Mines Corporation is drawing plans for a plant to make 10,000 tons of spelter per annum at Sakchi, which will probably be completed and producing toward the end of 1920.

China.—There is a small production of zinc in native furnaces in China. This country is always a potential producer. A few years ago the erection of a plant there was considered.

Japan.—This country has produced as high as 60,000 tons of spelter per annum, and probably has capacity in excess of that, but finds its main difficulty in getting adequate ore supply. The Australians have not been keen about supplying ore to Japan, but the Japanese will undoubtedly get what they need from Siberia and China in the course of time.

Australia.—There is a small production of distilled spelter at Port Pirie, and of electrolytic spelter at Risdon (in Tasmania). The Risdon production at present is at the rate of about 3000 tons per annum, but it is contemplated to increase it to 30,000 tons as rapidly as possible. The Mount Lyell interests are also planning to produce electrolytic spelter from ore from the Roseberry mine.

Canada.—Trail has a capacity of producing perhaps 15,000 tons of electrolytic spelter per annum, but there has been doubt if economic conditions in British Columbia are as favorable as they ought to be. However, according to its last report, the Consolidated Mining and Smelting Co. has made such improvements in its metallurgical methods that zinc and lead can be produced at a profit on any market that has existed in recent years, providing that costs of labor and materials fall with the prices for the metals. It is said, moreover, that the Sullivan mine has developed into "one of the most valuable mineral deposits in America if not in the whole world."

Mexico.—A small plant (distillery) is under construction at Saltillo. Petroleum is to be the fuel.

The important thing to be deduced from the above summary, it seems to me, is what I have remarked in previous papers, to wit, whereas zinc smelting was for more than a century confined to certain districts where there was experienced labor, and it was considered venturesome to try any experiments outside of them, there is no longer such hesitation. Thus we now see zinc-smelting projects under way or in contemplation in all parts of the world.

Aluminum and the War

The aluminum industry in 1918 differed in some respects from many other American industries. This is particularly true in that it required no material expansion to take care of war needs, but merely had to be shifted from a peace-time to a war-time basis. The industry was almost entirely engaged in war work, upward of 95% of the product of the principal producer in the United States being used for military purposes. Practically every Government department was a purchaser or a user of aluminum. Some of the amounts used were relatively unimportant from the standpoint of tonnage, but the diversified adoption of aluminum indicates a growing knowledge of methods of handling this metal. The following description indicates some of the more important uses to which aluminum was put:

Aëronautics.—Perhaps in no one field did aluminum play a more important part than in aëronautics. It was used in some of the most important of the component parts of aircraft, and it was found a component of some of the smallest and most delicate instruments. In the airplane, the most obvious and critical part played by aluminum was in the engine. Substantially one-third the weight of the Liberty motor was composed of aluminum. Though no exact figures are at hand, it is highly probable that an even higher proportion of aluminum is used in certain other engines, as, for example, the Hispano-Suiza. Aluminum has been used for many years in automobile engines, but in aircraft work great efforts were made to reduce the weight of the engine to the lowest limits, and to this end aluminum was adopted wherever possible for engine beds, crank cases, pistons, oil pumps, camshaft housings, and numerous other parts. Forty separate parts of the Liberty motor alone were made of this metal, and these parts do not include any of the auxiliary apparatus attached to the airplane. Among the other parts of the airplane where aluminum is used may be mentioned gasoline tanks, fusilage, hoods, cowling, seat backs, and aileron frames. Aluminum is used wherever possible in instruments used on airplanes, such as binocular parts, wireless telegraph and telephone, barometer cases, camera parts, and in range finders.

Although rigid dirigibles have not been adopted in the United States, aluminum is used for important purposes on observation and other types of balloons. All such aircraft has the exterior surface painted with a coat of aluminum paint, to give it a reflecting exterior, thereby obviating changes of temperature as much as possible in the interior of the balloon.

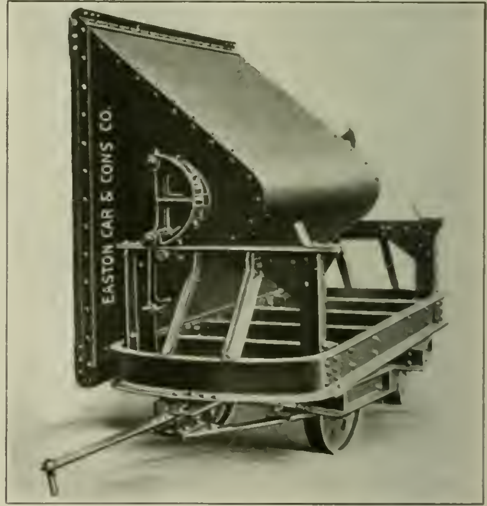
Ordnance.—Every soldier is well acquainted with aluminum from the fact that his mess equipment, consisting of a water bottle, meat pan and cup, is made of this metal, and he is provided with an aluminum identification tag. A small amount of aluminum is also used in gas-mask manufacture.

In the field of explosives, aluminum has found varied uses, as, for example, in ammonal, where aluminum powder is mixed with ammonium nitrate. It is also used in night flares of various sizes, such as are used for illumination or signal purposes. Indirectly, aluminum is of an essential constituent in the production of explosives. In the manufacture of artificial nitric acid, by any one of the several methods employed, aluminum apparatus is used in large quantity. This apparatus takes the form of immense tanks, reaction chambers, pipes, coils, condensers, and similar equipment. All this apparatus requires most careful construction, and must be made, as far as possible, without joints.

A Trackless Trailer

The increasing use of industrial tractors has created an unusual demand for all kinds of trailers. To meet the demand for a car that would not only admit of easy trailing, but would also speed up loading and unloading of loose materials, the new Easton car, here shown, was developed.

It is a four-wheel steer trailer, which will run smoothly over cement, wood, composition or other flooring. All wheels are equipped with roller bearings and may be furnished with rubber or composition tires. Close tracking of trains of these cars is accomplished with comparative ease, because both front and rear trucks of each trailer swivel. Trains of six cars will track within three inches and will take a curve of 8 ft. radius, or smaller.



A TRACKLESS TRAILER WITH DUMP-CAR BODY

The body of the trailer is distinctive and possesses many features that make for economy and speed in loading and unloading coal, ashes, sand, ore, slag, refuse, and practically every kind of bulk material. Some of the more important features include a special latch for locking the body in a half-dumped position, thus lowering the loading height for hand loading; automatic safety latches; an extra heavy body that dumps clear of the wheels; cast-steel rockers, and extra heavy underframes. The car is built by the Easton Car and Construction Co., of Easton, Pennsylvania.

Use and Abuse of Safety Fuse*

THE only legal definition known of the term "safety fuse" is the one contained in the British Explosives Act of 1876, which reads: "Safety fuse means a fuse for blasting that burns and does not explode, which does not contain its own means of ignition, and which is of such strength and construction and contains an explosive in such quantities that the burning of the fuse will not communicate laterally with other fuse."

Any definition other than the above has no foundation; and the so-called guarantees regarding its performance exist only in the mind of the person quoting them. A fuse manufacturer does not guarantee one single factor of its performance, for the reason that he cannot control the actions of the persons purchasing, storing, and using it; nor can he guard against the many forms of abuse to which it may be submitted.

CHOICE OF FUSE

It is important that attention be directed to some underground conditions that should be taken into consideration, particularly by inspectors when making recommendations regarding types of fuse best suited for the work. Where water drills are in use, the employment of a tape-covered fuse is recommended, the grade depending on the temperature and the amount of water and the nature of the ground.

When acid is present in sufficient quantities to make it necessary to line the mine pumps with bronze, the use of a fuse of the triple-tape type is desirable. It has been clearly demonstrated that the lighter forms of jacketing do not meet this severe condition satisfactorily.

In a poorly ventilated mine, the use of a white cotton-countered fuse should be discouraged, for the reason that this type of fuse is more easily penetrated by the moisture precipitated by slow-moving air currents than is the black-finished type.

BURNING RATE INFLUENCED BY TRANSPORTATION AND STORAGE

Fuse in transit may be easily spoiled by being allowed to come in contact with moisture, or with oily or greasy substances, or by being exposed to the direct rays of the sun for any considerable time.

Inspectors should caution superintendents or foremen that fuse which has had oil, gasoline, or distillate spilled on it, or that has been carted to the mine during wet weather without being protected, is likely to be the cause of misfires.

Proper storage of safety fuse is a vital factor. On every case is found the caution, "keep contents cool and dry." It is absolutely imperative that this be followed to the letter. Fuse which has been stored underground is never in prime condition.

It should not be stored near a boiler, furnace, hot steam pipe, or lighted stove. Exposure to heat for only short periods may result in misfires, or may retard the rate of burning, and so greatly increase the liability to cause hold-backs. Fuse that becomes overheated to such a degree that it is absolutely spoiled is harmless, but fuse that has been overheated only to such a point that the powder train has become partly saturated with the materials that were originally put on as a water-resisting covering is extremely likely to cause serious trouble, owing to irregular burning.

Fuse stored in temperatures ranging from 45° to 75° F., in buildings that are dry, will remain in good condition for a considerable time. It is, however, always well to restrict this storage period to a matter of months. Sometimes lack of surface buildings forces temporary storage of fuse, in its original cases, underground. The underground storage place should be well ventilated and cool. A drift or tunnel in which conditions are such that hay or grain will become mouldy is absolutely unfitted for storage of any explosive.

Storage of fuse in a damp place retards its burning speed. Even if precautions are taken to attempt to re-dry the fuse before using, it will be found that the burning rate has slowed down and is irregular. This irregularity tends to increase the liability of misfires.

It should be remembered that fuse waterproofing is quite as effective in keeping dampness in as it is in keeping external water out, and for this reason the thorough drying of fuse that has once been wet is indeed difficult. Experiments have proved that the burning speed of fuse that has been stored in a damp place varies from 17 to 45% from normal.

Exposures to comparatively high or low temperatures for long periods of time retard the burning speed. Cotton-covered types of fuse do not exhibit the marked changes that the tape-covered types do. Fuse warmed near a stove showed variation in burning time up to 28 per cent.

When considering the matter of uneven burning time of fuse, it should be remembered that poor storage and the placing of the fuse under uneven stemming[1] and powder loads, in the same round of holes, are responsible for most of the complaints.

MAIN CAUSE OF MISFIRES

Misfires may, for the sake of reference, be placed in three subdivisions: (a) Preventable, (b) non-preventable, and (c) misfires due to mishandling which extreme care in manufacture cannot guard against.

Preventable misfires are caused by improper capping, sharp tamping material, wet fuse ends, poor storage, the use of oil, light grease, or turpentine-varnish as a waterproofing material, non-lighting of all fuse in a round, using, for primers, fuse that has been crushed or walked on, and the improper spacing of holes.

Non-preventable misfires are caused by defective fuse and destruction of fuse by water pressure caused by firing holes in dense ground filled with water.

Misfires due to mishandling are often the result of cutting fuse with a dull instrument, cutting fuse at a slant, using a narrow-jawed, ring cutting crimper, the non-seating of fuse against the cap composition, using fuse for a sling or belt before attempting to use it for its normal function, placing a foreign substance between the ends of the fuse and the cap composition, and the use of oil, grease, gasoline, distillate, or a paint containing turpentine or linseed oil in the mistaken idea that it will exclude water from the fuse.

---

*Abstracted from Bulletin No. 9 of the Industrial Accident Commission of the State of California.

[1] Tamping.

Additional Causes of Misfires

Certain causes of misfires have been overlooked by the underground staffs of properties registering complaints. Such causes include the following:

1. Fuse powder has been knocked from the end of the fuse by the use of a wire brush, in a misguided attempt to clean the end of the fuse before it was inserted in the cap.
2. Axle grease had been smeared on the entire 50-ft. length of the fuse before it was cut into the desired lengths for blasting.
3. A mixture of black powder and guncotton that had been allowed to become wet was placed in the caps before the fuse was inserted.
4. Fuse had been placed in a warm room for several days before it was used, after being capped and dipped, in some cases in light grease and in others in cable dressing.
5. Fuse had been capped and hung submerged in a barrel of oil several hours before using.
6. Fuse had been allowed to hang on nails, underground, for days and even weeks before use.
7. Fuse was cut, capped, and then piled on the floor of the drift for weeks before an attempt was made to use it.
8. Large quantities of fuse were hung on nails, for long periods of time, before use. This caused a fracture of the powder train.
9. Primers were placed over the crossbar of the cage, and jerked down sharply to hold them on the bar while being lowered into the mine. The jerking was sufficient to fracture the powder train of the fuse.
10. Defective caps. These caps had been spoiled by exposure to steam and moisture.

Another cause of misfire, not so generally recognized as it should be, is the sweep of the air returning to place during blasting operations. This feature is most noticeable in development work, and particularly in massive ground. The displaced air returning to place causes several things to happen. The most common is the throwing of powder out of untamped holes; another, in wet holes, is the driving of the water with great force into the powder cartridges. This at times will so completely surround the powder with water as to cause an imperfect shot. Still another is the destruction of the fuse in the hole that is wet through saturation.

Causes of Uneven Burning

A common cause of uneven burning is that a mining company often allows a warehouse man to pile an incoming shipment of fuse in front of the shipment already in stock. Where this is done trouble results for the reason that with age fuse slows down in burning speed. An attempt to use fuse that has been stored for months in a warehouse in combination with a fresh shipment has been known to spoil many a round of holes.

Methods and materials used in stemming cause variations in burning time as high as 80%. The normal speed on the Pacific Coast is 40 sec. per ft., when the fuse is burned in the open at sea level. Investigation of reports of uneven burning time in development work brought to light a curious circumstance: In a majority of the cases investigated it was discovered that the holes that were reported to have gone out of their turn, and thus spoiled the round, were the lifters.

Questioning of the miners who had loaded and fired such rounds showed that they all believed that "the fuses in the lifters had to stand the jar and vibration of all the other holes in the same round, and for that reason should be located as deeply and tamped as securely as possible." Following that line of argument, the miner loaded the primer in the point (bottom) of the lifter and also tamped it. The lifters were usually the only holes in the round that were carefully tamped, and the placing of the primer in any one of the other holes was largely problematical, usually at some point in the hole that suited the fancy of the particular miner loading the hole. The result of this method of loading was that the lifter would fire out of rotation and spoil the round. The speed of the fuse in the lifters was governed by the pressure exerted on it for considerable length by the explosive load and the stemming. This caused rapid burning.

Although the mining company, as a general practice, should not attempt to settle the much-mooted question of the most desirable position of a primer in a hole, it should insist that, if good results are expected from safety fuse in regard to even burning, the primers in all the holes in the same round should be subjected to about the same pressure on relatively equal lengths.

Another cause for uneven burning for which the fuse is in no way to blame is the improper spacing of holes. This practice often causes holes to fire out of rotation, owing to ground squeeze created by firing holes drilled too closely together. If a mine inspector receives complaints that lifters are missing in wet ground, he should carefully determine whether too close spacing of holes, instead of defective fuse, is not responsible for the trouble. Where the holes immediately above the lifters are drilled too close to them, their bursting causes the water in the lifters to drive laterally through the fuse, in many cases destroying it. This trouble can easily be remedied in wet and damp ground by putting a reasonable burden on the lifters.

Elimination of Misfires

Having stated the causes of many misfires, let it be assumed that the fuse has been properly made and stored. What, then, may be done to eliminate much of the trouble? Consider first the making up of the fuse into a primer. (The term primer for the purpose of this paper may be considered to be a capped fuse.)

The first operation is cutting the fuse with a sharp instrument, square across. Never fail to cut off a fraction of an inch from the end of a fuse that has been exposed to the air for any length of time, and never cut a fuse on a slant, as this may cause the sharp point formed by this kind of cut to double over in the cap barrel. This would cause the fire from the fuse to hit the side of the cap instead of reaching the cap composition. Next, care must always be taken to press the end of the fuse lightly against the cap composition before crimping. This precaution must be used so that no air space is left between the end of the fuse and the cap composition. A large percentage of misfires in mining is caused by not following this simple but vital practice. For the benefit of many persons who do not know the reason for the necessity of observing great care in this matter, the following explanation is offered, together with a simple demonstration to prove the contention:

Burning fuse generates about one and one-quarter liters of gas for each foot, and this gas is known, by analysis, to contain, roughly, 23% carbon monoxide and 33% carbon dioxide. An indefinite volume of the gases generated by the burning fuse precedes the fire in the fuse, through the powder train. The distance is governed largely by the jacket of the fuse and the condition under which the fuse is used. When fuse is burned in dry ground, unstemmed, the gas precedes the fire by only a short distance, but when burned in a wet hole where the water keeps the fuse jacket cool and holds down the side spit, the gas generated by the burning fuse is forced ahead of the fire, in many instances, as far as 24 inches.

It can readily be seen that under these conditions, if an air space is left in the cap barrel, and the cap is crimped tightly enough to retain the fire-extinguishing gases in the unoccupied space, the spit from the inclosed fuse end will not shoot forward with its usual heat and energy, but will simply bubble feebly and will not come in contact with the cap composition with sufficient heat to fire it.

A simple way to demonstrate this matter of gas preceding fire in a fuse is to take a basin of clear water, submerge 2 ft. of a 3-ft. piece of fuse, and light the dry end. Before the fire in the fuse reaches the water level, gas will be observed coming from the submerged end. By the time the fire reaches a point about 9 in. from this end, the flow of gas will have become continuous and relatively large in volume.

For crimping a cap to the fuse, only a broad-jawed crimper should be used. This type of tool seldom cuts a cap shell. In cold weather fuse should be warmed slightly before uncoiling is attempted. In outside work fuse should be protected from dampness and the direct rays of the sun when circumstances force its being exposed to the weather for any length of time.

When fuse is to be used in wet work, it is well to seal the joint of cap and fuse with a suitable preparation. For this purpose P & B roofing paint having an asphaltum base, pine tar, and Celakap are recommended as the most suitable.

ERRONEOUS THEORIES

Some beliefs that time and constant repetition have caused to be accepted, but which are erroneous, are worth repetition.

The exterior appearance of a fuse is often taken as a reliable indication of its quality. Fuse of dingy appearance, however, is often excellent in quality. Some grades of fuse waterproofing will absorb the white material put on the outside, causing the fuse to become a dirty yellow color. This in no way affects the burning quality. A test would easily determine the quality of the fuse and avoid unnecessary complaints. Contrary to popular belief, the center thread is not chemically treated to assist in the burning quality of the fuse. The absence of the center thread will not alter the burning speed of the fuse; its function is merely to make a more certain flow of powder in the fuse-making machine.

It should be recollected that safety fuse is not intended to be tied into knots, nor is it designed to withstand other unnecessarily rough or careless treatment. If carefully handled, it is expected to serve as a reliable means of conveying fire to the charge. In only rare instances will safety fuse fail to perform its function if common sense is exercised in its use.

China's Richest Iron Mine

An agreement has been practically concluded with the Japanese government under which the immensely valuable iron mine of Feng Huang Shan, near Nanking, will be worked by the Chinese government, and steel will be manufactured by Chinese and Japanese, the latter providing 20,000,000 yen to carry out the work, states the *North China Daily News*. This means that the Japanese will acquire control of the total output of the mine. At present they are pressing for the right to take part in working the mine, and, pending a decision on this point, the final signature of the agreement is temporarily delayed. The Chinese have always steadfastly refused to part with this mine, and although the Japanese have long been anxious to obtain it, it is thought that the agreement has been made possible only by a resolution of the Chinese Cabinet transferring the control of the mine from the Ministry of Agriculture and Commerce to the Ministry of War. The Feng Huang Shan mine is the largest single deposit of iron ore in China. It is estimated to contain 50,000,000 tons of available ore.

Effect of Mining Patents

BY A. L. H. STREET*

In a suit involving priority of rights in a lode mining claim, the United States Circuit Court of Appeals, Ninth Circuit, lately declared that any invalidity in a certificate of location was cured by the issuance of patent covering the mining claim, the patent having remained unassailed (Butte & Superior Mining Co. *vs.* Clark-Montana Realty Co., *248 Federal Reporter, 609*).

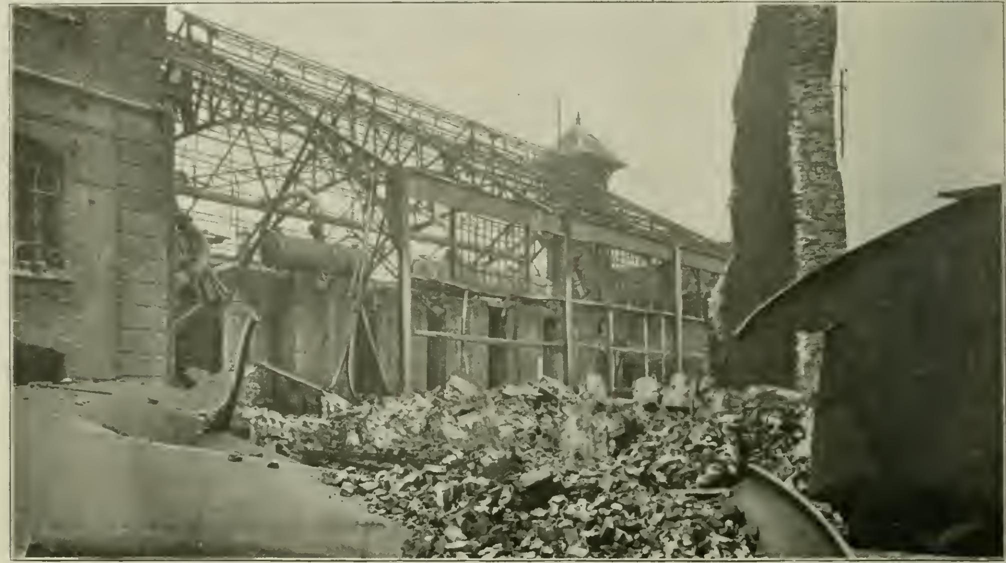
The decision follows the general rule of law, applicable to the Interior Department, that the finally expressed judgment of the department is conclusive as against collateral attack. Unless and until direct proceedings are brought to annul or limit the decision of the department in a given matter, the adjudication concludes dispute as to the existence of all facts upon which the decision legally depends.

The court cites a decision of the United States Supreme Court holding that a patent to a lode claim in Colorado carried, by conclusive implication, proof that a mineral vein had been discovered and that there had been compliance with all statutory prerequisites to valid title. Another decision of the same high court is cited on the point that issuance of a final receipt to a locator operated as a binding judgment that the location was valid, that assessment work had been completed, and that there were no adverse claims.

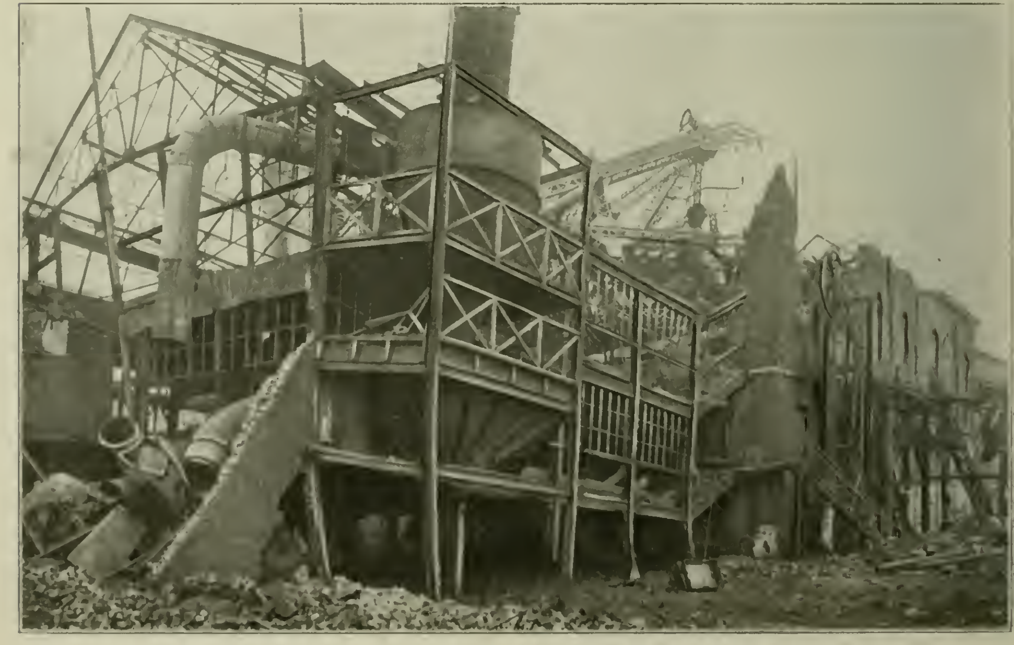
---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

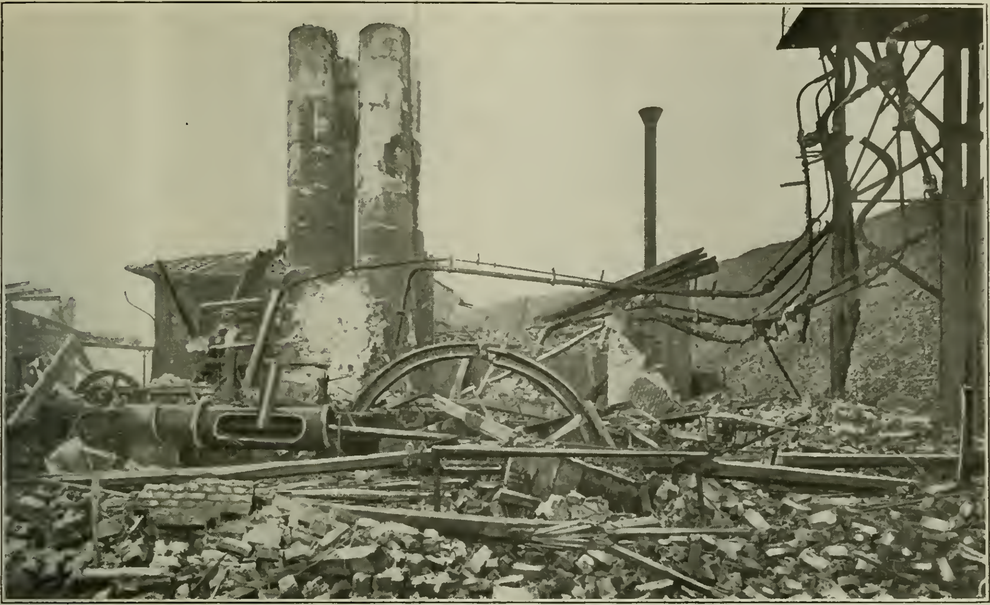
German Vandalism at French Mines



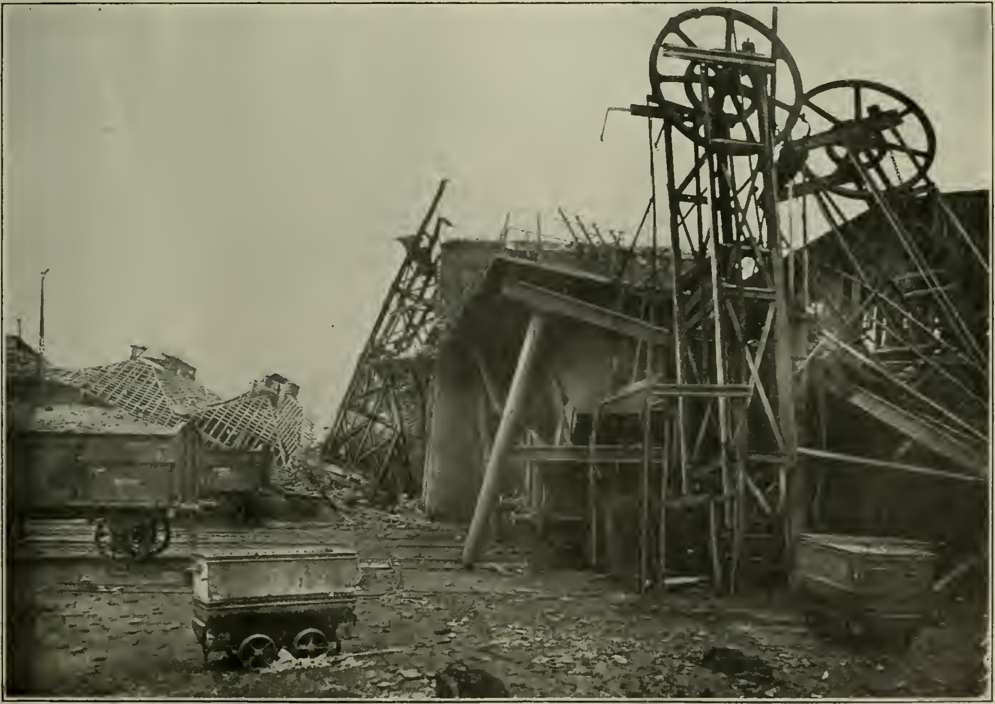
GERMAN DESTRUCTION OF MINE MACHINE SHOP AT DROCOURT, PAS DE CALAIS, FRANCE



REMAINS OF SURFACE PLANT AT COAL MINES AT DROCOURT, FRANCE



DESTRUCTION OF COMPRESSOR PLANT AT COAL MINES OF ANICHE, PAS DE CALAIS, FRANCE



HEADFRAME, SHAFT COLLAR, AND BUILDINGS AT ANICHE, DEVASTATED BY GERMANS

Anaconda Copper Mining Company

IN A PAMPHLET recently issued to the shareholders of the Anaconda Copper Mining Co., it is to be noted that the directors have authorized an issue of $50,000,000 ten-year secured gold bonds, and that $25,000,000 of said bonds, to be known as Series A, will be issued immediately under a trust agreement dated as of Jan. 2, 1919, with the Guaranty Trust Co. of New York. The issue has been sold to bankers. The bonds of this series bear date of Jan. 1, 1919, and will mature Jan. 1, 1929. The proceeds obtained from the sale of these securities are to be used for the equipment of the properties of the Andes Copper Mining Co. and the Santiago Mining Co., and to replace in current account part of the earnings which have been invested by the company.

It is purposed to proceed, as expeditiously as is consistent with prevailing conditions, with the construction of plant facilities for the South American properties, so that they may, at as early a date as is practicable, begin production, and thus contribute to income.

The method of financing decided upon was adopted for two reasons: First, because it was deemed more advisable to raise the necessary funds by a loan, which can be largely repaid from the earnings of these properties, when equipped, than to add permanently to the capitalization of the company. The shareholders will thus be assured of the profit resulting from these new enterprises, and the company will be strengthened by the addition of new mines of large tonnage to replace ore extracted from its producing mines. Second, because to continue to finance from earnings the requirements mentioned, properly chargeable to capital account, would impose an undue burden upon present shareholders.

ANACONDA COPPER MINING CO. EARNINGS

Year	Amount	
1913	$12,050,857.41	
1914	9,635,216.05	
1915	18,596,384.55	
1916	57,941,835.29	
1917	39,721,188.39	
Nine months to Sept. 30, 1918 (estimated)	27,115,499.01	
		$165,060,980.70

DIVIDENDS

Year	Amount	
1913	$12,997,500.00	
1914	9,077,500.00	
1915	9,325,000.00	
1916	17,484,375.00	
1917	19,815,625.00	
To Sept. 30, 1918	13,987,500.00	
		$82,687,500.00
Balance		$82,373,480.70

In connection with the issuance of these securities, the directors have submitted a summary of the combined results which have been obtained by the company and its subsidiaries (whose outstanding capital stocks are owned entirely by it with the exception of directors' qualifying shares), exclusive of the South American companies, which will be dealt with separately, during the period embraced from Jan. 1, 1913, to Sept. 30, 1918, the last-named date being the latest to which results can be ascertained with accuracy. This period covers not only the era of extraordinary industrial activity incidental to the conduct of the war, but also the period of rapid enlargement and expansion of the business of the company.

That a comprehensive idea may be obtained of the extent to which the company has been expanded and additional assets added, it is to be noted that, during the period under consideration, upon a conservative basis there has been added, in fixed assets, investments, and new mines in South America, values which exceed the par value of the total outstanding stock of the company, as shown by the summary of income, distribution thereof, and assets acquired.

During the period from Jan. 1, 1913, to Sept. 30, 1918, the company earned, after payment of interest but before depreciation charges, the amounts shown in the accompanying earnings and dividends table.

FIXED ASSETS

The fixed assets of the company and its subsidiaries show a substantial increase. the total under this heading as of Sept. 30, 1918, aggregating the sum of $155,687,252.75, an increase during the period of $59,109,457.61. The principal items of increase so classified consist of the following:

Metal mines and mining claims, coal mines and coal lands, and lands for reduction works, refineries, etc.		$6,598,215.51
Buildings, machinery, ventilating, pumping and miscellaneous equipment at mines	$3,639,493.23	
Buildings, machinery, equipment, etc., at reduction works and refineries:		
Washoe reduction works, Anaconda	11,938,868.35	
Great Falls reduction works	10,183,741.22	
Tooele and Miami plants	7,445,705.21	
Raritan Copper Works	8,326,771.33	
Miscellaneous subsidiary companies	1,575,562.81	
Miscellaneous subsidiary departments	756,288.37	
Total	$43,866,430.52	
Against the foregoing increase in fixed assets there has been charged for obsolescence and depreciation a sum aggregating	5,658,019.12	
Leaving a net increased amount of		38,208,411.40

INVESTMENTS

Inspiration Consolidated Copper Co., 250,900 shares @ $32.72 per share	$8,210,433.02	
Greene Cananea Copper Co., 69,600 shares @ $37.94 per share	2,261,437.11	
Arizona Oil Co., amount paid on 8160 shares	780,000.00	
Miscellaneous stock investments, Liberty bonds, etc.	3,050,960.27	14,302,830.70
Making the total as given above		$59,109,457.61

NOTE—The foregoing statement of increases in fixed assets does not include the South American properties, upon which, to Sept. 30, 1918, there had been expended $15,234,914.90.

In dealing with the general subject of earnings and fixed assets it is necessary to do so on a combined basis. That the shareholders, however, may be given a clear idea of the results obtained from expenditures made by the company in additions and extensions to its own plants and in acquiring its principal constituent companies and outside investments, the following memoranda are submitted:

The improvements and additions which have been made to the plants and methods devoted to copper recovery at the Washoe reduction works and the Great Falls reduction works have demonstrated that under conditions of cost which existed during the years 1911, 1912, and 1913, and the pre-war prices which prevailed for metals, these additions and improvements in practice would add approximately $8,000,000 a year to the net earnings of the company. Included in the above amounts spent at Great Falls and Anaconda, as shown under the heading "Fixed Assets," are expenditures made upon the new electrolytic zinc plant of the company. The total sum expended was $6,852,923, and the profit resulting from its operation during 1916 and 1917 was $5,250,201.

From the principal subsidiary companies and investments, the following results have been obtained during the period:

Inspiration Consolidated Copper Co.		
Cost 250,900 shares @ $32.72		$8,210,433,02
Dividends received	$4,544,700.00	
Annual return at present rate	2,007,200.00	
Greene Cananea Copper Co.		
59,600 shares @ $37.94		$2,261,437.41
Dividends received	$1,130,600.00	
Annual return at present rate	476,800.00	
International Smelting Co.		
Book value 120,000 shares		$12,000,000,00
Dividends received	$3,600,000.00	
Earnings from May 27, 1914, above dividends	974,864.73	
Total	$4,574,864.73	
International Lead Refining Co.		
Book value 7500 shares		$750,000,00
Earnings from May 27, 1914	$216,567.21	
Raritan Copper Works		
Book value 20,000 shares preferred and 40,000 shares common stock		$6,994,773,68
Dividends received	$3,030,000.00	
Earnings from May 27, 1914, above dividends	921,739.09	
Total	$3,951,739.09	
United Metals Selling Co.		
Book value 50,000 shares		$5,741,249,13
Dividends received	$3,700,000.00	
Earnings from April 1, 1915, above dividends	564,813.35	
Total	$4,264,813.35	

An appraisal of the securities enumerated at market value for those dealt in by the public, and upon the basis of actual value of assets owned by subsidiaries, where not so dealt in, would increase substantially the amounts at which they are carried on the books of the company. That it has been decidedly to the advantage of the shareholders to make the above investments has been, it is believed, amply demonstrated by the returns realized and the present prosperous condition of the business of the companies whose securities have been acquired.

CURRENT ASSETS AND LIABILITIES

The enlarged scope of the business conducted by the company has necessarily resulted in increasing materially its accounts of both current assets and current liabilities. In connection with its large custom gold, silver, copper, and lead smelting and refining business, and its zinc business, large sums of money are required to enable it to purchase and reduce ores, to carry stocks of metals, and to provide sufficient working capital to enable its operations to be conducted upon the present scale. The following table shows the current position as of Sept. 30, 1918, as well as the change during the period under consideration:

	Sept. 30, 1918	Increase
Current assets	$73,000,000.00	$44,500,000,00
Current liabilities	41,400,000.00	33,300,000.00
Net current assets	$31,600,000.00	$11,200,000,00

SOUTH AMERICAN PROPERTIES

The company has expended, through its South American subsidiaries, to Sept. 30, 1918, the sum of $15,234,914.90. Included in this amount are all items of examination, exploration, and development on every account, and also the purchase price paid for and all expenditures thus far made in connection with the properties of the Andes Copper Mining Co. and the Santiago Mining Co. Development work on these properties is being pushed as expeditiously as possible.

The Andes Copper Mining Co. has completed its wharfs and warehouses at Barquito, its Pacific port, has constructed an aggregate of 58 miles of main-line railroad, is working on the section of railway from mill site to mine, a distance of 5.5 miles; office buildings and houses for the accommodation of employees are rapidly being completed; a temporary power plant, transmission line from coast to mine, water supply line, and other necessary improvements, are under construction, and definite plans for permanent plant and equipment are now in course of preparation.

It is estimated that, in addition to the amounts which have been expended as above, there will be required to fully complete the equipment of these properties for an annual production of 140,000,000 lb. of copper, an additional sum of approximately $30,000,000.

The South American mines have not as yet been fully explored, but sufficient ore has been developed to insure, upon a basis of a cost of 9c. per lb. of copper, which is believed to be liberal, and a price of 15c. per lb., which is conservative, aggregate net earnings in excess of $100,000,000 within a period of 12 years after reaching the output for which plant and equipment are now being designed. Production will, it is estimated, reach the above amount of 140,000,000 lb. per annum within three years after orders for equipment have been placed, which will be done as soon as shipping facilities are assured. The minimum value of these properties may be indicated in terms of present worth, which it is calculated, after making provision for the complete amortization of all capital requirements, is as of Jan. 1, 1919, in excess of $60,000,000 net, taking only developed ore into consideration.

SUMMARY

The authorized capital stock of the company is 3,000,000 shares, which at $50 per share totals $150,000,000 The outstanding stock is 2,331,250 shares, having a par value of $116,562,500.

Within the period under consideration, there has been added to the company's assets the following:

Fixed assets	$44,806,626,91
Investments	14,302,830,70
Mining properties in South America, having a present worth in excess of all capital requirements	60,000,000.00
Total	$119,109,457,61

Against this increase in assets there has been issued but $8,250,000 par value of stock, which was paid to shareholders of the International Smelting and Refining Co., in part consideration for the acquisition of the shares of that company in 1914.

British Electric Steel Furnaces numbered 140 at the end of 1917, according to a report recently read before the Staffordshire Iron and Steel Institute, says *Iron Age*. These varied in capacity from one-half ton to 15 tons, and nearly one-half were in the Sheffield and Rotherham district. Furnaces of the arc type have established their superiority from a commercial point of view. It is stated that there are at the present time one or more 25-ton furnaces under construction.

Mining in Idaho in 1918

By R. N. Bell*

EXTREME shortage and poor quality of mine labor during 1918 caused a serious slump in the metal output of Idaho compared to that of the preceding three years. This shortage was particularly felt in the Cœur d'Alene district, which produced 90% of the lead-silver and zinc output of the state. The mines of this region have abundant ore reserves, owing to a well-advanced policy of development instituted by the big mines several years ago, but it was impossible to get the necessary labor. According to the best estimate possible at this time, the metal output of the state in 1918 was as follows: Lead, 296,803,425 lb.; silver, 9,203,897 oz.; zinc, 51,691,000 lb.; copper, 5,142,000 lb.; and gold, 24,827 oz. In 1917, the output was as follows: Lead, 395,000,000 lb.; silver, 12,496,000 oz.; zinc, 96,000,000 lb.; copper, 7,282,000 lb.; and gold, 53,000 oz. These figures were closely approximated in 1915 and 1916. The draft, enlistments, and war industries were directly responsible for the scarcity of labor.

The Bunker Hill & Sullivan company, the largest in the state and with a normal crew of 1000 men, contributed 300 men to the war's demands, and all other big mines of the state experienced a drain that reduced normal crews 30 to 50%. The Cœur d'Alene district was about 2000 men short throughout 1918. The high wages prevailing attracted plenty of common labor, but good miners were scarce, and the labor turnover was excessive. The progress of dead development work was retarded, as a result, in the big mines, and new development enterprises were largely at a standstill owing to high costs. From the start of the Great War to the present time, the big mines have been largely operated on proved ore resources. What new work has been accomplished, however, has shown marked results, especially as to persistency of ore channels.

Ore Persists in Deep Levels of Bunker Hill

The persistency is particularly true of the Bunker Hill & Sullivan mine, where sufficient dead work was done at the deepest point, which is 4600 ft. on the dip and 3400 ft. vertically below the surface. Here the main ore channels were intersected and even the narrower ore-bearing fissures were found to be in normal condition as to position and character, with no sign of deterioration or exhaustion.

The Hecla mine, at Burke, likewise is making the best showing of its history in its deepest working levels. The Hercules mine, in its three new stoping levels below the lowest drainage entry, still displays its characteristic large stope faces of galena. Stations are being cut at the 2800 and 3000 levels, preparatory to crosscutting and drifting.

At the Tamarack & Custer Consolidated, one of the newer producers, crosscutting and drifting on new ore courses gave good results in 1918. This mine, like the Hecla, now exhibits zonal proportions, including a trunk channel up to 40 ft. in stoping width and 1400 ft. long, with three closely parallel veins, recently opened, of good length and width. It made a daily output of 450 tons throughout 1918, with an underground crew of 120 men; and has a present depth of 1200 ft. It is under the control of the Day brothers.

With the return of the men from the Army and Navy and of war-industry workers, the labor situation materially eased up in December, but the rapidly falling lead market and apparent glut of metal, with high operating costs still prevailing, cast a gloom over the industry. If the period of reconstruction to normal business conditions can be sanely accomplished, the Cœur d'Alene district can continue to maintain its standing as a lead-silver producer for years, as it has weathered the war draft in good fashion.

Idaho Continental Develops New Resources

One notable improvement in lead-silver resources was that made at the Idaho Continental mine, where a limited amount of new development demonstrated that three supposedly separate oreshoots were really one persistent channel. The extension beyond a short fault of several hundred feet of good stoping ground to the south was also revealed, which, together with the proved persistency of the vein in good ore croppings 2000 ft. north of the main lower-adit tunnel portal, indicates a persistent channel of galena nearly a mile long. This mine is situated 26 miles from the railroad, at Porthill, in Boundary County, near the Canadian line. Its isolated position has greatly retarded its progress. In 1918, the property shipped by motor trucks, over a rather difficult route, concentrates and crude ore containing 7,000,000 lb. of lead with 129,000 oz. of silver.

The ore of the Idaho Continental is similar to that of the Cœur d'Alene district, occurring in a clean quartzite formation resembling the famous ore-bearing Burke horizon of that district. A wagon road has been built on a uniform maximum grade of 4%, with a view to future equipment with a Shay railway.

North Star Ore Difficult To Treat

In the Wood River district of Blaine County, the Federal Mining Co., of Wallace, continued its efforts until September to solve the metallurgical problem involved in treating the ore from its North Star mine. By that date, it had its 150-ton mill working favorably and was producing 40% zinc concentrates. This mine developed zinc-lead ore carrying about 14% zinc, 8% lead, and 8 oz. of silver in bodies up to 20 ft. thick and proved for several hundred feet in length and depth. This interesting deposit is complicated from a metallurgical aspect by the fact that it contains an excessive proportion of arsenical iron sulphide and some antimony. In September, the slump in the zinc market made it practically impossible to market the product, and operating was suspended. About a year ago this same company was fortunate in picking up the Independence mine, which is on a vein parallel to the North Star less than a mile away.

The Independence differs from the latter, however, in that its ore is practically free from zinc and is easy to treat, consisting principally of sheared quartz with coarsely crystalline galena and little pyrites. The property has been developed with six levels, its main feature being an oreshoot about 80 ft. long with a maximum width of 30 ft. It is equipped with a small mill, and its old development has been materially extended, so that with little stoping, it has produced 25 tons daily of high-grade shipping mineral as concentrates and crude ore, the latter carrying 30 to 50% lead, with over two ounces of silver per unit of lead. The enterprise gives promise of success with further development. It is purposed to crosscut from the deep level of the Star mine to the Independence vein, a distance of about 3000 ft., which will afford a better outlet to the property and access to a new mill.

---

*State inspector of mines for Idaho, Boise, Idaho

Empire Mine Output Cut Fifty Per Cent

The Empire mine, in Custer County, recorded a 50% reduction in output in 1918, as compared to that in 1917, attributed to labor and car shortage, and made a yield of about 30,000 tons of crude shipping ore, containing about 5% copper, with several dollars in gold and silver. This property produces a siliceous fluxing ore that finds a ready market with the Salt Lake Valley smelters. A new aërial tramway, three miles long, was completed and put in operation during 1918, taking the place of the more expensive Shay road, which was six miles long on a 6% grade. The mine continues to exhibit its normal ore resources at the Albert tunnel level, 700 ft. deep, but the development at the 6000-ft. tunnel entry, cutting the ore 1600 ft. deep, was retarded by a shortage of labor.

Lessees at the Red Bird mine, near Clayton, in Custer County, shipped 40 carloads of 40% lead ore, with 30 oz. of silver.

In the Gilmore district, the Pittsburgh-Idaho mine completed the installation of a 250-hp. Diesel-engine plant for operating its compressor, hoist, and pumps, The new 700 level was opened, but an excessive flow of water was encountered that retarded production. This has now been substantially overcome, and the new level is producing better ore than any level above. The ore is still completely oxidized, indicating that, in spite of the water encountered, permanent water level has not yet been reached, and that the water troubles are due to leakage from a 6000-ft. drain tunnel that crosses the ore course at the 400 level near the shaft, a condition that may be cured by deepening and cementing the drain, and thus relieving the excessive pumping costs involved.

The Latest Out mine, adjoining, made one of the best productions of its history during 1918. This company is also operating the adjoining Gilmore company's property under lease through the long drain tunnel at a depth of 900 ft. under the surface of the mountain, where rich lead-silver ore has been found. A number of carload shipments have been made from the latter property.

New Copper Developments at Harmony Mines

Fifty miles west of Gilmore district, interesting new copper developments were made at the Harmony mines, the Pope-Shenon mine and the Torney mine. These properties are three or four miles apart on the same general strike, the ore occurring in pronounced sheared fissure veins, inclosed in siliceous schisty walls of pre-Cambrian formations resembling the Prichard formations of the Cœur d'Alenes. They each exhibit ore courses varying from 2 to 10 ft. wide, with average values of 3 to 4% copper. The three together produced eight carloads of crude shipping ore in 1918, the smelter returns ranging from 5 to 17% copper. All ore is conveniently situated within five to ten miles of the railroad at Salmon City.

An interesting deposit of zinc-lead mineral is being developed on Carmen Creek 10 miles east of Salmon City and is being equipped with a 200-ton mill. This exhibits a surface exposure, 600 by 900 ft., of what is believed by the owners to be a siliceous igneous formation. Dozens of shallow surface cuts over the area, 15 ft. deep at the maximum, show rich bands, up to two or three inches thick, of fairly clean zinc sulphide, with galena and disseminated iron pyrites. Zinc and lead are found also throughout the body of the rock, with some gold and silver.

Blackbird District Yields Cobalt Ore

An extensive group of claims, having cobalt sulphide ore, is owned by the Haynes-Stellite Co., of Kokomo, Ind., in the Blackbird copper district, 36 miles west of Salmon City. The property was operated throughout 1918 with a crew of 12 to 15 men. It is equipped with a 10-stamp mill and concentrating tables for preliminary testing purposes. High-grade concentrates were produced and shipped to Kokomo for further treatment. A new adit tunnel was driven several hundred feet on the strike of the main orebody, together with systematic crosscuts. A zone of cobalt-sulphide ore, of milling grade and from 60 to 100 ft. wide, was thus proved, as well as a course of high-grade ore 5 to 10 ft. thick.

The Blackbird district, in which this cobalt ore occurs, has been better known in the past for its copper prospects, the sulphide ore all being associated with cobalt and a little nickel. The ores occur in some instances as broad disseminations in black siliceous schist, grading at the northwest end of the district into eruptive granite and extensively intruded with dikes of diorite-diabase and minette. The district is isolated, being 36 to 40 miles from the railroad terminal at Salmon City. It can be made easily accessible by auto truck or railroad by way of Salmon River Canyon and Big Creek, the distance being about 80 miles.

A few miles south of the Blackbird district, at Prairie Basin, interest was stimulated during 1918 in the development of a gold-tin placer deposit, which has so far yielded 130 lb. of tin concentrates assaying 30% tin and $20 gold. Water is abundant for hydraulicking, and it is purposed to operate the property in 1919.

In Latah County, activity was revived during 1918 in the mica prospects of Mica Mountain, 30 miles east of Moscow. This district contains pegmatite zones up to 20 ft. thick, with segregations of high-grade mica "books" up to 10 x 18 in. in size. One of these properties has been developed and is 200 ft. deep and 500 ft. long. It has produced 50 cars of mica, which turned out 5% first-class sheets, 15% second class, and the remainder scrap. These coarse pegmatite deposits are numerous in the district.

The high price of quicksilver resulted in the further development of quicksilver deposits in the Yellow Pine mining district in central Idaho, 70 miles east of Cascade on the Long Valley branch of the Oregon Short Line Ry. The discoveries were originally made at the time of the Thunder Mountain boom, and lie only 10 miles east of Roosevelt, at the head of two tributaries of the South Fork of the Salmon River known at East Fork and Cinnabar Creek.

The original discoveries were made by Pringle Smith, who has done much development on a zone showing exposures of well-fissured ground on a quartzite-limestone contact. Cinnabar is disseminated throughout, with lines of enrichment in places several inches thick, the latter ore running as high as 5% quicksilver. There are also several exposures from 4 to 10 ft. thick, the ore running 20 lb. of quicksilver per ton. Later, the Fern mine was located and developed by Theodore Van Meter and associates, supported by local Boise capital.

A 100-ft. tunnel was run on the Fern property, developing a steep fissure vein, a foot to three feet wide, of high-grade cinnabar ore containing, on the average, 1% to 5% quicksilver. A small Johnson-McKay furnace was built on this property and operated for a short time last summer, producing 22 flasks of quicksilver, which were shipped to California and sold on the open market. The enterprise was poorly handled, and the extent and richness of the deposit remain to be proved.

As a result of these operations, a boom was started, and many claims adjoining the properties to the north and south were located. Other quicksilver prospects were discovered, but little development was accomplished before the close of the season. Two or three small crews are operating in the district this winter. Its geology is decidedly favorable to the occurrence of quicksilver ore, and it is possible that a productive district will ultimately develop at this point.

American Mining Congress Organizes California Chapter

Two hundred mine owners, operators, and oil men met at the Palace Hotel, San Francisco, on Jan. 15, at 10 a. m., having been called together for the purpose of organizing a California chapter of the American Mining Congress. From the registration it was apparent that the interest was not merely local, as Nevada, Oregon, Utah, Arizona, and Colorado were represented, and later discussion developed the fact that interest in formation of state chapters was widespread.

The session was called to order by Albert Burch, president of the California Metal Producers' Association, acting as temporary chairman. G. M. Swindell, secretary of the Los Angeles Chamber of Mines and Oil, acted as temporary secretary.

The principal speaker of the morning session was James F. Callbreath, secretary of the American Mining Congress, to whom is due the present success of the organization as a potent factor in the great constructive mining program now before Congress at Washington. Mr. Callbreath strongly urged the formation of state chapters to aid in the future program of the American Mining Congress. This program, as outlined, is more far-reaching and ambitious than anything yet undertaken, and includes a segregation of the mineral industry into eight divisions, such as copper, gold, silver, the non-metallics, oil, and three others, each to be represented in the American Mining Congress, in Washington, by a man who is an authority in that particular branch of the industry which he represents.

OBJECTIVES OF THE MINING CONGRESS

The main objects of the Mining Congress may be briefly stated as follows: To bring about Federal coöperation through research and investigation; to protect mining investors against fraud and misrepresentation; to promote safety and efficiency in mining operations; to secure uniformity in state laws governing mining operations under like conditions, and, especially at the present time, to aid in passing legislation for the relief of chrome, manganese, and pyrites producers.

For the financing of the activities of the Mining Congress, a system was prepared, similar to that adopted by the Arizona chapter on Jan. 13. This provides for a voluntary yearly tax of 10c. per $1000 of production, with a minimum fee of $60, and a maximum of $6000. This method seemed to meet the approval of the local gathering.

At luncheon, J. K. Lynch, governor of the Federal Reserve Bank, spoke on the "Relation of Mining to the Banking and Financial Interests of the Country."

At the afternoon session, a committee on organization consisting of George W. Starr, managing director of the Empire mine, Grass Valley; George W. Metcalfe, manager of the Mammoth Copper Co., Kennett; Murray Innes, quicksilver operator, San Francisco; Thomas A. O'Donnell, oil operator, Los Angeles; and G. M. Swindell, secretary of the Chamber of Mines and Oil, Los Angeles, was appointed to frame bylaws. A committee on membership, Edwin Higgins, chairman, and one on resolutions, J. H. Mackenzie, chairman, were also appointed.

The first day's proceedings closed with an address by H. Foster Bain, assistant to the director of the U. S. Bureau of Mines, his subject being "The American Mining Congress and the Bureau of Mines." At dinner, addresses were made by T. A. O'Donnell, on the "Accomplishment of the Oil Industry Toward National Welfare During the War Period," and by T. A. Rickard on the "Effect of Publicity Upon Mining."

On the morning of Jan. 16, Bulkeley Wells, the president of American Mining Congress, further outlined the work and scope of the congress. D. M. Folsom, former Federal oil director for the Pacific Coast, spoke on "Ore and Oil Land in Times of Peace." At luncheon, Judge John F. Davis pointed out the great need for a Secretary of Mines as a member of the Cabinet, and Frank B. Anderson, president of the Bank of California, addressed the meeting on "The Attitude of Bankers Toward Mining Investments."

At the afternoon session, organization of the California State Chapter was completed, and the following directors were elected: For one year, Andrew Carrigan, L. D. Gordon, M. H. Whittier, K. Kingsbury and Clifford G. Dennis; for two years, Albert Burch, George Metcalfe, W. J. Loring, E. J. Doheny and John Barneson; for three years, F. W. Bradley, T. A. Rickard, J. H. Mackenzie, L. P. St. Clair and M. H. Gallagher. The meeting was then adjourned.

The Future of Mexican Mining

FROM AN OCCASIONAL CORRESPONDENT

YOUR request for information respecting conditions as they affect mining in the districts with which I am familiar reached me while traveling in Mexico, but was not answered until I returned to the States. You know that the censorship on the American side is still in force in respect both to letters entering and coming out of Mexico. You also know that there are many employees of the Mexican government and of various revolutionary heads on our side of the line, and consequently there is always the possibility of casual remarks being translated and returned to headquarters, where they are not always read in the spirit in which they are written. Suggestions made for the benefit of Mexico at large are not always relished by the present government nor by revolutionary heads, and their authors may be treated most unpleasantly.

"Mexico for the Mexicans" is an expression that we frequently hear these days, meaning, literally, "there is no room here for foreigners"; and if we could get out with whole skins, or with a reasonable portion of the funds that we brought into Mexico to develop the mines, many of us would be glad to go, in spite of the fact that we were not only invited but urged to come and help her open her mineral and oil deposits.

MEXICO DEPENDENT UPON FOREIGNERS

But what would Mexico be without foreigners? Does she really need them or does she not? Does she need their initiative, energy and money?

One of the chief sources of national and state income is that derived directly or indirectly from the operation of her mineral deposits. Ownership is taxed, production is taxed, transportation is taxed, and imports consumed by the miners and laborers are taxed; indeed, were it not for these various taxes Mexico would be in sore straits for income and the wherewithal to maintain her government. Her agricultural possibilities are much overrated. True, she can raise cattle, cotton, corn, fruits, sugar cane and some other commodities, but large areas are so dry and forbidding that they can maintain but a sparse population. The country is not self-supporting. Along the coast line agriculture is of importance, but the area concerned is insignificant compared with the great stretches of table land of which only small sections have been brought under irrigation. There are extensive areas of this that might be irrigated, but the operation would require large expenditure of money. The individual farmer or rancher cannot do it. It is government business, and yet the government has no means of launching such projects.

Mexico needs this agricultural land, but she can only realize its possibilities through the use of foreign capital, and this cannot be secured unless a reasonable guarantee is given for the security of capital and interest. Today her mines are worked only half-heartedly, and she fails to see that lighter taxation would not only stimulate production in the operating mines but would result in the reopening of many closed properties. This would result in a net tax greatly exceeding that which she is now able to levy and collect.

It is not necessary to criticise the present government. The caliber of the men that constitute it is realized. Their idea seems to be to levy a tribute as great as the traffic will bear; and they constitute themselves the judges of this. The old Cientifico group understood better the principles of economy. They were satisfied with a reasonable tribute, and the country prospered under them. Whatever may be the desire of the better element within or outside of the government circles, it is powerless, because of the much greater number of incompetents who would not hesitate to again overturn the government if too great pressure were brought to bear in an attempt to curb their actions.

During the revolution, which goes merrily on, the loss of foreign-owned property has been great. Claims have been presented, but no serious efforts have been made to adjudicate the losses or to reimburse the losers. The claims of foreigners are still pending, and, so far as we are informed, no government has taken any steps to back up its nationals in securing redress.

LOSSES INCURRED BY MEXICANS

The losses among the better class of Mexicans have been heavy. The large *haciendas* have been stripped of their livestock and agricultural implements, and then their owners have been told to pay their taxes. Robbed of money, livestock, and tools, it is not an easy matter to set things going again, let alone pay heavy taxes.

The destruction of railway property—bridges, track, engines, and cars—has been enormous. The whole country is suffering for lack of rolling stock, and business on several lines is practically at a standstill for the want of it. A large portion of Mexican freight is now handled by private companies using their own cars and locomotives with the aid of the Mexican railway employees and under the direction of the Mexican railway officials. Among those operating in this way are the American Smelting and Refining Co., American Metal Co., International Ore Co., Mazapil Copper Co., Teziutlan Copper Co., Monterey Mining, Smelting and Refining Co., Guillermo Colignon, and Republican Mining and Metal Co. No interest has been paid to the bondholders of the railways for five years, notwithstanding the fact that a tax was collected for this purpose.

One thing that is extremely aggravating and that militates against further resumption of business is the frequent issuing of decrees, which order one thing today and something else tomorrow, so that no one knows where he stands or what he can depend upon. It is generally supposed in the States that there is a Mexican Congress that is responsible for the laws. There is a Congress, but such laws as we are now trying to obey come by decree from Carranza.

It is strange that Carranza and his associates should have such a hatred for Americans, for he occupies his present position because of the action of our Executive in respect to Mexican affairs a few years ago, and every official move on the part of the United States has been of a friendly nature.

One of the petty annoyances that we suffer is that respecting passports at the Mexican border. As a war necessity the United States Government required everyone leaving the States to obtain a permit from Washington. When this order was issued the Mexican Secretary of Foreign Affairs issued instructions to the effect that no one be allowed to enter Mexico without his passport first being viséd by a Mexican Consul, and this may be done only on written permission from the Mexican government. The necessary correspondence requires about 20 days. The visé is good for only one occasion. This is exceedingly vexatious to those who are doing business in the two countries and are frequently making trips to and fro. There are, of course, ways of cutting red tape, but they are not creditable to us nor to the Mexican officials. We are informed that all this is in retaliation because our Government required residents to account for their migrations during war time.

Another inconvenience to which travelers are subjected is that of fumigation at the border. When typhus was raging throughout Mexico about two years ago there was good reason for fumigating all baggage coming into Texas from the south. This necessity certainly does not now exist. Here, again, Mexico retaliated, but in practice the operation seldom goes beyond the necessity of paying the fumigation fee, after which the baggage passes on as clean.

Some one has said that "peace still rages in Mexico." Villa is at his old stand in Chihuahua and Durango; Zapata in Morelos; Palaez and Cedillo in Tamaulipas. Aguilar is in Vera Cruz dynamiting trains from time to time as they pass to or from Mexico City. Eulalio Gutierrez, one-time president of Mexico, is in San Luis Potosi and Zacatecas, and Chevez Garcia is in Jalisco. These are the names we hear quoted in the north as bandits of no mean type, but it is doubtful if they are doing any more toward destruction of Mexico than the recognized government. Indeed, it is a common experience to hear of more severe treatment at the hands of the present military officials than at the hands of the so-called bandits, many of whom were at one time loyal Carrancistas. To a foreigner there appear to be two types of bandits—those who are in power, and those who would like to be there, but. lacking that advantage, must make a living anyway.

We long for the time when our Government may give some attention to this distracted country and may lend a hand to save the Mexicans from themselves.

Chemical Alliance Extends Its Scope

At the second annual meeting of the Chemical Alliance, held at the Biltmore Hotel, New York, on Jan. 23, the question of the continuance of the organization was discussed and voted upon. The president, Horace Bowker, outlined the history of the Alliance, particularly with reference to the assistance given to the Government during the war, recalling the fact that it superseded and absorbed the Advisory Committee on Chemicals of the Council of National Defense. Its function, as defined in strict accordance with the conditions prevailing at that time, was that of a war agency, and the question arises as to whether the signing of the armistice and the imminence of actual peace should indicate the desirability of its dissolution, either now or in the near future.

Although obviously created for war purposes, the need of such an organization, as representative of the entire chemical industry, will be, during the reconstruction period, as great as or greater than it has been in the past. Studied consideration must be given to three important problems which face the industry at the present time. The first of these is in connection with the urgent need for the validation of war contracts, involving vast expenditures on the part of the industry, which were not executed, in the stress of wartime haste, with due regard to all the necessary legal formalities. In many cases such a procedure was impracticable. In others it would have entailed an unjustifiable delay.

In the face of existing legislation the Government cannot pay any debts incurred under such circumstances, although the moral obligation in the matter is unquestioned. Legislation must therefore be enacted to remedy the existing status. The matter is well in hand, and adequate protective action is already under consideration.

The second question which demands consideration refers to the resale of material bought by the Government under war contracts and to be resold as soon as practicable. Some business dislocation has already been caused by inconsiderate action in this connection, and the best means of avoiding further trouble is occupying the attention of the Alliance. The third question of importance refers to the possibility of expanding foreign trade in chemical products.

It was announced that the board of directors had decided to support any scheme for the continuance of the organization in its present form. The proposition was put to a vote at the general meeting, and there was unanimous concurrence. The special committee which has been appointed to study the question of foreign trade is now to act under the ægis of the Alliance, and expects to report its findings within two months.

Foreign Trade in Copper

Exports of copper from the United States in November, 1918, and for the first 11 months of the year, are reported by the Department of Commerce as follows:

	Nov., Lb.	Jan.-Nov., Lb.
Ore and concentrates metal contents	51,500	3,249,839
Unrefined, in bars, pigs, etc	110	14,015,823
Refined, bars, etc	44,582,955	645,128,960
Old and scrap	22,400	257,403
Pipes and tubes	581,992	3,948,432
Plates and sheets	168,530	14,211,152
Wire, except insulated	965,295	14,353,361
Composition metal, copper chief value	20,064	151,680

The weight of ore exported in November was 130 long tons; and of concentrates, matte and regulus, 105 long tons.

Imports of copper into the United States in November and for the first 11 months of 1918 are reported by the Department of Commerce as follows:

	Nov., Lb.	Jan.-Nov., Lb.
Ore and concentrates, contents	8,420,871	114,095,936
Matte and regulus, etc	6,978,944	32,924,521
Unrefined, in bars, pigs, etc	22,293,791	351,965,947
Refined, in bars, etc	3,132,388	15,400,209
Old, etc., for manufacture	299,641	1,273,882
Composition metal, copper chief value		202,675

Material imported in November was 18,256 long tons ore, 12,729 long tons concentrates and 5451 long tons matte and regulus.

Assayer and Chemist

Determining Dissolved Oxygen in Water*

By Isaac S. Guest

The determination for dissolved oxygen is not usually made in the examination of water, but in the making up of standard solutions for oxidizing purposes the oxygen content of the water used should be known. The latter is only necessary in the most accurate work. The solutions used are: potassium permanganate, 4 gm. per liter; potassium oxalate, saturated solution; sulphuric acid, 1 to 5 or 6; manganous sulphate, 350 gm. per liter; alkaline potassium iodide, 400 gm. KOH, 150 gm. KI to make a liter of solution; N/40 sodium thiosulphate solution.

The sample is collected in a 100- or 200-cc. bottle the volume of which is known. Care must be taken that all the air originally in the bottle is completely removed before stoppering the bottle. If the sample is collected from a pond, or like source, it should be sunk beneath the surface, or if from a tap, a hose should be run to the bottom of the bottle and the water allowed to flow for at least 5 min. One cc. each of permanganate and acid should then be added, using a long narrow tube, releasing it at the bottom of the bottle. The stopper is replaced, the bottle well shaken and allowed to stand for 20 min. provided the color persists that long; if not, more permanganate is added. At the end of that time enough oxalate to decolorize it on standing a short time is added. The purpose of the process is to destroy any nitrite which may be present.

Two cc. each of manganous sulphate and alkaline iodide are then added in the same manner, and the bottle is stoppered and shaken and set aside for the precipitate to settle. Enough acid, about 3 cc., to dissolve the precipitate is then added. The solution is then poured into an Erlenmeyer flask and titrated at once, using the standard thiosulphate solution, with a starch indicator N/40 thiosulphate is equal to 0.0002 gm. of oxygen per cc., so the oxygen content of the bottle is 200 N/V, N being the number of cc. used to titrate, and V the volume of the bottle. The percentage of saturation is 20000N/VO, O being the solubility of oxygen in water at the particular temperature at which the sample was collected.

As the sample rapidly assumes the temperature of the air, the manganous and manganic hydrate should be precipitated as soon after collection as possible. After precipitation, it may stand some time without harm. After the liberation of the iodine, it should be titrated immediately, as standing in light decreases the iodine content and standing in the dark increases it.

To determine the oxygen content of the reagents, a blank may be run, using oxygen-free water. This is prepared by precipitating manganous hydrate in a large bottle of water and allowing it to stand. The manganous hydrate gradually is oxidized to a mixture of the -ous and -ic hydrates. The sample should be taken from the bottom, using a bulb and a tube extending to the bottom of the bottle. This blank is seldom necessary, as the amounts used of the reagents are small and the oxygen in them is generally low.

---

* Abstracted from *Chemist-Analyst.*

Time Limits for Analyses

Years of actual experience in the metallurgical laboratory have shown the following time limits to be practicable for rapid determinations without impairing the accuracy of the results obtained, says A. F. Macfarland in *Iron Age.* One man performs the analysis, and his time is counted from the moment he receives the drilled sample to the time the written report is ready: Carbon, 10 to 13 min.; carbon and manganese, 12 to 14 min.; carbon, manganese and nickel, 14 to 18 min.; carbon, manganese, nickel and chromium, 22 to 28 min.; carbon, manganese and sulphur, 15 to 19 min.; carbon, manganese, sulphur and phosphorus (estimated), 18 to 24 min.; carbon, manganese, sulphur, phosphorus, nickel and chromium, 35 to 40 min. If other than preliminary tests are analyzed in the laboratory, as is usually the case with small steel plants, the chemist should be notified 10 or 15 min. before the preliminary sample is furnished, to enable him to make the requisite preparations.

Minor Economies in Assaying*

By T. Graham Martyn

A little economy that I effected about six years ago may be worth recording. By keeping an extra muffle door in use I do all the parting without any cost for heat either with primus or other burner or electric heater. A muffle door showing a good red heat over, say, half its inner surface is replaced by the spare one and carried into the parting room, laid, cooler side down, on a suitable non-conducting support, and propped up, if necessary, so that the hot side or top is level. A frying pan, preferably of aluminum, is placed on it; and the porcelain crucibles, as soon as the 1 to 2 nitric acid is poured into them, are placed one after the other in the form of a spiral, beginning on the margin and proceeding in clockwise direction toward the centre. A few moments' pause after the crucibles are filled and *in situ* suffices for heating the acid, and beads are flattened and transferred to them.

When the brick is too hot and the action becomes violent, the frying pan is lifted for a moment and three little pieces of asbestos board are placed on the brick to keep the frying pan from contact with the hot surface. The handle of the frying pan should be cut to a

---

*Abstracted from the *Journal* of the Chem. Met. and Min. Soc. of South Africa.

length of about five inches, with asbestos cord wound round it and made secure, so that it can be easily handled. When the acid treatment is considered sufficient, distilled water is added, preferably by siphoning over from a Winchester quart bottle placed on an adjacent shelf. The slightly cooled and diluted acid is poured off, the empty crucibles being placed, in turn, on the working bench, preferably on a square of asbestos board in the same spiral fashion. Wash water is run on and again poured off, and the empty crucibles are replaced on the frying pan, covered with a large filter paper, left about five minutes to dry, and then transferred to an annealing tray and annealed in a suitable muffle, preferably one reserved for this work, and having the slit at the back closed, to avoid drawing dust-laden air over the crucibles.

Titration of Copper With Cyanide*

By M. P. Applebey and K. W. Lane

The titration of ammoniacal Cu solutions with KCN ceases to give a sharp end point when the concentration of Cu is much less than 1 gm. per liter. Solutions of the alkali Cu carbonates in excess of Na_2CO_3 can be titrated directly with KCN with fair accuracy, even at concentrations of 0.1 gm. Cu per liter. Add the solution containing the Cu to be estimated to a warm solution containing about 70 gm. of anhydrous Na_2CO_3 and 50 gm. of $NaHCO_3$ in 500 c.c. Prepare a standard Cu solution by dissolving 0.1 gm. in dilute acid, and add slowly, with constant stirring, to 500 c.c. of the Na_2CO_3-$NaHCO_3$ solution; standardize the KCN solution against this solution as in the ordinary NH_4OH method. The double carbonate solutions are a deep Cu blue, quite unlike a Cu-NH_4 blue. On adding KCN, the color changes to a pale bluish purple, which on further addition of KCN changes to a grayish—the end point. The titration requires a good daylight and experience. The gray end tint is not permanent, the solution becoming clear and colorless after standing for a few minutes. It is, therefore, not possible to use one completed titration as a standard tint for subsequent titrations. The titer of the solutions depends to a small extent on the amount of $NaHCO_3$ used in making up the solutions so that it is necessary either to have approximate equal concentrations of NaHCO in the two solutions which are being compared, or to make an allowance for any difference in $NaHCO_3$ concentration.

Determination of Lead in Copper†

In the spectroscopic determination of lead in copper, an electric arc that may be controlled and maintained under constant conditions is utilized to melt a carefully weighed sample of the copper to be tested. This sample is placed within a cavity in the positive electrode, which is made of graphite. The negative electrode is of carbon and is so suspended that it may be rotated.

A spectroscope is so adjusted that the observer may see the lead-line, within the molten copper, as a bright, distinct line. With a stop-watch, the time is determined between the melting of the copper sample and the disappearance of the lead-line from the spectrum. This time is proportional to the lead content of the sample, the exact determinations depending upon the apparatus employed.

The apparatus is first calibrated by means of various samples of lead in which the content is known from comparative electrolytic analysis of the samples, and by checking routine analysis. Also by using synthetic samples made by adding a carefully weighed amount of pure lead to the required amount of pure molten copper.

The chief advantages are accuracy, speed, and facility of operation. The analysis can be made in a few minutes by the foreman of the refining plant, or a boy of high-school intelligence, and the process can be followed rapidly without the necessity of holding back the furnace for a chemical analysis. Even the final analysis made just before pouring, which requires great accuracy, can be made in a few minutes and is of greater accuracy than that of the chemical method.

The disadvantage of the spectroscopic method for determining the percentage of lead present in copper is that the method can be used only where the lead is uniformly distributed throughout the sample.

Determination of Molybdenum*

By C. S. Epperson

Owing to the increased importance of molybdenum, and the scarcity of published data, the method to be described for the determination of molybdenum in wulfenite ores may be of use to metallurgists. My own experience has shown it to be suitable when extreme accuracy is not required.

Weigh out 0.5 gm. of the finely pulverized ore and digest with 10 c.c. of HCl, and, after evaporating almost to dryness, take to fumes with H_2SO_4. The assay at this point is diluted and allowed to stand at a temperature of 80° for 10 min., so as to permit all anhydrous ferrous sulphate to dissolve. It is then filtered and the precipitate run for lead if desired. The filtrate is made alkaline with NH_4OH and the iron filtered off. At this point the Mo is in the filtrate, which is acidified with acetic acid, heated to 80° C. and titrated with standard lead acetate solution.

It is convenient to have the lead acetate solution to read c.c. to c.c. of the ammonium molybdate solution. Five grams of c.p lead foil is dissolved in nitric acid and taken to fume with H_2SO_4; the precipitate is then dissolved in $NH_4C_2H_3O_2$ and made strongly acid with acetic acid. Twenty-five cubic centimeters of the lead acetate is then titrated with the standard ammonium molybdate, in order to obtain the lead value of the acetate solution. The lead factor of the acetate solution multiplied by 0.4640 gives the Mo factor.

Impervious Concrete is now possible by the application of a liquid known as "Metalo," according to *Iron and Coal Trades Review*. The process, which is a secret one, accelerates the setting of the concrete and, in the case of reinforced concrete, it is said to produce greater adhesion between the metal and the concrete. The accelerated speed of setting and the greater density materially diminish the tendency to crack, and not the least important consideration is that porosity is entirely eliminated. It is claimed, further, that the application of "Metalo" to timber will harden it and render it waterproof and fireproof.

---

*Excerpt from the *Analyst*, and *Chemical Abstracts*.

†Abstract of a paper by C. W. Hill and G. P. Luckey, in Bull 1[illegible]3, A. I. M. E.

*Excerpt from *Chemist-Analyst*

Industrial News from Washington

By Paul Wooton, Special Correspondent

New Potash Bill Drafted

Control of imports of potash by a licensing plan is provided in the draft of a bill now before Senator Henderson, the chairman of the Committee on Mines and Mining. The bill has the approval of the Secretary of the Interior and is intended to safeguard the interests of the domestic potash producers until trade conditions are readjusted. The text of the bill follows:

A bill to safeguard temporarily, by a license control of imports of potash, the interests of domestic potash producers, until trade conditions are readjusted.

Sec. 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that, inasmuch as it is important for the national welfare and security to provide for an adequate and permanent supply of potash, and for this purpose to encourage the domestic production, manufacture, and recovery of potash, the Secretary of the Interior is hereby authorized and empowered to issue licenses from time to time, to persons, firms, or corporations, for the importation of potash, and from and after 30 days after the approval of this act no potash shall be imported into the United States without such license. Each license shall state the amount of potash which the licensee shall be permitted to import and shall be issued only on condition that the applicant has purchased or contracted, under guarantee satisfactory to the Secretary of the Interior, to purchase an amount of potash produced in the United States bearing the same ratio to the amount which he is permitted to import as the estimated total production of potash in the United States bears to the difference between this estimated total production and the estimated total requirements of the United States. Estimates of the total requirements and of the total production in the United States shall be made under the direction of the Secretary of the Interior at intervals of not less than six months, and as so made shall be taken as conclusive: Provided, That potash once reckoned in any transaction shall not be reckoned again: Provided, further, That whenever the Secretary of the Interior shall find that potash is not being produced, or is not likely to be produced, in time or at a cost to make it economically available in the United States in sufficient quantities to meet the requirements as estimated by him, or whenever he shall find that the price thereof is not fair and reasonable, he may issue licenses for the importation of potash in excess of the proportion fixed under this section.

Sec. 2. That there is hereby appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $150,000, to be available until June 30, 1924, for every expenditure requisite for and incident to making the estimates provided for in this act and for conducting investigations relating to the production of potash, including personal services in the District of Columbia and in the field, the purchase of filing devices and other office furniture and equipment, the hire, maintenance, repair, and operation of motor-propelled and horse-drawn passenger-carrying vehicles for field use only, to be expended under the regulations from time to time prescribed by the Secretary of the Interior: Provided, That not to exceed $30,000 shall be expended for the above objects during the remainder of the fiscal year ending June 30, 1919, and not to exceed $30,000 during each succeeding fiscal year until June 30, 1924.

Sec. 3. That five years after the proclamation of peace this act shall cease to be effective, all powers conferred thereby shall end, and the Secretary of the Interior shall terminate all transactions under this act.

H. S. Gale, the potash specialist of the U. S. Geological Survey, speaks as follows concerning the bill:

The proposed bill to insure the sale of domestic potash seems to be the most satisfactory solution of the problem that can be found. By allocating imported potash in the same proportion as domestic potash, the consumers' cost is not raised to the price paid for the domestic product, but is much lower. Under present conditions, for example, when the quantity of domestic production is one-fourth of that which may be assumed would be normally consumed, one part of domestic potash will be combined with three parts of imported potash, to be sold at the average price of the whole. Thus it affords an automatic method of safeguarding the domestic producer, insuring a market for domestic material at a price to be fixed by competition among domestic producers alone. The slight increase of the average price of potash to the consumer will not be a serious burden, and will at most be temporary.

Much of the uncertainty with regard to potash importations from Alsace was removed Jan. 24, when the War Trade Board announced that no Alsatian potash would be available before June. Domestic producers of potash have been insisting that an official statement be made which would clear up this uncertainty entirely. The Secretary of the Interior, it is understood, also will be requested to issue a formal statement with regard to the Alsatian potash situation. The official statement of the War Trade Board reads as follows:

France will be unable, at least until April, to ship potash from the potash mines of Alsace. The War Trade Board announced today that it has received authentic and official information to that effect from the French High Commission in the United States. These advices further indicate that for the next few months practically the entire potash output of the Alsatian mines will be urgently required for agricultural purposes in France.

It is the view of the War Trade Board, based upon this information, that, even under the most favorable circumstances, no potash from Alsace could be available in the United States for agricultural uses before June, 1919, and that, therefore, it will be necessary that the United States rely entirely upon its domestic potash production for the coming spring season.

Excess Labor Supply in Arizona

Every effort is being made by the Department of Labor to advertise the fact that a surplus of labor exists in Arizona. This is attributed to the curtailment in the production of copper. One of the department's announcements reads as follows:

The Federal Director of the U. S. Employment Service for the State of Arizona and the Arizona Labor Director have both wired the Federal Service urging that all discharged soldiers and sailors not formerly residents of that state be diverted from seeking employment there. Arizona is accumulating a large surplus of labor, and, owing to a heavy curtailment in the production of copper, opportunities for employment are rapidly decreasing.

For some time copper producers in Arizona have not been able to market the copper produced, with the result that there is now an immense unsold stock. On account of this condition, both smelteries and mines are shutting down, and thousands of men are being laid off. Up to the present about 30% of the normal number employed has been laid off.

The state purposes taking care of and providing employment for all returning soldiers and sailors who went from Arizona, but cannot take care of the thousands that are pouring in from other states, attracted by the reports that wages are unusually high in Arizona. Many of these men arrive practically without funds, only to find that there is little or no prospect of securing employment of any kind.

The Senate has passed a resolution by Senator Henderson making sure that the relief from assessment work on mining claims will extend to Alaska. Section 2324 of the Revised Statutes, which refers to annual assessments, dates from 1872. Annual assessment in Alaska, however, is covered by Section 5051 of the Revised Statutes, which dates from 1907. It was feared that the amendment to the former statute might not apply to Alaska, and Senator Henderson's resolution removes any possibility of misunderstanding.

Butte & Superior Profits

In opposing Minerals Separation's request for a Supreme Court injunction restraining Butte & Superior "from disposing of its assets pending action on the mandate of this (Supreme) Court," the last-named concern, after asserting its solvency and ability to meet any judgment, made the following statement:

> The alleged profits of $18,000,000 (named by Minerals Separation in its petition for restraining order) are all the profits . . . made in the conduct of both its mining and milling operations (including concentration) for the 12 years it has been engaged in the business of mining and milling ores. The statement in the petition regarding profits due to the alleged infringement (of Minerals Separation patents) are all based on mere speculation and conjecture, without any supporting proof.
>
> It should be understood that respondent is engaged not only in the business of concentrating ores, but is, at the same time, engaged in . . . mining and milling such ores before concentration—that is, taking the ores out of the ground, and grinding them so as to render them fit for concentration by non-infringing as well as alleged infringing processes.
>
> Mining and milling operations are separate and distinct operations, and are frequently conducted by separate and distinct companies. The ore when taken out of the ground is more valuable than when in the ground, and a profit accrues from this operation. The ore after preliminary milling is more valuable than when taken out of the ground, and a profit also accrues from this operation. The preliminary wet concentration of the ground ore . . . makes the resultant product more valuable than the milled ore, and a profit accrues from this operation.
>
> The alleged infringing operation . . . is the final concentration of the concentrates or tailings, . . . and the profit which accrues from this last operation is the only thing with which the petitioners are concerned.

Australian Mining in 1919

SYDNEY (N. S. W.) CORRESPONDENCE

Subject to metal prices and labor, some forecasts of Australian metal outputs in 1919 may be attempted.

Gold production will hardly be as much as in 1918, barring new finds, because the conditions which depressed production during the last three years will still obtain. The 1918 output may be put roundly at under 1,250,000 oz. Judging by the decreases since 1915, an estimate of just over 1,000,000 oz. for 1919 seems optimistic. It may be remarked that in West Australia fully 90% of the output is produced by about 12 mines, the remaining 10% coming from approximately 400 small mines.

Tin output may reach 3000 tons, but this seems doubtful, because the price is so much lower than in 1917-18. Even with the record prices, it may be recollected, the output showed little increases over that of 1916. An estimate of 2000 tons may be rather under the mark. Since the "control" has been lifted there is no difficulty about the disposal of the metal, which is on the priority list for shipping space.

It was recently announced that the sale of lead had been "arranged" for up to Mar. 31. The basis price in Australia, offered by the only customs works in operation, is £27 15s.; and, after Feb. 16, this price will be £20 pending "adjustments." The price arranged for is, of course, much below the London quotation, which is about £40. Under the conditions of price and scarcity of shipping space, it does not seem probable that the usual output of 160,000 tons per annum will be exceeded in 1919.

For all producing copper mines the Imperial contract ended on Nov. 1, 1918. It takes 60 days to refine their blister, and the present contract ended on Dec. 31, 1918. The two refining works, Wallaroo and Port Kembla, pay £80 as an advance pending realization in 1919. This does not cover costs except for Mount Lyell and Wallaroo. There seems, however, a good prospect of getting an extension of the contract to June 30, 1919. Under above conditions it does not seem likely that the usual output of 40,000 tons per annum will be attained in 1919.

It is plain that the extension of contracts with the Imperial government for the whole output cannot continue, and a return to pre-war conditions is inevitable, with the exception that the whole output will now be handled by one body—the Copper Producers' Association. The trial and test of the commercial efficiency of these Australian metal associations is now beginning. They will no longer be able to sell the whole output to one buyer, but will have to cater to the many smaller consumers. That is to say, they will have to trade on the London Metal Exchange.

These attempts to forecast conditions are overshadowed by the shipping scarcity, for accumulations of produce already sold to the Imperial government will take priority on any other produce during 1919.

Chilean Nitrate Movements

Shipments from Chile to the United States were still on a considerable scale in the first half of December last, namely, 97,000 tons, only 3030 tons to Europe, and 2800 tons to "other parts," according to the *Chemical Trade Journal and Chemical Engineer*. Although the monthly rates stipulated in the contract for 680,000 tons entered into between the nitrate of soda executive and the Chilean government have not been adhered to, the whole quantity has now been delivered, and it will be interesting to see how much nitrate will be exported during the next few months. British firms are not yet allowed to make independent purchases on the West Coast, and the big German houses in Valparaiso formerly transacting the bulk of the business are on the "black list," and consequently not doing business. In the meantime, the Allied governments, acting through their purchasing agents—themselves nitrate producers and exporters—are reselling in different quarters the large quantities no longer required for the manufacture of explosives. The legitimate trade is thus brought to a standstill until such liquidation is completed, and the nitrate producers who hold large unsold stocks are placed in an awkward position; it is the more tantalizing in that the depreciation of the Chilean currency has materially reduced the cost of production, as also the export duty equivalent, thus enabling the acceptance of lower prices if there were a free market. The Santiago Co. has announced the shutting down of its works.

Employment for Engineers

For the convenience of engineers returning from military service, a list of agencies is here given which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau: Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service: A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service: George W. Kirchwey, state director, 16 East 42d St., New York City.

27th Forms Permanent Organization

Our latest direct news from the 27th Engineers is through letters dated Dec. 30, 1919, but we hear from Washington that they have not yet embarked for home, although they are scheduled for early convoy.

Colonel Perry wrote that the $2500 for the boys' Christmas party, that we sent over from the Comfort Fund, arrived in due time, and Colonel Perry making a generous addition of his own, the boys had "some Christmas." Colonel Perry continued:

> As soon as the donation was received it was distributed to the several companies with instructions to the officers to get busy and rustle up the stuff for a real Christmas. Trucks were sent out to scour the countryside for pigs and poultry, and other trucks were sent to the market at Bar le Duc for various Christmas plunder, including cigars.
>
> The dinner was a great success. The boys all enjoyed themselves hugely and were more than grateful for the generous contributions of their friends in the United States, who made such an affair possible. There has been something of a shortage of rations lately, particularly in the line of fresh meats and fresh vegetables, most of which are being shipped to the 3rd Army in Germany, and this fact made the fresh stuff, which we were able to buy for the men, all the more welcome.
>
> While the dinner was in progress yesterday, Captain Norcross and myself made the rounds and took a vote of the men on the idea of making the Association of the 27th Engineers a permanent organization, with the men of the regiment and the men who have contributed so generously to its Comfort Fund as members. The membership fee is to be $1 a year, to pay for postage and keeping in touch with the men of the command. The idea is to have an annual dinner at some place or places to be decided upon later, when we can get officers and men together and talk things over. A motion to make the organization a permanent one was carried through with a whoop. W. R. Ingalls, of New York, was elected permanent president.
>
> We all feel we have been most lucky as representing an industry that has been so generous to its representatives. We also feel that we have been more than fortunate, since we could not do any mining, to be put at work which the men could do and do well.
>
> I want to say for the men that they are worthy of all the efforts that have been made in their behalf. No man could possibly have a better bunch of loyal, enthusiastic, and willing soldiers under him than I have had. We were all disappointed at the outset in not having any mining work to do, but that was soon forgotten when the bridge work once got under way. The men were at all times ready to fight on the drop of the hat, and never allowed discouraging features, like shelling or Boche aëroplane bombs, to interfere with their work. I wish they could have had a chance to go over the top with the infantry a few times; but this, of course, was not possible.

All who have not contributed to the Comfort Fund are urged to do so. No greater satisfaction can be obtained for the same amount of money.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$19,653.56
W. E. Defty	10.00
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
Interest to Jan. 1, 1919	105.30
L. W. Strauss	10.00
Total	$19,898.36

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Aëro Station Service

Major-General Squier told the American Institute of Electrical Engineers at a recent meeting of that body that under the effective direction of Major W. R. Blair, one of the most experienced aërologists of the United States, commissioned for the service from the Weather Bureau, about 20 upper-air stations were established in France and England, and a forecast based on data furnished by these stations was made regularly to the A. E. F. The use which such forecasts may serve, both in connection with the aviation mail service and ultimately with the transatlantic service, may be seen from the fact that above the level of 10,000 ft. 95% of the winds in both the United States and Europe are from west to east.

On Nov. 6, 1918, at Chattanooga, Tenn., a velocity of 154 miles an hour at an altitude of 28,000 ft. was observed. It is because of this westerly direction of these upper air currents that all of the long flights thus far made have been from west to east. The importance of a forecast of such currents for the purposes of long flights will be appreciated as soon as the foregoing facts are understood. An airplane capable of a velocity of 154 miles an hour in still air either would remain stationary or travel at 308 miles an hour, depending on whether it was headed into or with a wind of the velocity of that observed at Chattanooga.

Extensive War Plant To Be Sold

Ten million dollars' worth of equipment owned by the U. S. Spruce Production Corporation, with headquarters in Portland, Ore., is to be sold; and sealed bids will be received by the Sales Board in the Yeon Building, in that city, up to and including February 15.

The equipment, which consisted of everything from picks and shovels to complete railroads and mills, is in excellent condition, and much of it was never used, because of the abrupt ending of the war. It is believed that this is an opportune time for the sale, as the country is facing reconstruction and adjustment and many large projects will undoubtedly be instituted soon.

The equipment has been stored at Vancouver, Wash., where it may be inspected by interested persons, upon proper certification by the Sales Board in the Yeon Building at Portland, Oregon.

To Confer on Labor Situation

In view of the curtailment of the copper output which followed the signing of the armistice, and the consequent reduction of working forces, the Secretary of Labor invited the grievance committees of employees of all the copper companies operating in Arizona, and representatives of labor in Utah and Montana, to send delegates to Washington to confer with him on January 31.

"On account of the grave conditions confronting the copper industry," says the Secretary's telegram, "it is the desire of the Department of Labor to coöperate in securing the best possible working conditions during the readjustment period. Therefore you are respectfully requested to join with other grievance committees in the ——— district which may be selected in the same manner as you elect members of your own grievance committee; these delegates, with similar delegates from other districts in the state, to report at the Department of Labor in Washington, D. C., on the morning of Friday, Jan. 31, for the purpose of general conference with the Department of Labor."

The mining and metallurgical district of Russian Poland, occupied by the Germans since 1914, has been evacuated and is now in the hands of the Polish authorities. This releases the collieries and the zinc and iron works of Dombrowa, Sosnowice, and adjacent places.

Editorials

Progress of the Readjustment

WE DO not think that the readjustment of business in this country has progressed so far as two months ago there was reason to suppose it would have by this time. Indeed, we doubt if it has really begun in any broad way. Our reason for this opinion is the persistence of ideas, that we behold on all hands, that economic evils can and ought to be maintained. So long as such ideas prevail, real readjustment will be delayed. As it is, we have got to pay a big penalty for the economic crimes of the last two years. We cannot continue criminal policies and expect to thrive.

Granted, a very difficult situation has been produced. The industries were not free to regulate their own affairs, and their direction was taken over by inexperienced doctrinaires. What was deemed to be nonessential consumption was arbitrarily cut out, while junior officers, without any thoughtful estimates of military consumption, bought recklessly of goods produced by labor at a fantastic wage scale. The disclosures after the armistice showed the Government to be overbought in everything to a degree that was all but incredible. Even under normal conditions the absorption of such enormous stocks would be a matter of a long time.

Then the labor leaders assume the attitude that wages must be maintained on the war scale, for they say the cost of living is as high as it was. Some producers say that they will not reduce their prices from the war scale, or not materially, for their cost of production is so high that there is no profit even at present prices. Every economist knows that there are temporarily market conditions when cost of production has nothing to do with the price. We see such conditions prevailing in some markets right now.

In general, the argument that wages cannot come down owing to their not having risen as high as the cost of living is a fallacy. The best evidence is that average wages rose in about the same ratio as the average wholesale prices of commodities, but that the average cost of living did not rise so much. There is a slack between wages and cost of living that can be taken up, and of course will be.

The great trouble in speaking of this problem in erms of averages is the range between the extremes. Some big classes of labor have profited at the expense of other classes of labor, and the situation of some of the latter is now very serious. The labor leaders have not thought sufficiently about this, viz., that when they were getting more wages for one group—the steam railway men, for example—they were taking it out of another group, say the trolley-car men, but that is just what they were doing. Readjustment of this, which is going to be necessary, is not going to be easy.

The idea of merely tiding over a difficult period in industry, after which prices and wages would naturally be the same as they were in 1918, wherefore keep them there in the interval, is grotesque. Consumers cannot be taken by the scruff of the neck and compelled to buy on terms that the Government would pay when it was a matter of life or death. The only way they can be led to buy is to offer them attractive terms. Not getting them, they will not buy at all, and producers, being unable to sell their product, will have to cease producing. The men will have their old scale of wages, but the pay window will be closed.

Already is idleness spreading over the country in a way that is alarming the authorities. They are imploring the people to buy goods to keep the mines and mills going. The people are in the main the wage-earners themselves. They cannot buy goods in sufficient quantity at war prices. The only way of stimulating consumption is by offering lower prices, and first the prices will have to be lower than economic conditions of the period would indicate. But then once more is there the everlasting spiral of rate of wages and cost of living. Profits no longer enter into consideration, for capital knows well enough that temporarily it has got to forego all profit.

We think we can foretell the day when real, broad-scale readjustment in this country will begin. It will be that day when it becomes certain that the wheat market is going to be set free, and set free it must be, no matter what the cost in keeping the Government's word to the farmers. Then will the cost of living begin to fall, then may lower wages be kindly accepted, then may attractive prices for commodities be made, and then will the wheels of industry begin to hum again.

Standardization of Mine Cars

IN THIS issue we present an excellent paper by Prof. R. M. Raymond on mine-car standardization which was read at the Seventh Annual Safety Congress of the National Safety Council. The views expressed in the article will make a valuable addition to the series on standardization by Charles A. Mitke which was recently completed in the *Journal.* There are so many factors that contribute to the success or failure of an underground haulage system, from an economic as well as from a safety point of view, that it would be well if Professor Raymond's article be regarded as but one fundamental idea of several considerations that are necessary in underground transportation. Sufficient clearing space, proper maintenance of track and grades, and efficient arrangement of block signals are all subjects that warrant further discussion in this connection, and that form a considerable part of mine operation.

It not infrequently happens that a well-planned mine, particularly if it be one of comparatively short period of existence, will offer conditions at the latter part of its life which will differ to a great extent from those determining the original scheme. This refers particularly to flat-lying deposits, having a fairly uniform thickness and worked by one or another of the caving systems, where weight has a tendency to exert a lateral as well as a vertical pressure. The drifts, as originally planned, offered sufficient clearance and permitted ample room for transportation, removal of ore from chutes and contiguous operations. As the weight increased, the haulageways became smaller, and the problem of ore transportation required further planning. Such contingencies should be studied from the practical standpoint of dollars and cents, and not in a haphazard manner. Is it the more expedient for the mine manager to secure smaller equipment, which is more adaptable to the working space, or should he increase his opening area with the addition of more timber?

An analogous problem may arise concerning the track grades in the mine. A properly prepared, comparative cost sheet will often show that the mine management is using small equipment on heavy grades, whereas a slight expenditure would cut down the grade and permit the use of larger cars at a decreased cost in power account.

These suggestions are not in the nature of criticism, but are merely ideas inspired by a thoughtful reading of Professor Raymond's article. The paper, we believe, was written mainly for the propagation of the safety idea, but safety and efficiency go hand in hand, and the suggestion of a standardization of mine cars leads to the development of closely allied considerations in mine development and operation.

Technical Organization in Industry

THE saying that "peace hath her victories no less renowned than war" is as true as ever, but recent international happenings of great import were needed to bring home the fact that victory cannot be won in either instance without organized talent. Misdirected ability is less excusable than ignorance, because waste is unforgivable.

Events went well with Germany for many years. Early in 1917 the president of one of our greatest universities made the ominous remark, which was based on indisputable fact, that Germany was winning the war. In the light of more recent events the statement will bear a new analysis; and the lessons to be derived therefrom are of vital interest and significance.

Germany realized that her enemies were in earnest, and that they had men and materials in plenty. The morale of the armies of the Entente nations on the Western front, where the war would be won or lost, was and always had been excellent. French and British technicians were capable and even brilliant. Patent office records of the world's principal inventions during the past 100 years show that Germany is, comparatively speaking, low on the list. In resourcefulness both France and Great Britain, with their extensive colonies and overseas possessions, could justly claim a high place. Unlimited raw material was available for the Allied armies, whereas Germany was shut off from the rest of the world. On what controlling factor did the Central Empires rely to achieve their purpose? What lay behind the oft-repeated challenge as to the invincibility of Germany?

The passage of time enables one to view such happenings with due regard to their significance or insignificance in matters of great moment. Germany doubtless came to an early conclusion that, so long as she was opposed only by men and materials and valor and *esprit de corps*, her ultimate victory would be certain; for such qualities are no match against poison gas and other achievements of applied science. Great Britain's force of technical engineers, both in quality and quantity, was as great as or greater than her own, but security was felt in the fact that this talent would never be utilized, much less organized. Nothing could have given the German command greater confidence during the earlier stages of the war than the knowledge that British engineers—men skilled in mining, chemistry, and all the other vital branches of modern military engineering service—were offering themselves—nay, being urged by precept and advice—to squander their ability, experience, and worth as privates in infantry battalions. This fatal mistake did not lose the war for the Allies in Europe, but it took from them the credit of having ultimately won it unaided.

Germany's boasting lost none of its power or significance until it was realized that she was opposed by a nation where technical talent would be recognized and organized. She saw the writing on the wall when the fact was known that skill in engineering matters would be fully utilized in the United States, and that men of exceptional worth, in the same category as the chief of the chemical warfare service of the British Army, would not have to waste their time and talents, as he did, in the ranks, before they could rise to executive positions and so serve their country to the utmost of their ability. The impossibility of successfully opposing the organized technical talent of America was a potent factor in bringing home to Germany the knowledge that the end was near. The entry of the United States into the world war decided the conflict in favor of the Allies.

The lesson can be applied during the reconstruction period which is ahead of us. Real industrial progress is impossible without applied technical ability, and this must be fostered and encouraged. Our great technical and trade journals and engineering societies have done much. Our captains of industry must do more. Technical talent must be brought to light, and not allowed to hide itself under a bushel. For in peace time, as in war time, technology and scientific organization and management are the fundamental requirements for successful development. Recognition of circumstances and the realization of the facilities at command must come first. The utilization and organization of technical talent, to the utmost, must follow.

German Vandalism at French Mines

IN THIS issue, under the above caption, we publish photographs showing the destruction wrought by the Germans at some of the plants at French coal mines in the Valenciennes Basin. The story told by the photographs is a well-known one, and only bears out the statement that the ruthlessness of the Hun knew no bounds, whether it was destruction of industry, property, or lives. Little but a tangled mass of steel is left to mark a once-prosperous industrial center, a miscellany of ruin, unrecognizable for the most part.

The importance of the district, as a coal producer, will doubtless lead to a speedy reconstruction in that section, for the large deposits still remain; but engineers will realize that it is no easy task that confronts the French operators. Not only will the reopening of the enterprise require a vast amount of construction work, but the underground rehabilitation will be an immense undertaking.

The *American Machinist* has made the interesting suggestion that the great stock of machine tools accumulated by the United States Government, for which now it has no need, be applied to the equipment of a national system of trade training schools in which the mechanical talent of America can be fostered and developed. This looks like a good idea and much better than throwing all this surplus equipment on the market.

We are amply on record as having opposed the price-fixing of copper from the time when it was first suggested in 1917. We said in the course of numerous commentaries that the price-fixers were moving without any sense of perspective or any idea of patience; and that the copper market could have been handled by men experienced in it, without any price-fixing, with safety to the industry and with better advantage to the Government itself. As facts are now becoming revealed, and anticipating those that are yet to come, we believe that the historian of a few years hence will write of the Government nandling of copper as one of the colossal and egregious industrial blunders of the war, and one of the most troublesome in its after-effects.

BY THE WAY

The Rocky Mountain Club has been appointed the official representative of the State of Montana, to receive and welcome the returning Montana soldiers and sailors. Governor Stewart hopes to obtain an appropriation from the state to help carry out this work.

A soft blue-white diamond weighing 388¼ carats has been found at the Jagersfontein mine, Orange River Colony. This promises to become one of the diamond fields' historic gems. It is said to be the largest stone unearthed since the Cullinan diamond was discovered, in 1905. In the rough the latter weighed about 3000 carats. The Koh-i-noor weighs about 100 carats.

An amusing sidelight on the prosperity which the Cornish tin-mining industry is at present enjoying may be found in the fact that over 100 men on one well-known property received recently the first demand they have ever had for income tax, states the *South African Mining Review*. It was a new experience, which, naturally, most of them hardly relished.

Réaumur, the well-known French savant, is generally credited with the invention of the process of making malleable castings, which he described in a book published in Paris in 1722. However, a writer in a recent issue of *Stahl und Eisen*, says *Iron and Coal Trade Review*, states that Réaumur was anticipated by Prince Rupert, of the Royal Society of London, basing his claim on a statement printed in Dr. Joh. Joachim Becher's German book, entitled "Foolish Wisdom and Wise Folly," published at Frankfurt in 1682, according to which the prince had invented a process by which iron "could be made soft and ductile, so that it could be turned and used for making cannons of iron, which is not brittle but quite ductile, and, consequently, they are more suitable than those of ordinary gun-metal, their only drawback being that they were liable to rust." The writer quotes three patent specifications taken out in London by this prince, dated between Dec. 1, 1670, and the same day in 1671, relating to his process of softening cast or melted iron so that it may be filed and wrought as forged iron is. According to Becher the prince was carrying on his process in England on a large scale.

A dinner was recently given in New York complimentary to Col. William Boyce Thompson, in celebration of the successful work of the Home Paper Service, which was organized, with Colonel Thompson's aid, about a year ago, for the purpose of sending neighborhood newspapers to soldiers abroad. In the course of a speech upon this occasion, according to *Financial America*, Colonel Thompson said:

> Here we have had the advantage of free speech and free press Here we work under an agreement that the majority shall rule. We have schools and community houses and hospitals and playgrounds and have made some advancement in housing conditions and in improving the self-respect of the worker. But over there in those countries now torn by revolution, free speech and free debate were unknown The public will could find expression only in revolution. These men and women cannot be led very well just now; they cannot be coerced at all. These men and women are from the soil. Over 80% of them have made and will continue to make their living from the soil. That sort of humanity usually does not go far wrong if let alone to work out its own salvation. We have highly important duties to perform toward that section of the world, and we should divest ourselves of any intention of participating in their politics or internal difficulties. Some headway in such a move might be made if those countries had our advantages of education. If they had been given a free and enlightened press, the work of preparation for the exercise of reasonable republican government would have been far advanced But, over there they have got to build from the ground floor up. Without trying to control their inclinations in any way, surely we can offer to them sympathy and assistance. Above all, we can help them with our example.

Cap'n Dick had been watching the operation of an underground loading machine with much interest. "Dam-me," said he, " 'er do 'andle tha h'ore, doesn't un? Reminds me o' tha story o' Mother 'Oney's duck, 'er do. Jan Trebilcock were boardin' to Mother 'Oney's 'ouse, an' one moornin' 'e come 'ome from night shif'. T'were'nt quite time for breakfus', so Jan 'e figgered as 'ow 'e'd be a bit 'andy. 'Mother,' sez 'e, 'can I 'elp thee a bit?' 'Coorse thee can, Jan,' sez she, ' 'Ere; take this 'ere corn do, an' gaw h'out an' feed chickens.' So, dam-me, h'out gaws 'e with tha pail an' all, an' starts thrawin' corn to tha chickens. All at once Jan 'e looks daown an' sees one o' these 'ere ducks with a bloody gert bill. Never befoor 'ad 'e seen one o' they, un' 'ere wuz tha creature gobblin' corn as fas' as ever 'e could. Jan 'e turns an' runs back to tha 'ouse. 'Mother', sez 'e, 'w'ere's tha butcher knife to?' 'W'ot's for thee want tha butcher knife, Jan?' sez she. 'Never thee min' naow, Mother.' So she gives 'im tha butcher knife, an' h'out 'e gaws, grabs h'up that there duck by tha neck an' slashes, firs' daown one side, then on t'other o' tha bloody beggar's bill. 'There naow, gos' along do,' sez Jan, 'Fight fair, m'son, fight fair—naw shovelling gaws.' "

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

COPPER

10365—ALASKA—Gold, Silver, Copper and Lead in Alaska in 1917. G. C. Martin. (Mineral Resources of the U. S., 1917—Part. I; 15 pp.)

10366—ARIZONA—Copper Production in Arizona. Walter Douglas. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10367—LAKE SUPERIOR COPPER INDUSTRY in 1918. James MacNaughton. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10368—MARKET—The Copper Market in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1⅓ pp.) 20c.

10369—METALLURGY of Copper. Arthur L. Walker. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

10370—MONTANA—The Butte District in 1918. B. B. Thayer. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10371—PRODUCTION, ETC., of Copper in 1918. (Eng. and Min. Journ., Jan. 11, 1919: 1 p.) 20c.

10372—PYRITES—Chloridizing Roasting of Burnt Pyrites on the Ramen-Beskow System. Peter Klason. (Min. Mag., Dec., 1918; 13 pp., illus.) 40c.

10373—RUSSIA—Copper Deposits of the Caucasus. (Russia, Oct.-Nov., 1918; 3 pp., illus.)

10374—SMELTERS—Copper-Smelting and Refining Works of North America. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) List giving location, number of furnaces, etc., and capacities. 20c.

10375—UTAH COPPER ENTERPRISE—VI, The Mills. T. A. Rickard. (Min. and Sci. Press, Nov. 30, 1918; 12 pp., illus.) 20c.

10376—UTAH COPPER ENTERPRISE—VII. Flotation practice. T. A. Rickard. (Min. and Sci. Press, Dec. 7, 1918; 4¾ pp., illus.) 20c.

10377—UTAH COPPER ENTERPRISE—VIII. The Leaching Plant. T. A. Rickard. (Min. and Sci. Press, Dec. 14, 1918; 4½ pp., illus.) 20c.

GOLD DREDGING

10378—DEVELOPMENTS IN 1918—Dredging in 1918. (Eng. and Min. Journ., Jan. 18, 1919; 1 p.) 20c.

10379—TOPOGRAPHY AND GEOLOGY of Dredging Areas—I. Charles Janin. (Min. and Sci. Press, Dec. 7, 1918; 2 pp., illus.) 20c.

GOLD AND SILVER—CYANIDING

10380—FLUID TON, The. A. W. Allen. (Eng. and Min. Journ., Jan. 4, 1919; 1½ pp.) 20c.

10381—METALLURGY of Gold and Silver in 1918. A. W. Allen. (Eng. and Min. Journ., Jan. 11, 1919; 4¼ pp.) 20c.

10382—PRECIPITATION—The Application of Charcoal to the Precipitation of Gold from Its Solution in Cyanide. H. R. Edmands. (Bull. 171, I. M. M., Dec. 12, 1918; 10½ pp., illus.) Further contributed remarks on article previously indexed.

10383—PRECIPITATION—Zinc-Box Practice. A. W. Allen. (Eng. and Min. Journ., Dec. 14, 1918; 4¼ pp., illus.) 20c.

GOLD AND SILVER—GENERAL

10384—ALASKA—Gold, Silver, Copper and Lead in Alaska in 1917. G. C. Martin. (Mineral Resources of the U. S., 1917—Part I; 15 pp.)

10385—GOLD PRODUCTION—Report of the Committee on Gold. (Min. and Sci. Press, Jan. 4, 1919; 3¾ pp.) 20c.

10386—METALLURGY of Gold and Silver in 1918. A. W. Allen. (Eng. and Min. Journ., Jan. 11, 1919; 4¼ pp.) 20c.

10387—REFINING GOLD BULLION with Chlorine Gas and Air. Also discussion. R. R. Kahan. (Bull. 170 and 171, I. M. M., Nov. 14 and Dec. 12, 1918; 5½ pp.)

10388—SILVER in 1918. Edward Brush. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

10389—SMELTING AND REFINING of Cobalt Silver Ore. Sydney B. Wright. (Bull. 80, Can. Min. Inst., Dec., 1918; 3 pp.) 40c.

10390—TRANSVAAL MINING in 1918. H. F. Marriott. (Eng. and Min. Journ., Jan. 11, 1919; 3½ pp.)

10391—WESTERN AUSTRALIA—Gold Mining in Western Australia—VI. Thomas Buteman. (Chem Eng. and Min. Rev., Nov. 5, 1918; 4¾ pp., illus.) Continuation of article previously indexed.

IRON ORE DEPOSITS, MINING, ETC.

10392—BRITISH COLUMBIA—The Iron Ores of British Columbia. R. C. Campbell-Johnston. (Min. Journ., Dec. 28, 1918; 2 pp.) 40c.

10393—CHATTANOOGA DISTRICT—The Coal and Iron Resources of the Chattanooga District. E. M. Jones. (Am. Electrochem. Soc., May, 1918; 3 pp.)

10394—PRODUCTION, ETC., of Iron and Steel. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10395—UNITED STATES—Iron Mining in the United States. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

IRON AND STEEL METALLURGY

10396—BLAST-FURNACE PRACTICE—Dorr Thickener in Blast-Furnace Field; Used in the Clarification of Washer Discharge Water. It Eliminates Troublesome Problems and Yields Valuable Product. (Iron Age, Jan. 9, 1919; 4 pp., illus.) 20c.

10397—FERRO-ALLOYS in 1918. Robert J. Anderson. (Eng. and Min. Journ., Jan. 11, 1919; 2¼ pp.) 20c.

10398—MARKETS—Pittsburgh Iron and Steel Markets. B. E. V. Luty. (Eng. and Min. Journ., Jan. 11, 1919; 1½ pp.) 20c.

LEAD AND ZINC

10399—ALASKA—Gold, Silver, Copper and Lead in Alaska in 1917. G. C. Martin. (Mineral Resources of the U. S., 1917—Part I; 15 pp.)

10400—CONCENTRATION of Lead-Zinc-Silver Ore at the Zinc Corporation's Mine. Geo. C. Klug. (Min. Mag., Nov., 1918; 3 pp., illus.) 40c.

10401—FLOTATION—The Development of Galena Flotation at the Central Mine, Broken Hill. R. J. Harvey; also discussion. (Bull. 170 and 171, I. M. M., Nov. 14 and Dec. 7, 1918; 21¾ pp.)

10402—IDAHO—The Cœur d'Alene District in 1918. Stanly A. Easton. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10403—JOPLIN DISTRICT—Lead and Zinc in the Joplin District. Jesse A. Zook. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10404—LEAD PRODUCTS Other Than White Lead. J. R. Wettstein. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10405—METALLURGY of Lead. H. O. Hofman. (Eng. and Min. Journ., Jan. 11, 1919; 1⅔ pp.) 20c.

10406—METALLURGY of Zinc. W. R. Ingalls. (Eng. and Min. Journ., Jan. 11, 1919; 1½ pp.) 20c.

10407—NEW YORK—Genesis of the Zinc Ores of the Edwards District, St. Lawrence County, N. Y. C. H. Smyth, Jr. (Bull. 201, N. Y. State Museum, N. Y. University, Sept. 1, 1917; 39 pp., illus.)

10408—OKLAHOMA—The Miami District, Oklahoma. A. E. Bendelari. (Eng. and Min. Journ., Jan. 18, 1919; ¾ p.) 20c.

10409—PRODUCTION, MARKETS, ETC.—Lead in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1¾ pp., illus.) 20c.

10410—PRODUCTION, MARKETS, ETC.—Zinc in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1¼ pp.) 20c.

10411—SOUTHEASTERN MISSOURI LEAD DISTRICT, The. H. A. Wheeler. (Eng. and Min. Journ., Jan. 11, 1919; 1¾ pp.) 20c.

10412—TAILING—Treatment of Accumulated Tailing as Practiced by the Zinc Corporation. Geo. C. Klug. (Min. Mag., Dec., 1918; 3 pp., illus.)

10413—WHITE LEAD AND OXIDES in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10414—WISCONSIN—Zinc Mining in Wisconsin. J. E. Kenedy. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

OTHER METALS

10415—ALUMINUM—The Analysis of Aluminum Alloys and Metallic Aluminum. J. J. Fox, E. W. Skelton and F. R. Ennos. (Journ. Soc. Chem. Ind., Dec. 31, 1918; 5½ pp.)

10416—ANTIMONY in 1918. K. C. Li. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10417—CHROME—Recent Activities in the Quebec Chrome Industry. Robert Harvie. (Bull. 1, Can. Min. Inst., Jan., 1919; 3 pp.)

10418—CHROME MINING in Canada. Robert Harvie. (Eng. and Min. Journ., Jan. 18, 1919; 1 p.) 20c.

10419—CHROME ORE in 1918. F. F. Sharpless. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10420—MAGNESIUM in 1917. Ralph W. Stone. (Mineral Resources of the U. S., 1917—Part I; 5 pp.)

10421—MANGANESE ORE in East Tennessee. Henry V. Maxwell. (Eng. and Min. Journ., Jan. 18, 1919; ¾ p.) 20c.

10422—MANGANESE ORE in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1½ pp.) 20c.

10423—MOLYBDENUM Within the Empire. Sydney J. Johnstone. (Journ. Soc. Chem. Ind., Dec. 16, 1918; 2 pp.)

10424—MOLYBDENUM ORE MARKET in 1918. Charles Hardy. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c

10425—MOLYBDENUM ORES in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10426—PALLADIUM, SELENIUM, ETC.—Uncommon Ores and Metals in 1918. H. C. Meyer. (Eng. and Min. Journ., Jan. 11, 1919; 1¾ pp.) 20c.

10427—PLATINUM in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10428—QUICKSILVER in California. Murray Innes. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10429—QUICKSILVER in Texas in 1918. W. D. Burcham. (Eng. and Min. Journ., Jan. 18, 1919; ¾ p.) 20c.

10430—QUICKSILVER—Metallurgy of Quicksilver. Murray Innes. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10431—TIN—A Symposium on the Conservation of Tin. (Bull. 144, A. I. M. E., Dec., 1918; 36 pp., illus.) 40c.

10432—TIN—Slime Treatment on Cornish Frames: with Particular Reference to the Effect of Surface. S. J. Truscott. (Bull. 171, I. M. M., Dec. 12, 1918; 4 pp., illus.) Further contributed remarks on article previously indexed.

10433—TIN—The Cassiterite Deposits of Tavoy. J. Coggin Brown. (Rec., Geol. Surv. of India, May, 1918; 11 pp.)

10434—TIN Market in 1918. J. H. Lang. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10435—TUNGSTEN—The Metallography of Tungsten. (Bull. 144, A. I. M. E., Dec., 1918; 3¾ pp.) Discussion of paper by Zay Jeffries, previously indexed. 40c.

10436—TUNGSTEN INDUSTRY in 1918. George J. Young. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

10437—TUNGSTEN, MOLYBDENUM AND VANADIUM. E. S. Boalich and W. O. Castello. (Prelim. Report No. 4, Calif. State Min. Bureau, Mar., 1918; 34 pp.)

10438—TUNGSTEN ORE MARKET in 1918. Charles Hardy. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

NONMETALLIC MINERALS

10439—ASBESTOS—British Empire's Resources. (So. Afr. Min. Journ., Oct. 12, 1918; 1¼ pp.) 40c.

10440—ASBESTOS INDUSTRY in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ¾ p.) 20c.

10441—ASPHALT, Related Bitumens and Bituminous Rock in 1917. John D. Northrop. (Mineral Resources of the U. S., 1917—Part II; 20 pp., illus.)

10442—BARYTES AND BARIUM Products in 1917. James M. Hill. (Mineral Resources of the U. S., 1917—Part II; 7 pp.)

10443—FLUORSPAR AND CRYOLITE in 1917. Ernest F. Burchard. (Mineral Resources of U. S., 1917—Part II; 12 pp., illus.)

10444—GRAPHITE—The Canadian Graphite Industry. Hugh S. Spence. (Summary Report, Mines Branch of the Can. Dept. of Mines, 1917; 2 pp.)

10445—GRAPHITE MINING in New York State. D. H. Newland. (Eng. and Min. Journ., Jan. 18, 1919; ¾ p.) 20c.

10446—MAGNESITE INDUSTRY in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10447—PHOSPHATE ROCK in 1917. With Notes on Phosphorus. Ralph W. Stone. (Mineral Resources of the U. S., 1917—Part II; 12 pp.)

10448—POTASH in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10449—PYRITES, SULPHUR and Sulphuric Acid. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10450—STONE in 1916. G. F. Loughlin. (Mineral Resources of the U. S., 1916—Part II; 86 pp., illus.)

10451—TALC AND SOAPSTONE in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

PETROLEUM AND NATURAL GAS

10452—ENGLAND—Search for Petroleum in the Derbyshire Coalfield. T. Sington. (Iron and Coal Tr. Rev., Dec. 27, 1918; 1 p.) Conclusion of article previously indexed. 40c.

10453—ENGLAND AND WALES—Oil Deposits in England and Wales. (Iron and Coal Tr. Rev., Dec. 13, 1918; ½ p.) Conclusion of article previously indexed. 40c.

10454—MONTANA—Geology and Oil and Gas Prospects of the Lake Basin Field, Montana. E. T. Hancock. (Bull. 691-D, U. S. Geol. Surv., July 17, 1918; 48 pp., illus.)

10455—OIL SHALES—Oil-Yielding Shales in the Province of New Brunswick. Louis Simpson. (Bull. 1, Can. Min. Inst., Jan., 1919; 5 pp.)

10456—OKLAHOMA—Structure and Oil and Gas Resources of the Osage Reservation, Oklahoma. Wilson B. Emery, Denn E. Winchester, C. F. Bowen, and K. C. Heald. (Bulls. 686-B, 686-C, 686-D, 686-E and 686-G, U. S. Geol. Surv., 1918.)

10457—SCOTTISH MINERAL OIL INDUSTRY, The. (Journ. Soc. Chem. Ind., Dec. 31, 1918; 1¼ pp.)

10458—TEXAS—The Oil Fields of Northeastern Texas. W. L. Watts. (Min. and Oil Bull., Dec., 1918; 4½ pp., illus.) Conclusion of article previously indexed.

ECONOMIC GEOLOGY—GENERAL

10459—INDIA—General Report of the Geological Survey of India for the Year 1917. H. H. Hayden. (Rec., Geol. Surv. of India, May, 1918, 22 pp.)

10460—SOUTHWEST—Notes on Certain Ore Deposits of the Southwest. W. Toyole. (Bull. A. I. M. E., Oct., 1918; 13½ pp.)

10461—TESTS—Field Tests for the Common Metals in Minerals. Geo. R. Fansett. (Bull. 93, Univ. of Ariz., 1918-19; 21 pp.)

MINING—GENERAL

10462—ALASKA—Broad Pass, Alaska. F. Le Roi Thurmond. (Min. and Sci. Press, Jan. 11, 1919, 1¾ pp., illus.) 20c.

10463—AUSTRALASIA in 1918. W. P. Geary. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

10464—BRAZIL—Mineral Resources of Brazil. (The Statist, Dec. 14, 1918; 1¼ pp.) 10c.

10465—BRITISH COLUMBIA—Mining in British Columbia in 1918. Robert Dunn. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10466—CENTRAL AND SOUTH AMERICA in 1918. (Eng. and Min. Journ., Jan. 11, 1919, 4½ pp.) 20c.

10467—COLORADO—Mining in Colorado in 1918. Geo. E. Collins. (Eng. and Min. Journ., Jan. 18, 1919; 2½ pp.) 20c.

10468—CUBA—Mining in Cuba in 1918. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10469—DUST—The Effects of Dust Inhalation. J. S. Haldane. (Journ. of Chem., Met. and Min. Soc. of So. Afr., Sept., 1918; 5½ pp.) Discussion of article previously indexed. 60c.

10470—LABOR and Mining in 1918. F. F. Sharpless. (Eng. and Min. Journ., Jan. 11, 1919; 1½ pp.) 20c.

10471—MANITOBA—Mining in Manitoba in 1918. R. C. Wallace. (Eng. and Min. Journ., Jan. 11, 1919; ½ p.) 20c.

10472—MEXICAN MINING in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 1 p.) 20c.

10473—NEW CONSTRUCTION—New Mining and Metallurgical Construction in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 5 pp.) 20c.

10474—ONTARIO—Mining in Ontario in 1918. Thomas W. Gibson. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c.

10475—PUMP STATION—A Non-Drowning Pump Station. C. Erb Wuench. (Min. and Sci. Press, Jan. 4, 1919; 1 p., illus.) 20c.

10476—QUEBEC—Mining in the Province of Quebec in 1918. Theo. C. Denis. (Can. Min. Journ., Dec. 15, 1918; ¾ p.)

10477—SHAFT PILLAR—Notes on the Removal of a Vertical Shaft Pillar. J. Chilton. (Journ. of Chem., Met. and Min. Soc. of So. Afr., Sept., 1918; 2¼ pp.) Discussion of article previously indexed.

10478—UNITED STATES—General Review of Mining in the United States in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 5 pp.) 20c.

10479—WIRE ROPES—Interior Corrosion of Wire Ropes. Report of Wm. Fleet Robertson. (Can. Min. Journ., Jan. 8, 1919; 2 pp.)

FLOTATION

(See also "Lead and Zinc")

10480—DEVELOPMENTS in 1918—The Flotation Process. A. W. Allen. (Eng. and Min. Journ., Jan. 11, 1919, 3½ pp.) 20c.

10481—UTAH COPPER ENTERPRISE—VII. Flotation Practice. T. A. Rickard. (Min. and Sci. Press, Dec. 7, 1918; 4¾ pp., illus.) 20c.

ORE DRESSING—GENERAL

10482—CRUSHING RESISTANCE of Various Ores. (Bull. 142, A. I. M. E., Oct., 1918; 2¼ pp.) Discussion of paper by Luther W. Lennox, previously indexed.

10483—DEVELOPMENTS in 1918—Notes on Ore Dressing. A. W. Allen. (Eng. and Min. Journ., Jan. 11, 1919; 2 pp.) 20c

METALLURGY—GENERAL

10484—GRAIN GROWTH in Metals. Zay Jeffries. (Advance Copy, Inst. of Metals, Sept., 1918; 32 pp., illus.) 40c.

10485—NEW CONSTRUCTION—New Mining and Metallurgical Construction in 1918. (Eng. and Min. Journ., Jan. 11, 1919; 5 pp.) 20c.

FUELS

(See also "Petroleum and Natural Gas")

10486—PULVERIZED COAL—The Use of Coal in Pulverized Form. (Bull. 141, A. I. M. E., Dec., 1918; 4½ pp.) Discussion of paper of H. R. Collins, previously indexed. 40c

10487—WOOD—The Production of Power-Gas from Wood. Leslie B. Williams. (Min. Mag., Nov., 1918; 5 pp.) 40c

MINING AND METALLURGICAL MACHINERY

10488—ELECTRIC-FURNACE DEVELOPMENTS. J. Bibby. (Iron and Coal Tr. Rev., Dec. 27, 1918; 4 pp., illus.) 40c.

10489—ELECTRIC MOTORS—Cooling of Electric Motors, with Special Reference to Totally Enclosed Machines. P. A. Mossay. (Iron and Coal Tr. Rev., Dec. 13, 1918; 1½ pp., illus.) 40c.

MISCELLANEOUS

10490—AUSTRALIA—Impressions of Australia and the Australians. George C. Stone. (Eng. and Min. Journ., Jan. 4, 1919, 2¾ pp.) 20c

10491—CHRONOLOGY of Mining for 1918. (Eng. and Min. Journ., Jan. 11, 1919; 2½ pp.) 20c.

10492—DIVIDENDS—Mining Dividends in 1917 and 1918. (Eng. and Min. Journ., Jan. 11, 1919, 3 pp.) 20c

10493—ENGINEERING SOCIETIES—Consolidating the American Engineering Professions. A. D. Flinn. (Eng. and Min. Journ., Jan. 4, 1919; 2¼ pp.) 20c.

10494—GOVERNMENT OWNERSHIP—Should the Government Own the Telegraphs? Clarence H. Mackay. (Eng. and Min. Journ., Jan. 18, 1919; 2 pp.) 20c.

10495—ROAD MATERIALS—Non-Bituminous Road Materials. L. Reinecke. (Econ. Geol., Dec., 1918; 40 pp., illus.)

10496—RUSSIA—The Russian Industrial Nightmare. (Eng. and Min. Journ., Nov. 16, 1918; 1¾ pp.) 20c.

10497—STATE GEOLOGICAL AND MINING OFFICIALS. (Eng. and Min. Journ., Jan. 11, 1919, ¾ p.) 20c.

10498—STOCKS AND BONDS—Mining Stocks in 1918. (Eng. and Min. Journ., Jan. 18, 1919; 1¾ pp.) 20c

10499—WAR—A Review of the Work of the War Committee of Technical Societies. (Eng. and Min. Journ., Jan. 4, 1919, 2 pp.) 20c

10500—WAR—Mining Engineers in the War. F. F. Sharpless. (Eng. and Min. Journ., Jan. 4, 1919, 3½ pp., illus.) 20c

10501—WAR—Readjustment, Not Reconstruction. (Eng. and Min. Journ., Nov. 23, 1918, 3 pp.) 20c. Notes by J. R. Finlay read at a meeting of the New York Section of the Mining and Metallurgical Society of America.

10502—WAR TIME MINERAL ACTIVITIES in Washington. Edson S. Bastin. (Econ. Geol., Nov., 1918, 14 pp.)

Personals

Have You Contributed to the Association of the 27th Engineers?

Mark R. Lamb, mining engineer, is now in Paris.

Albert G. Wolf is in New York on professional business.

S. A. Ionides, metallurgical engineer, has returned to Denver, Colorado.

Basil Prescott has returned to Lordsburg. N. M., from field examination work at Santa Eulalia, Chihuahua, Mexico.

Harry J. Wolf, of the Malm-Wolf Co., has been appointed consulting mining engineer in the U. S. Bureau of Mines.

Frederic K. Brunton left Morenci, Ariz., recently, for Douglas, where he will be engaged at the Phelps Dodge Corporation's smeltery.

R. C. Gemmell, general manager of the Utah Copper Co., returned to Salt Lake City on Jan. 14, after a stay of a month in California.

Hugh Picard was elected president of the Institute of Mining and Metallurgy, at a meeting held on Nov. 21, 1918, to succeed **Hugh F. Marriott.**

Edward Hoopes, secretary of the San Toy Mining Co., expects to visit the Lordsburg, N. M., district early in February, where he will inspect properties in which he is interested.

O. C. Montgomery, formerly superintendent of the Oneida Mines Co.'s operations on the Cuyuna Range, is in charge of the Ida Mae mine, Cuyuna-Minneapolis Iron Co., Crosby, Minnesota.

Arthur E. Anderson, formerly assistant chief engineer for the Oliver Iron Mining Co., in the Virginia, Minn., district, is now assistant to **J. Uno Sebenius**, general mining engineer at Duluth, Minnesota.

Lieut. F. A. Ketley, recently stationed at Camp Humphries, Va., as an instructor of engineers, has been appointed superintendent of the Majorca mine of the Pickands-Mather Co., at Calumet, Minn. He succeeds **Charles H. DeVay**, who resigned.

Michael H. Loveman, formerly chief geologist of the Burma Mines, Ltd., has opened an office at 32 Broadway, New York, for the practice of mining geology. He will undertake prospecting and exploration work and the examination of mineral deposits; also geological mapping and the microscopic examination of rocks and ores.

Roswell H. Johnson, of Pittsburgh, Penn., recently registered at the office of the American Institute of Mining Engineers, New York. Others who registered there during the week were R. G. Wayland; J. A. Stewart, of Minneapolis, Minn.; Douglas B. Sterrett, Washington, D. C.; Raymond H. Summer, Wilmington, Del.; and Raymond B. Ladoo, of Cambridge, Mass.

John W. Sherwin has not resigned as manager of the West End and Halifax companies, as recently reported. The general manager's office has been removed from Tonopah, Nev., to Oakland, Calif., and the company is developing a Federal lease on Searles Lake, which facts were probably the cause of the error in this respect. **H. D. Budelman** has been appointed mine superintendent at Tonopah.

C. F. Kelley, president of the Anaconda Copper Mining Co.; **Walter Douglas**, president of the Phelps Dodge Corporation; **R. L. Agassiz**, president of the Calumet & Hecla Mining Co., and **Joseph Clendenin**, vice-president of the American Smelting and Refining Co., sailed for Europe on Jan. 25. They go abroad as a committee of the Copper Export Association, to look into the foreign situation.

Obituary

Edward M. Rabb, mining engineer, of Denver, Colo., died recently in Tonopah, Nev., of Spanish influenza.

Robert Anderson Cook, mining engineer, died recently at his home in New Brunswick, N. J., aged 58 years. He had been active in mining work for many years and was also chemist for the Lehigh Zinc Co., of Bethlehem, Penn. He was a member of the Engineers' Club of New York.

Chester J. Briggs, mining engineer, aged 34 years, died recently at an El Paso, Texas, hospital, of pneumonia. For the last three years he had been engaged in experimental and research work in ore concentration and in mill designing for the American Smelting and Refining Company.

Societies

American Institute of Mining Engineers, New York section, held its regular meeting Jan. 22, at the Machinery Club, 50 Church St., New York. The principal talk of the evening was from "Notes on a War-Time Trip to Europe," by H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*. There was also a discussion conducted by the committee on institute activities.

American Institute of Electrical Engineers, Denver section, held its first regular dinner meeting of the year on Jan. 18, at the Denver Athletic Club. The speaker of the evening was Franklin P. Wood, of Trinidad, Colo., who addressed the meeting on the subject of "The Future of Public Utilities as Affected by the War." A lively discussion followed, entered into by F. W. Hild, E. A. West, and others.

Engineers' Club of Northern Minnesota recently elected the following officers for the ensuing year: A. Tancig, Chisholm, president; Ellery Anderson, Chisholm, vice-president; Kenneth Duncan, Hibbing, secretary-treasurer; W. R. Van Slyke, Eveleth, L. D. Davenport, Hibbing, and A. E. Anderson, Duluth, directors. The regular meeting was held at Hibbing, Minn., Jan. 25, and the annual banquet of the club, which will take place at the Oliver Club, Hibbing, on Feb. 22, was the principal item of new business discussed at that meeting.

Teknik Club, of Denver, Colo., held its first regular meeting and dinner of the year on Jan. 14, at the Shirley Hotel. Henry W. Dahlberg, of the Great Western Sugar Co., addressed the meeting on the subject of "The World's Sugar Supply," and was followed by Prof. I. E. Cutler, of Denver University, who explained in an illustrated lecture the effects of "Xenia." Howard C. Parmelee, formerly secretary of the club and now editor of *Chemical and Metallurgical Engineering*, was elected an honorary member. About 50 members were present.

Industrial News

General Briquetting Co., 25 Broad St., New York, is installing its new demonstration and custom briquetting plant at 57th St. and 12th Ave., New York. H. K. Schoch, chemist, recently with the National Bureau of Standards, Washington, D. C., and George R. Cowan, briquetting engineer, of Ellington Field, Texas, have resumed their positions with the company, at 25 Broad Street.

Wheeler Condenser and Engineering Co., of Carteret, N. J., announces that it has obtained from the Schutte & Koerting Co., of Philadelphia, through the Alien Property Custodian, the exclusive right to manufacture and sell steam jet air pumps under patent No. 968,926, in connection with surface condensers, jet condensers, barometric condensers, vacuum pans and evaporating apparatus. Test data and full information will be sent on request.

Trade Catalogs

Waugh Drill Steel Punching Machine. Denver Rock Drill Manufacturing Co., Denver, Colo. Bulletin 10-V, Dec., 1918; 6 x 9¼; pp. 4; illustrated.

Tractors. Woodward Garage and Truck Attachment Co., Pico and Alvarado Sts., Los Angeles, Calif.; 8½ x 11; pp. 6; illustrated. Descriptive of industrial and lumber tractors.

Ladew Leather Belting. Edw. R. Ladew Co., Inc., Glen Cove, N. Y. ; pp. 108; 6 x 9; illustrated. A book devoted to Ladew leather belting, giving the history, standards, policies, and methods of the company.

Roots Rotary Blowers. P. H. and F. M. Roots Co., Connersville, Ind. Catalog No. 68; 11 x 8½; pp. 48; illustrated. Descriptive of Roots products, among which are blowers, gas exhausters, water pumps, vacuum pumps, and valves, and of the purposes for which they are used.

Steelcrete Machine Guards. Expanded Metal Engineering Co., 8 West 40th St., New York. Pp. 40; 3½ x 6¼; illustrated. A catalog describing Steelcrete machine guards, mesh for reinforced concrete, special meshes, machine guard accessories and other products, and the various ways in which they can be used to advantage.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Phosphate—Process for Making Phosphoric Acid. William H. Allen, Detroit, Mich. (U. S. No. 1,285,575; Nov. 26, 1918.)

Potash—Treatment of Feldspar, Leucite, and the Like. Franz A. Rody, Johnson City, Tenn., assignor to Metallurgical Co. of America, New York, N. Y. (U. S. No. 1,285,796; Nov. 26, 1918.)

Potassium Bearing Silicates, Method of Treating. Walter Glaeser, Brooklyn, N. Y., assignor, by mesne assignments, to Potash Extraction Corporation, New York, N. Y. (U. S. No. 1,285,121-2; Nov. 19, 1918.)

Potassium from Flue Dust, Process of Extracting. Edward W. Haslup, Bronxville, N. Y., assignor to Haslup & Peacock, Inc., New York, N. Y. (U. S. No. 1,285,152; Nov. 19, 1918.)

Reduction, Process for Treatment of Ores and Solid Salts by Electrochemical. Adrien Armand Maurice Hanriot, Paris, France. (U. S. No. 1,285,690; Nov. 26, 1918.)

Rock-Drill, Gasolene. Rolland S. Trott, Denver, Colo. (U. S. No. 1,286,152; Nov. 26, 1918.)

Sulphuric and Hydrochloric Acids, Process for Manufacture of. Harry V. Welch, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,285,856; Nov. 26, 1918.)

Sulphur in Globular Form and Process of Producing. Ray P. Perry, Upper Montclair, N. J., assignor to Barrett Company. (U. S. No. 1,285,358; Nov. 19, 1918.)

Tungsten, Etc., Powder, Method of Producing Hollow Objects of Compressed Metallic. Carl A. Pfanstiehl, Highland Park, Ill., assignor to Pfanstiehl Company, Inc., Chicago, Ill. (U. S. No. 1,286,089; Nov. 26, 1918.)

Tunnel Oven. Conrad Dressler, Marlow, England. (U. S. No. 1,285,647; Nov. 26, 1918.)

Vapor Converters, Cathode Structure for. Sidney W. Farnsworth, Pittsburgh, Penn., assignor to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,285,966; Nov. 26, 1918.)

Vapor Converters, Shielding Apparatus for. Sidney W. Farnsworth, Pittsburgh, Penn., assignor to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,285,967; Nov. 26, 1918.)

Furnace, Electric. Olof Sahlin, London, England (U. S. No. 1,286,794; Dec. 3, 1918.)

Furnace, Melting. Theodore W. Muckle, Denver, Colo., assignor to Case Manufacturing Corporation, Denver, Colo. (U. S. No. 1,286,719; Dec. 3, 1918.)

Magnetic Ore, Apparatus Involving Demagnetizing for Treating. Edward W. Davis, Minneapolis, Minn. (U. S. No. 1,286,247; Dec. 3, 1918.)

Nitrates From Ammonia, Etc., Process for Producing. Carl Theodor Thorssell and Harold Ludvig Reinhold Lunden, Gottenborg, Sweden. (U. S. No. 1,286,838; Dec. 3, 1918.)

Nitrate of Calcium, Process of Producing. Carl Theodor Thorssell and Harold Ludvig Reinhold Lunden, Gottenborg, Sweden. (U. S. No. 1,286,839; Dec. 3, 1918.)

Ore Treatment—Process of Treating Rebellious Rare-Metal Ores. Alfred L. Pellegrin, Tucson, Ariz. (U. S. No. 1,286,400; Dec. 3, 1918.)

Potash—Method of Treating Silicates Containing Potash and Alumina. Harmon N. Morse, Baltimore, Md. (U. S. No. 1,286,718; Dec. 3, 1918.)

Potash—Process of Extracting Soluble Potassium Salt From Feldspar. Henry Blumenberg, Jr., Los Angeles, Calif., assignor to Chemical Construction Co., Los Angeles, Calif. (U. S. No. 1,286,513; Dec. 3, 1918.)

Screen. John O'Brien, Stayner, Ont., Canada. (U. S. No. 1,286,888; Dec. 3 1918.)

Smelting—Process of Recovering Copper From Sulphide Ores and Ore Products in Electric Furnace. Gustaf Newton Kirsebom, Kjöbenhavn, Denmark. (U. S. No. 1,286,652; Dec. 3, 1918.)

Steel—Process for Eliminating Pipes and Segregated Metal From Ingots. Thomas H. Mathias, Buffalo, N. Y., assignor to Lackawanna Steel Co., Lackawanna, N. Y. (U. S. No 1,286,379; Dec. 3, 1918.)

Editorial Correspondence

PHOENIX, ARIZ.—Jan. 23

The New Apache Railway, tapping a new timber district, with 72 miles of trackage, will also develop a new lignite coal field south of Holbrook. Plans are being made for installing a great steam plant for generating electricity at the coal beds, and for wiring to points along the Santa Fe and to the mines of central Arizona, including Globe, Miami, Jerome and Prescott. The coal is considered equal to the best at Gallup.

Establishment of a State Smelting and Sampling Plant, to operate on a 10% profit basis, was provided for in a bill introduced in the last Arizona Legislature. Though it was alleged by members that small shippers were being "robbed" by custom smelters, the mining members looked askance at the measure and secured its reference to a special joint committee, of which Senator J. C. Devine, of Pinal County, was made chairman. This committee has had three meetings, but has spent no part of the $1000 appropriated for its investigations. One of its members states that a report will be filed soon and that it will recommend "no action," with some reference to the present unusual conditions in the copper industry of the state.

Application of Desert Power and Water Co. to increase the rates for power supplied to mines was denied by the Arizona State Corporation Commission on Jan. 11, which ruled that the consumer should not be called upon to stand all the burden created by war conditions, but that utilities corporations should bear a portion of it in smaller returns and not expect to realize fully on investments until the return of normal conditions. The opinion recognizes that the company is entitled to partial relief and permits a temporary surcharge of 15½% until otherwise ordered by the commission, but the application for an increase in rates is denied. The company supplies power in the Oatman, Gold Roads and Chloride mining districts in Mohave County. The application was opposed by the Tom Reed and Great Eastern mines, the largest customers of the company.

TONOPAH, NEV.—Jan. 23

The Tonopah Divide Mine is attracting much comment. Levels from the main shaft have explored the main vein on the 160, 265 and 370 levels, and the shaft has been sunk to the 470-ft. point, where a station is being started and a crosscut will be driven to the vein first exposed. The "gold" vein was cut on the 265 level, 580 ft. south of the shaft. The "new" vein was exposed on the 370 level by the southeast foot-wall drift on the main "silver" vein, 250 ft. from the shaft crosscut. The silver vein was exposed on the 160 level by the crosscut driven for the purpose of exploring the gold vein, which had yielded rich gold ore near the surface, higher on the mountain. The silver vein crops boldly, but the croppings show little of value. It was cut 145 ft. from the shaft and has been developed for over 300 ft. on the three levels, showing an average width of 26 ft., all ore of excellent grade. A drift east on the gold vein, at the 265-ft. level, advanced on from two to four feet of ore assaying from $10 to $80 per ton. The main silver vein strikes southeast, the new vein northeast and the gold vein due east. In developing the silver vein, foot-wall drifts have been extended northwest and southeast, with crosscuts and raises at 50-ft. intervals to block out the ore. At the point where the new vein was exposed on the 370 level, a drift was started southwest along its foot wall and a crosscut advanced through the vein back of the foot wall of the silver vein. The rock between these faces was broken down to the point where an 18-ft. face was exposed, all of the ore averaging above $160 per ton and car samples from this face averaging $177 per ton. The crosscut has advanced over 30 ft. without showing the hanging wall. At 24 ft. the crosscut assays fell to $16, but the next round increased to $68. A 9-foot crosscut north into the silver vein here averaged $268 per ton. Both the silver and new veins stand nearly vertical, with slight dips, respectively, to the northeast and southeast, and are nearly at right angles. A. I. D'Arcy, consulting engineer, says the newly found vein is the older fissure and is cut through by the silver vein, which probably derives its enrichment from the great cross vein. The ground at the junction is greatly crushed and shows wide seams and masses of kaolin, filled with particles and sheets of compact, glassy horn silver, some of this ore assaying over 1000 oz. silver per ton. Shipments approximating 30 tons daily are being sent to MacNamara mill at Tonopah, where a 92% extraction is secured by cyanidation. An ore dump at the shaft contains 6000 tons of $30 ore, but this is not being shipped, as it is in part from the upper level, where the ore contains molybdite, or yellow oxide of molybdenum, which is highly destructive of cyanide. On levels below the molybdenum metal is powellite, a calcium molybdate that is not soluble in cyanide or any alkaline solution. The water level here is estimated to be not less than 700 ft. Professional reports describe the geology as overlying rhyolite flows, with deeper strata of rhyolite breccia, the ore channels of greater importance being encased in the latter. The principal owners of the Divide property are H .C. Brougher, of Tonopah, and George Wingfield, of Reno, the latter president of the Goldfield Consolidated.

BATESVILLE, ARK.—Jan. 23

Contracts for the Sale of 2000 Tons of Arkansas Manganese Ore from the Batesville field have been made with Steel Corporation subsidiaries at the following prices: Ore of 45%, 55c. per unit, or $24.75 per ton; 46%, 60c., or $27.60 per ton; 47%, 65c., or $30.55 per ton; 48%, 70c. or $33.60 per ton; 49%, 75c., or $36.75 per ton; and 50%, 80c., or $40 per ton. These prices include Chicago delivery, and freight to Chicago is $4.56 per ton. As the cost of mining at Batesville has been lowered recently, these prices probably mean a fair return to favorably situated properties. A recent carload shipment to Birmingham running less than 50% was settled for at 80c. per unit, f.o.b. Birmingham, freight to Birmingham being under $3. Contracts are now under negotiation with Batesville producers for shipment of 10,000 tons over a period of a year at about the prices given above.

DULUTH, MINN.—Jan. 25

The Second Wave of Influenza has struck the Minnesota ranges, and, though not as serious as the first one, is causing marked reductions in the working forces of the mines.

Underground Miners Returning from Service in the Army are being put to work at their old jobs as fast as they are discharged, and returned men from other divisions of the industry are being accommodated during the dull season almost without exception. These will be put back on their old jobs as soon as shipping opens.

Stripping Operators are being greatly benefited by the non-appearance of the heavy frosts usual to the Minnesota ranges at this time of year. Many operators who are annually forced to close down or curtail about Jan. 1, because of excessive powder costs, are still running at full capacity, with every prospect of continuing right through until spring. The Winston-Dear Co., Butler Bros., Guthrie Bros. and the Oliver Iron Mining Co. are included among these.

Alien Workmen of the Mesabi, Vermilion and Cuyuna Ranges who refuse to declare their intention of remaining in this country after the restoration of peace will be called upon to waive their income-tax exemption and pay to the Federal Government a 2% tax based on their gross earnings during 1918. On the January pay day at all mine offices on these ranges, each alien workman was given the privilege of becoming a declarant or a non-declarant. Figures available at this time indicate that more than 50% of such employees have waived their exemption and intend to return to their native lands at the first possible opportunity.

A Surtax of Two Per Cent. on the Value of Ore at the mouth of the mine is provided for in one of four bills of direct interest to mine owners and operators that are before the Minnesota Legislature, now in session, which is paying particular attention to the mining industry. This surtax is the legitimate successor of the tonnage tax bills of previous sessions. Another bill is a part of the Non-Partisan League program and provides for a tax of 10% on the net value of the ore as determined by chemical analysis. A Senate bill would make it unlawful for a corporation to pay a salary to a deputy sheriff to act as watchman over its property, and another Senate bill provides that any worker who pays a certain weekly sum for medical attendance shall have the privilege of choosing his physician.

VICTORIA, B. C.—Jan. 23

Ore Resources of the Greenwood District of British Columbia are to be investigated by two government mining engineers appointed by the Minister of Mines, William Sloan. They are expected to submit reports at the earliest possible moment. This step was taken by Mr. Sloan after listening to the representations of citizens of Greenwood who are making efforts to have the local smeltery of the Canada Copper Corporation reopened.

The Mine Owners' Association of British Columbia will not recognize the committee which has been authorized by the Dominion government to investigate the question of rates charged for ore treatment by the Consolidated Mining and Smelting Co., at its Trail smeltery, has been stated in effect by C. F. Caldwell, president of the association. Mr. Caldwell says: "Should the mine owners appear before this committee they would be giving their approval of this mode of investigation. We publicly protested to both the Dominion and Provincial governments against the committee form of investigation, believing it was brought about for the express purpose of defeating the resolution of the mine owners, which asked for the appointment of a Royal Commission, one member to be chosen by the mine owners, one by the smelter, and one by the government. This would have been an investigating commission which would have brought results." A meeting of the committee was scheduled for Jan. 21 at Nelson, British Columbia.

THETFORD, QUE.—Jan. 20

Operations in the Asbestos Industry in Quebec have in no wise diminished since the signing of the armistice. Whatever decrease may have occurred in the war demands has been taken by the unfilled orders which were being held over. The shipbuilding program of the various countries is looked to as a compensation for any decrease in war orders, so that the prospects for asbestos in the near future look promising. Labor has become more plentiful, though there is no disposition to lower wages as long as present prices for production are realized. Higher efficiency is being obtained through contract work wherever possible, as well as by means of various bonus systems when applicable. In mining, the chief point of interest is the comparative results obtained by the recently installed underground systems, in contrast to the original systems of quarrying used since the inception of the industry. It is generally held that whatever advantages may be gained by the underground system of mining for asbestos, such advantages being continuous operation in wet or stormy weather, better working conditions for the winter season, and mechanical separation of crude, fiber and waste rock, are more than offset by the advantages of quarrying. Among the latter are cheaper rock blasting, superior advantages for sorting of crudes from mill-rock as well as mill-rock from waste rock and earth, and cheaper handling and freedom from wood splinters in the fiber. A system of ore storage bins is now being tried, to take care of any excess production that may accrue.

Chrome Operations in Quebec have fallen off the last few months, and general interest is now evidenced in the question as to whether the Canadian industry will survive the competition of pre-war competitive fields, such as New Caledonia and Asia Minor. Several companies are equipped with up-to-date concentrating plants, backed up by deposits of considerable value.

but these would again be unable to meet the same prices which put the Canadian chrome industry out of business in 1909. Criticism has been leveled by operators against the Canadian government for using undue influence to get the operators to intensify production, only to allow them to shoulder their own losses when the reaction caused severe losses. Much resentment is also felt toward government authorities, who from time to time have cast aspersions on methods followed by the chrome miners. It thus has been frequently mentioned that the lack of success in the Canadian chrome industry is due to lack of efficient mining methods, particularly as regards sufficient development work. It is pointed out that such opinions can gain ground only with those ignorant of conditions. It is held that deposits in the Black Lake-Coleraine area always have been of the indeterminable type, occurring in lenticular formations of unknown characteristics. This entirely geological problem has not been solved by the geological authorities. It is further maintained that successful mines now operating are freaks of discovery which defy classification. For example, the premier deposit at Danville was purchased as an asbestos property, with no suspicion of chrome within miles; the successful Dominion Mines and Quarries was condemned as below commercial value in 1901; and one of the most successful properties has been opened and developed by a man of no mining experience. It is held by some that until the Quebec government can imitate the action of the Ontario government in past years, in assisting the chrome miner in solving economic mining and geological problems, it might well reserve its criticism of those who are doing their best in the task of putting the chrome industry on its feet.

MELBOURNE, AUSTRALIA—Dec. 17

Power Supply for Electrolytic Treatment of the Mount Read and Rosebery zinc sulphides presents a difficulty that has brought together the Mount Lyell and Electrolytic Zinc companies (the latter has an option over a large parcel of power from the Tasmanian Government's Great Lake hydroelectric scheme), and the present indications are that a contract covering the treatment of a certain tonnage during the next three years or so will be entered into. The intention of the Mount Lyell company is to erect its own works having an output of 75 tons electrolytic zinc per day, but that is dependent on the development of the King River hydroelectric scheme by the government, which will take several years.

The Broken Hill Mines prior to the war used enormous quantities of imported Oregon fir for mine timber, but the shortage of shipping gradually compelled them to use local timbers, and now they are becoming enthusiastic on the subject. A number of the companies have taken forest areas in South Australia and Tasmania and are erecting sawmills, or have already done so. The Zinc Corporation, which has a large area at Myponga, South Australia, is embarking also on an afforestation scheme, so that it is possible that in 30 years' time this company's principal income will be derived from the sale of timber.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Lead mill closed Jan. 15, about 40 mill men being laid off as well as about 45 men underground.

GREAT WESTERN (Courtland)—Leasing miners have made good profits on ground that gave slight return to owners two years ago. Workings not over 300 ft. deep.

PEABODY CONSOLIDATED (Johnson)—This and Arizona United, Dragoon Mountain, and Keystone mines have suspended copper ore shipments, as present smelter settlements on 16-c. basis fail to pay costs.

BUNKER HILL (Tombstone)—About 25 lessees working in old Bonanza mines, which is only local activity.

Greenlee County

ARIZONA COPPER (Clifton)—December copper production was 3,600,000 pounds.

LESZYNSKY (Clifton)—Property, near Metcalf, under lease to John Christy, who has purchased machinery for 200-ton mill. Mill construction made necessary by closing of Shannon works, which had been handling output.

Mohave County

BRUNSWICK (Chloride)—Installing electric equipment purchased from Bullion property.

CHLORIDE QUEEN (Chloride)—Drifting on 220 level to cut silver vein developed on higher level.

ELKHART (Chloride)—Development to be resumed at once.

MINNESOTA-CONNER (Chloride)—Being unwatered, preparatory to development.

CHIMEHUEVIS (Kingman)—Copper claims located 22 miles south of Yucca by Asa LeBaron and J. K. P. Fancher.

LEXINGTON-ARIZONA (Oatman)—Sinking resumed in 126-ft. shaft. Ore cut on 126 level. H. E. Wood, stockholder and Texas oil operator, in charge.

Pinal County

RAY CONSOLIDATED (Ray)—Air locomotives operating successfully. These have displaced electric haulage in all but one main drift.

RAY SILVER-LEAD (Ray)—In last six months has produced over 5000 tons of ore, carrying more than 30% lead, with good silver content. To build road to avoid packing ore on mules over three-mile trail to Ray. Property now in litigation, on complaint of F. C. Armstrong, president of Ray-Hercules, who claims that lease on Ray Silver-Lead taken by C. E. Adams, former Ray-Hercules manager, should have been credited to Armstrong's account.

MAGMA COPPER (Superior)—December production was 1,049,783 lb. of copper.

Yavapai County

CONGRESS (Congress)—Two 40-stamp mills and roaster being demolished and sold piecemeal. Alvarado mill also being junked.

McCABE-GLADSTONE (Humboldt)—Sold to New York company represented by J. C. Rankin and Charles Batre. Sellers reserve about 20,000 tons tailings from old McCabe mill, now being shipped to Consolidated Arizona mill for recovering gold by flotation.

SILVER BELT (Humboldt)—New shaft, designed to get under old workings, has cut 12-ft. ledge of good ore at 125 feet.

CALUMET & JEROME (Jerome)—Vice-President C. M. Garrison states diamond drilling started on Calumet claim Jan. 20. Additional development work planned. Company had almost shut down, owing to labor and war conditions as well as influenza.

UNITED VERDE (Jerome)—Purchased several hundred acres of orchard land near Clarkdale smeltery, whereon vegetation is alleged to have been killed by stack fumes.

COMMERCIAL (Skull Valley)—Phelps Dodge ore shipments from Copper Basin discontinued, and mine force dropped. Similar action taken by many small copper properties of county.

CALIFORNIA

Alameda County

CHROMAN (Livermore)—Compressor and other machinery being installed to treat 50 tons daily. Chrome ore of good grade. Employ 15 men.

WIGGINS CHROME (Livermore)—Concentrator installed. Employ 20 men mining and treating 50 tons daily.

COLORADO

Boulder County

COLORADO PITCHBLENDE (Boulder)—Has taken over Blue Jay, Brownspar, Emmett, Argo, Alice, Warren, and Terry properties near Jamestown. Excavating and grading under way for addition to Golden Age mill at Springdale, where company's ores will be treated. Capacity of mill after enlargement will be 120 tons per day. J. F. Barnhill is manager. Four sets of assayers working on 20 samples of company's products. Results will be published soon.

ALASKA TUNNEL (Ward)—This tunnel, portal of which is at Brainerd camp, will be advanced to cut Utica, B. & M., and Wirth properties. Active development under way at Celestial Extension property, and payable ore opened.

IDAHO

Custer County

EMPIRE COPPER (Mackay)—Report that property has been purchased by Nipissing Mines, of Cobalt, Ont., denied by latter's New York office. Option was held but dropped.

Shoshone County

HERCULES (Burke)—Development work only; 35 to 40 men employed.

SHERMAN (Burke)—Lower crosscut to orebody, which is exposed in two levels above, cut blind lead containing considerable galena. Several hundred feet to main vein.

CHICAGO-BOSTON (Wallace)—Quarters being prepared for employees and surface equipment installed preparatory to working Chicago-Boston. Control under option to John A. Percival, of New York, president of Interstate-Callahan company. Shaft down 200 ft., showing good body of lead-silver ore on two levels. Ore exposed 300 ft. in lower tunnel.

SUNSET (Wallace)—All work suspended and pumps drawn. Shaft down 1000 ft. and vein explored on various levels, exposing much lead and zinc ore. Property owned by ex-Senator W. A. Clark, of Butte, whose plans regarding further development are unknown.

TAMARACK & CUSTER (Wallace)—Development work only; 20 to 25 men employed, majority being in Puritan crosscut to main vein.

KANSAS

Joplin District

QUEEN ESTHER (Joplin)—Will sink new shaft on property southwest of Baxter. Underground development has proved up orebodies at second level, a little over 200 ft. down. Upper level worked out.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Company and subsidiaries beginning Jan. 20 established working schedule of four days one week and five the next in alternation, equal to working time of 75% of that recently existing, when properties were running at 85 to 90% capacity. Thus operations are reduced by 35-40% of capacity.

SENECA (Calumet)—Sinking temporarily stopped while 200 ft. or more of concrete work is being done where shaft makes turn on entering formation. Foot wall not yet in sight, shaft being only half through lode.

MINNESOTA

Cuyuna Range

FERRO—(Ironton)—Sinking shaft deeper. Manganiferous property of Onahman Iron Company.

HOPKINS (Ironton)—Breitung & Co. property, manganiferous producer, shut down Jan. 12 to install larger pumps. Will renew operations in spring.

Mesabi Range

MAJORCA (Calumet)—Considerable stripping being done in preparation for spring shipping. The washing plant is being overhauled.

MISSOURI

Joplin District

ST. REGIS (Joplin)—Has good drill strikes on property at Chitwood and will sink third field shaft.

LITTLE BILL (Joplin)—Is in rich run. Now one of best producers Joplin camp has had in months. Operating at about 180 ft. W. J. Cochrane, Webb City, manager.

MONTANA

Mineral County

ST. LAWRENCE COPPER (Saltese)—Company again shipping copper ore, hauling six miles to railroad. Raise from lower tunnel up 50 ft. in good ore. Much ore in upper workings will be made accessible by raise. Company controlled by Pittsburgh people.

NEVADA

Esmeralda County

MERGER MINES (Goldfield)—Drift on 1350 level in ore; raise on this shoot up 45 ft.; shallow winze from level also in ore. Drift being driven from long crosscut connecting Merger shaft with Grizzly Bear workings of Goldfield Consolidated. Development work on same level in St Ives claim opening large tonnage milling-grade ore. Will start development soon in western part of this claim seeking extension of Grizzly Bear oreshoots. Milling of custom ores at Goldfield Consolidated by flotation discontinued temporarily. Merger company has agreement with Spearhead company permitting development of Sunflower claim through Spearhead ground.

SPEARHEAD (Goldfield)—On 200 level drift from old Wheeler lease workings opened oreshoot one foot wide, which widened to four feet on raising. Raise from 910 level, in south end of property, now up 100 ft., exposing good ore. Crosscutting will be done from top of raise to reach contact zone. H. F. Bruce, superintendent.

Humboldt County

ROCHESTER ELDA FINA—(Rochester)—Suit filed Jan. 1 in Washoe County against Rochester Mines. Claimed defendant has extracted ore from property of plaintiff to value of $1,216,000. Property of defendant attached. Similar suit filed in Humboldt County in September, 1918, was dismissed.

SUNSET M. AND DEV. (Unionville)—Work in new tunnel progressing satisfactorily. Will cut vein 33 ft. below deepest of old workings. First 30-ton unit of new flotation plant expected in operation within three weeks. Mill will include crusher, tube mill and K. & K. flotation machines. F. W. Lockman, manager.

Lincoln County

PIOCHE DISTRICT ore shipments for week ended Jan. 22, were: Prince Consolidated, 25 cars; Virginia-Louise, 7 cars; Combined Metals, 2 cars.

Nye County

TONOPAH SHIPMENTS for the week ended Jan. 18 totaled 7450 tons, estimated gross milling value being $126,650. Shippers were: Tonopah Belmont, 2124 tons; Tonopah Mining, 1100; Tonopah Extension, 2280; West End, 1102; Jim Butler, 237; Montana, 54; Tonopah Divide, 225; MacNamara, 230; Midway, 82; and miscellaneous, 16 tons.

Washoe County

MINE OPERATORS' ASSOCIATION, of Reno, elected W. H. Blackburn, of Tonopah, president; E. A. Juliao, first vice-president; L. A. Friedman, second vice-president; and Henry M Rives, secretary.

White Pine County

NEVADA CONSOLIDATED (Ely)—Mine force reported two weeks ago to have been reduced by 1000 men. Endeavor being made to retain men having dependents. One-half of concentrator said to be closed also. Smeltery operating with slightly reduced force. Confirmation or denial could not be obtained from New York office.

NEW MEXICO

Grant County

ATWOOD (Lordsburg)—Will continue sinking new shaft on Southern group when new hoist is installed. J. Tangye, superintendent.

BONNEY (Lordsburg) — Ore survey completed, showing 45,000 tons milling ore, broken and blocked, averaging $15.57 per ton. Ore siliceous gold-silver-copper. Will install 100-ton mill and complete new power plant. J. P. Porteus general superintendent.

BOSTON-HECLA (Lordsburg)—Twenty men employed building road to shaft site. Will begin hauling machinery in few days. J. C. Taylor superintendent.

CAP ROCK (Lordsburg)—Shut down owing to there being no manganese market.

EIGHTY-FIVE MINE (Lordsburg)—Mine and mill shut down owing to accident to one of Diesel engines.

LAST CHANCE (Lordsburg)—Milling 70 tons daily concentrating 50 to 1. Meeting of directors of Pyramid Milling Co. which holds mine under lease and option from Fairley & Sholley, on Feb. 6. B. Prescott, superintendent.

OCTO (Lordsburg)—Force preparing to start deepening main shaft from 185 ft. to 500 ft. Will employ 50 men. E. J. Ernest superintendent.

GREAT EAGLE (Red Rock)—Continuing to develop fluorspar, but is not shipping.

CALUMET-NEW MEXICO (Silver City)—Mines at Pinos Altos and Magdalena, N. M. Company operating over three years at former, where it has seven claims and two fully equipped main working shafts. Complex zinc-lead-copper-gold-silver ores developed in both shafts. Ores have been shipped raw to smelteries, netting only $25 per ton, because of complexity of mixture, average contents being worth $100 per ton. Langston mine recently acquired near Pinos Altos property; has ores of same complexity but higher in gold. Langston has yielded over $150,000 in high-grade gold alone. Company at present has concentrating and separating mill nearing completion on Pinos Altos property, having following equipment purchased through Colorado Iron Works, Denver: 10 x 16 Blake crusher; 36 x 16 rolls; drag classifier (company's own type); two Colorado impact screens; two Deister-Overstrom slime tables; three Butchart tables (special riffle); plunger feeder; 4 x 4 Colorado ball mill; flotation equipment (own type); three elevators; conical tanks; East-Butte type thickener. Gould triplex water-supply pumps; Krogh centrifugal sand pumps, etc. All reservoirs, tanks, concentrate bins, etc., of concrete. Fairbanks-Morse oil engine used. All material first class and on ground. Milling problem one of separation rather than concentration. Capacity from 50 to 125 tons per 24 hours, depending on fineness of grinding necessary to secure best results. J. A. McCallum, superintendent.

OKLAHOMA

Joplin District

LUCKY KID (Douthat)—Has opened new ore run in new field shaft. Will start mill again soon.

JEFFERSON (Miami)—Has begun operation of new mill on lease near Picher. Mill originally erected by St. Louis Lead and Zinc Co. on lease near Quapaw, but heavy water resulted in plant being torn down and moved without ever being started. A. B. Clark, of St. Louis, Mo., is president of Jefferson company.

MIAMI WONDER (Miami)—Will sink two new shafts on lease southeast of Picher.

QUEEN CITY (Miami)—Has scrapped mill. Ground will be worked and material handled at Sullivan mill by Miami Mining Co. Otis White manager.

OKO (Picher)—Has purchased Lennan mill at Commerce and will move it to lease near Picher.

UTAH

Juab County

CENTENNIAL-EUREKA (Eureka)—Third shift added. Ore opened on 1900 being followed toward water level. Winze down 60 ft. from 1900.

TINTIC CENTRAL (Eureka)—Ogden-Tintic Mining Co. formed to take over property under lease. Capitalization, $50,000. O. M. Runyon, president.

DRAGON CONSOLIDATED (Silver City)—Shipping two cars iron ore daily. Demand lessened. North end worked by Tintic Milling and supplying greater part of ore treated in Tintic Milling plant.

KNIGHT INVESTMENT (Silver City)—Large new compressor added to plant near Iron Blossom, which furnishes air to number of properties. Capacity 4200 cu ft per minute.

Piute County

BRADBURN (Marysvale)—Car of potash ore shipped to Florence mill from this property being developed by Swift & Co. Another car shipped to company's plant at Harvey, La. Stated that, until spring, shipments will be made to local plant first, and then East. Later, direct shipments to East will also be made.

Salt Lake County

ALTA COMPANIES shipping at present are South Hecla, Michigan-Utah, Columbus-Rexall Sells and Alta Consolidated, although output being sent down Little Cottonwood canyon has decreased owing to bad roads. Lack of snow hampering operation of sleds, which are nevertheless in use.

CARDIFF (Salt Lake City)—Property in Big Cottonwood shipping 10 tons of silver-lead ore daily. Oreshoot recently opened to south on tunnel level followed 75 ft. Ore silver-lead of good grade.

Summit County

SILVER KING COALITION (Park City)—Lafayette Hanchett appointed consulting engineer. W. W. Armstrong, of National Copper Bank, Salt Lake City, president of company.

SILVER KING CONSOLIDATED (Park City)—Trial run of new 150-ton mill to treat low-grade ores, chiefly from recently acquired California-Comstock ground, reported satisfactory. Ore treated carried silver, lead and iron. Zinc reserved for later treatment. Spiro tunnel being driven to connect older ground with California-Comstock and develop ground in between, was in 9001 ft. on Jan. 1.

CANADA

British Columbia

GRANBY CONSOLIDATED M. AND S. (Grand Forks)—Three furnaces in operation. Granby mines, at Phoenix, expected to supply sufficient tonnage.

EUREKA (Granite)—Inland Mining Co., of Walla Walla, Wash., operating this copper property in Nelson division for about four months. Has spent $15,000 on development. Producing 25 tons daily and shipping to Trail smeltery. Further development planned, including construction of tramway to Canadian Pacific Ry. W. M. Meyers, mine superintendent.

MARY REYNOLDS (Merritt)—Property has 100 ft. shaft and 45 level drift. Stoping in progress in latter. Entire vein good milling ore, with high-grade pockets. Deeper development to start soon. Ore is silver-lead. Mine in Stump Lake district 35 miles east of Merritt.

CASSIAR CROWN COPPER (Telkwa)—To drive 90-ft. tunnel to tap vein at 75-ft. depth and then drift on ore. Vein shows strongly on surface. Property on Grouse Mountain, in Omineca Division.

CONSOLIDATED M. AND S. (Trail)—Ore receipts for first week in January totaled 7736 gross tons.

Manitoba

MANDY (Schist Lake)—Diamond drilling resumed from 200 level.

Ontario

DECEMBER SHIPMENTS of silver ore over Temiskaming & Northern Ontario Ry. were: Buffalo, 402 tons of 2000 lb.; Coniagas, 177; Dominion Reduction, 72; Hudson Bay, 32; Kerr Lake, 29; La Rose, 33; McKinley-Darragh, 74; Nipissing, 78; O'Brien, 76; Trethewey, 43; Crews-McFarlane, 30; Pittsburg Lorrain, 45; and Casey-Cobalt, 30; total, 1121 tons. Above was shipped to following companies: Deloro S. and R., 141; Coniagas Reduction, 63; Campbell & Deyell (Cobalt), 106; and American S. and R., 812 tons. Alexo shipped 507.5 tons nickel ore.

ADANAC (Cobalt)—Has encountered high-grade ore in vein cut short time ago.

OPHIR (Cobalt)—Has optioned 51% interest to Nipissing for $150,000. Latter will spend about $10,000 in exploring along Keewatin diabase contact.

PETERSON LAKE (Cobalt)—Will issue $100,000 preference stock, carrying cumulative dividend of 15c. a share per year. Will use money to increase mill capacity and to carry on development.

BURNSIDE (Kirkland Lake)—Start of milling operations indefinitely postponed, owing to non-arrival of machinery parts.

TOUGH OAKES (Kirkland Lake)—At annual meeting in Toronto on Jan. 21, announced that, owing to termination of litigation, control of property had been handed over to following directors, elected January, 1916: Harry Oakes, R. J. Robins, John B. Holden, J. Y. Murdoch and A. Burt. Number of directors reduced from seven to five, head office changed from Haileybury to Toronto, and sale of unissued shares at discount of not less than 55% of par value authorized. Investigation and report by competent engineer will be made before any program will be adopted.

PORCUPINE CROWN (Porcupine)—At annual meeting on Jan. 22, president Sir John Carson announced board hoped to resume active operations soon.

MEXICO

MINES CO. OF AMERICA preparing to resume operations at Mexican properties with improvement of conditions in Mexico. Hayden, Stone & Co. announces it has completed plan of reorganization by which the necessary working capital will be supplied. Assets of present company will be sold to new corporation to be known as Dolores Esperanza Corporation, with the same number of shares. Holders will be permitted to purchase stock in the new company on surrender of old stock and payment of $ a share.

The Market Report

SILVER AND STERLING EXCHANGE

Jan.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Jan.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
23	4.7580	101⅛	48 7/16	27	4.7580	101⅛	48 7/16
24	4 7580	101⅛	48 7/16	28	4.7580	101⅛	48 7/16
25	4.7580	101⅛	48 7/16	29	4 7580	101⅛	48 7/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Copper: Electrolytic	Tin: Spot.†	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
23	•	67	5¼ @5⅜	5 15 @5.20	6 60 @6 70
24	*	67	5¼ @5⅜	5.10 @5 20	6.55 @6 60
25	*	67⅛	5¼ @5½	5 10 @5.20	6.55 @6 60
27	*	67⅛	5⅛ @5¼	5.00 @5.20	6.55 @6 60
28	*	67¼	5.10 @5.15	4.92½ @5.17½	6.50 @6.55
29	*	67½	5 @5⅛	4.92½ @5.07½	6.55 @6.60

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

* Undetermined.

† For American tin of 99% grade.

LONDON

Jan.	Copper: Standard Spot	Copper: Standard 3 M.	Copper: Electrolytic	Tin: Spot	Tin: 3 M.	Lead: Spot	Lead: 3 M.	Zinc: Spot
23	91	82	105	248	244	35	30	56
24	90	83	105	248	245⅛	35	30	56
25	.	.	. .	. .	.	....	. .	
27	89	83	105	248	244½	35	30	56
28	89	83	105	246	242½	35	30	56
29	88	83	105	244½	(*a*)	34	30	56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

(*a*) No quotation.

Metal Markets

NEW YORK—Jan. 29, 1919

The markets show gradually more signs of developing upon a regular basis, especially those that are freest from meddling, or rather, we should say, those in which nature has been allowed to take its course.

There is a tendency to exaggerate the amount of the stocks of metals held abroad; but, nevertheless, there is no doubt about their being large, and good authorities on the other side express the belief that they will be found to be ample for all requirements for some months to come.

The market for sulphuric acid of 60° B. in the Middle West has dropped to $9.50 per ton, f.o.b. works.

The reduction in freight rate to Europe to 1c. per lb. was an important event of this week.

Copper—No sales of copper were made this week by any of the large producers. We have reports of sales by several of the small producers aggregating 2,850,000 lb., which were all made on the 28th at 18¾ @ 19c. We have heard indirectly of some other sales made by small producers from whom we do not receive reports, amounting perhaps to 1,000,000 lb. more. The best estimates are that the total sales from Jan. 1 to Jan. 25 aggregated about 20,000,000 lb., and since Jan. 25 we may add about 4,000,000 lb. This illustrates the situation completely, viz. small sales in the aggregate, sporadically made at variable and uncertain prices. There has not been, and is not yet, any market in the broad sense, but at this writing there are signs that things are coming to a head and that there will soon be conditions approaching the natural.

Copper Sheets—The base price of copper sheets is 29c. per lb. Copper wire is quoted at 22½@23c. per lb. f.o.b. mill, carload lots. Unchanged.

Tin—There is no change in the elements of the situation in this metal, except that the Government seems to be becoming more strenuous in its attempts to force metal upon consumers who do not want it. Some lots of Banka and Straits tin, amounting to 275 tons, were advertised for auction today. One lot of 25 tons was sold at 71.1c., this being apparently to establish a record for some purpose. The other parcels were withdrawn, apparently so as to avoid any record being established. We quote the market from day to day on the basis of American tin.

The American Iron and Steel Institute, under date of Jan. 23, issued a circular letter saying that the U. S. Steel Products Co. has now been authorized to fill all orders at the Government price, regardless of the quantity.

Lead—A larger amount of business was done this week than in the previous week, both in specific sales and in contracts to be settled on average prices. There is a good deal of irregularity in the terms. Thus, on Jan. 27 lead was offered in tonnage at 5c., St. Louis, as we learned from several parties to whom it was offered, while on the same day a round lot was actually sold at 5.20c., St. Louis. This discrepancy we are unable to explain. Differences in price in New York are explained by whether lead is quoted as actually here or for prompt shipment hither. An interesting feature of the week was the appearance of offers of considerable tonnage originating from manufacturers who desired to dispose of surplus.

The home trade in pig lead and manufactured lead in France has been freed from control, but the license system will remain in force for imports and exports. The production of lead in Germany is no longer controlled officially, and the maximum prices have been abolished. Producers are free to sell as they please.

Zinc—With the further decline in this market the volume of business increased from day to day, and on Jan. 28 considerable buying developed around 6.50@6.55c. Practically all of this business came from galvanizers, who seem to have become interested in spelter at this level.

Zinc Sheets—Unchanged at $13 per 100 lb.

Other Metals

Aluminum—Unchanged.

Antimony—The market was quiet. We quote spot at 7¼@7½c.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40@1.45 per lb. in lots of 100 to 500 lb.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—California virgin is quoted at $100. San Francisco reports, by telegraph, $102.50.

Silver and Platinum

Silver—Market remains unchanged and steady. For the week ended Jan. 25, shipments to London were 1,090,000 oz. December shipments from San Francisco were 34,268,000 ounces.

Mexican dollars at New York: Jan. 23, 77½; Jan. 24, 77½; Jan. 25, 77½; Jan. 27, 77½; Jan. 28, 77½; Jan. 29, 77½

Platinum—Unchanged.

Palladium—Unchanged.

Zinc and Lead Ore Markets

Joplin, Mo., Jan. 25—Blende, per ton, high $52.80; basis 60% zinc, premium, $50; Class B, $42.50; Prime Western, $40; sludge, $37.50; calamine, basis 40% zinc, $35@30. Average selling prices: Blende, $43.08; calamine, $36.46; all zinc ores, $42.95.

Lead, high, $64.70; basis 80% lead, $60@58; average selling price, all grades of lead, $59.82 per ton.

Shipments the week: Blende, 11,588; calamine, 237; lead, 1101 tons. Value, all ores the week, $573,790. Shipments the month: Blende, 43,708; calamine, 1031; lead 4991 tons. Value, all ores the month, $2,239,370.

Buyers of Prime Western grades offered but $40 basis this week, and they and sellers stood firm, the latter refusing to accept. Though the shipment is a large one, sales dropped approximately 60 per cent.

Platteville, Wis., Jan. 25.—Blende, basis 60% zinc, $70 per ton base for premium grade; $45 down to $42 base for high-lead blende. Lead ore, basis 80% lead, $56 to $60 per ton. Shipments reported for the week were 1946 tons blende, 62 tons galena, and no sulphur ore. For the year to date the totals are 5862 tons blende, 335 tons galena, and no sulphur ore. During the week 3241 tons blende was shipped to separating plants.

Other Ores

Molybdenum—Buyers and sellers are far apart, but some small business was reported done at 85@90c.

Tungsten Ore—The talk in this market is very bearish. For the moment there is no market, for nobody seems to have the nerve to make one. If anyone did, the price might be $12 or lower. Nobody can tell.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight.

Iron Trade Review

NEW YORK—Jan. 29

Export inquiry is awakened by the sharp cuts given to ocean freight rates on both sides of the Atlantic. The disparity of British and American charges, according to "The Iron Age," has not been materially reduced, but the change is sufficient to cause concern abroad, particularly over the possibility of United States steel and iron being imported to the exclusion of the home product.

Some thousand-ton lots of finished steel for England are now in storage here awaiting favorable vessel rates, and stocks there made at high costs are not yet liquidated.

At present the chief competitor of the United States for the world's business, England's iron and steel industry, burdened with high fixed prices thrown upon it when the government discontinued its subsidy of increased labor and freight costs, is now threatened with strikes. Meanwhile in a few months 2,000,000 tons' annual capacity of blast furnaces will be in operation in Lorraine.

The pig-iron production of the United Kingdom for 1918 was about 250,000 tons below the 9,420,254 tons of 1917, and the steel ingot production of 1918 about 200,000 tons less than the 9,804,079 tons produced in 1917. In 1913 the British pig-iron output was 10,260,315 tons. These figures show how much a handicap was the war shortage of labor.

The withdrawal by the American Iron and Steel Institute of its recommendation that the proposed uniform sales contract be adopted by the trade is understood to be due to the encountering of unexpected difficulties. The prospect for general agreement on a formal contract is not now favorable. Some companies may, however, individually adopt the contract proposed by the Institute's committee on contract obligations.

Competition with steel bars has brought bar iron in the West to a parity at 2.70c., Pittsburgh, but bar-iron makers in the East adhere to the 3.50c. price, contending that their costs are too much to permit of a reduction.

A further reduction of $2 per ton in cast-iron pipe has been made by Eastern shops, so that the total drop is $5, as in the West.

PITTSBURGH—Jan. 28

The independent steel companies are operating at an average of 60 to 65%, on the basis of tonnage capacity and actual output, but few departments are entirely closed, the work being distributed. The Steel Corporation as a whole is reported to be operating at a much higher rate, about 90%, and the explanation offered for this divergence is that the Steel Corporation is putting large quantities of steel into warehouses, its warehouse capacity being large. It is said that it is more economical to operate at 90% than at 60%, and it may be inferred that, later on, some Steel Corporation plants will be closed entirely if demand from consumers does not increase.

New business being received from week to week, in the form of fresh orders and specifications against old contracts, represents much less tonnage than is being produced, and probably not over 25% of the existing capacity. The old orders on which the mills are running will not last long, and, though a revival in demand is expected in early spring, production at that time may not be as heavy as at present.

If the scrap market is any evidence of the amount by which the excess in steel prices must be eliminated, heavy declines must eventually come. The Government price on heavy melting steel was $29, and dealers were allowed to charge 3½% commission, making the cost of scrap $30. This week, dealers are willing to sell at $18, but as a rule the highest bid of consumers is $16. Taking the mean, $17, there is represented a decline of $13 per gross ton, or 43%. Last month's declines in finished-steel products, from Government levels, averaged barely $4 per gross ton.

A fair tonnage of plates and structural shapes is being rolled for the Emergency Fleet Corporation, but there are complaints from ship-yards of over-shipments. The maximum requirements of the Fleet Corporation did not represent more than 5% of the total capacity in finished rolled steel. About 75,000 of the 100,000 freight cars ordered last spring by the Railroad Administration are still to be made, and the car shops have been speeding up on this work. The automobile factories are taking steel freely. Some manufacturing consumers, like nut and bolt producers and shafting makers, are reported to be fairly busy. Jobbers are buying sparingly, and only for known requirements. There is practically a complete absence of demand for steel for general construction purposes.

Pig Iron—There is practically no demand for pig iron, and the market is in a sense nominal, but no indication appears that definite inquiry would bring out cut prices. Shipments against contracts are somewhat curtailed, but are still heavy. We quote: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—Regular prices for soft unfinished steel are firmly held. Billets, $43.50, small billets, $47, sheet bars, $47, slabs, $46; rods, $57. There is scarcely any demand. Shell steel, discard steel, and like forms are being offered at low rates.

Ferromanganese—Producers still name $225, delivered, as their asking price on 70%, but if any buyers were in the market they would not think of paying such a price. Resale material could probably be had at $200, and it is thought imported could be had at about $150. Spiegeleisen is nominal at $65, furnace, asked for 16 per cent.

Coke—The poorer grades of Connellsville coke, formerly shipped on contract to furnaces at the full Government price of $6, can now be disposed of as heating coke bringing, say, $4.25 @ $4.75. Furnace coke of fair grade is quotable at $5.50 @ $5.75. Some operators still quote the Government limit of $6, but cannot sell at the price. Furnaces that have contracts calling for "last Government price" when Government control ends, as it will on Feb. 1, expect operators to make a concession, otherwise, some are likely to blow out. Foundry coke of best grades is still held at the Government limit of $7, but some fair brands are available at $6.50.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56 775	75.630	88 702	26.960	36 682	44 356
Feb.	56 755	77.585	85 716	26.975	37 742	42 792
Mar.	57 935	73 861	88 082	27.597	36.410	43 620
April	64 415	73 875	95 346	30.662	36 963	47 215
May	74 269	74 745	99 505	35.477	37 940	48 980
June	65 024	76.971	99 500	31 060	39 065	48 875
July	62.940	79.010	99.625	30 000	40 110	48 813
Aug.	66 083	85.407	100.292	31 498	43 418	49 077
Sept.	68 515	100.740	101.125	32 584	50 920	49 500
Oct.	67 855	87 332	101.125	32 361	44 324	49 500
Nov.	71 604	85 891	101.125	34 192	43 584	48 969
Dec.	75 765	85.960	101 125	36.410	43 052	48.492
Year	65.661	81 417	96 772	31 315	40 851	47.516

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23 500	131 921	110.000	142.895	125.000
Feb.	31 750	23 500	137 895	110.000	148 100	125.000
Mar.	31 481	23.500	136.750	110.000	151.000	125.000
April	27 935	23 500	133 842	110.000	147.158	125.000
May	28.788	23.500	130.000	110.000	142.000	125.000
June	29 962	23.500	130.000	110.000	142 000	125 000
July	26 620	25.904	128 409	119.913	140 409	134 913
Aug.	25.380	26.000	122.391	122.000	137.000	137.000
Sept.	25.073	26.000	117.500	122.000	135 250	137 000
Oct.	23.500	26.000	110.000	122 000	125 000	137 000
Nov.	23 500	26.000	110.000	122.000	125 000	137.000
Dec.	23.500	(a)	110.000	118.447	125 000	133 167
Year	27.180	24.628	124 892	115 530	138 401	130 507

(a) No Market.

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293 227
February	51.420	92.000	198 974	311 525
March	54.388	(a)	207 443	318 875
April	55.910	(a)	220.171	329 905
May	63.173	(a)	245.114	364.217
June	62.053	(a)	242.083	331 925
July	62.570	(a)	242 181	360.347
August	62.681	(a)	243.978	380 900
September	61.542	(a)	244 038	343 905
October	61.851	(a)	247 467	335 543
November	74 740	(a)	274 943	323.550
December	87 120	(a)	298 556	267.736
Av. year	61 802	88.750	237 563	330 138

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6 782	7.530	6 684	30 500	29 00
February	8 636	6 973	8.595	6 899	30 500	29 00
March	9 199	7.201	9 120	7 091	30 500	29 00
April	9 288	6 772	9.158	6 701	30 500	29 00
May	10.207	6 818	10.202	6 704	30 500	29 00
June	11 171	7 611	11 123	7 511	30 500	29 00
July	10.710	8 033	10.644	7 750	30 500	29 00
August	10.594	8 050	10.518	7 750	30 500	29 00
September	8 680	8 050	8 611	7 750	30 500	29 00
October	6 710	8 050	6.650	7 750	30 500	29 00
November	6 249	8.050	6 187	7 750	30 500	31 20
December	6.375	6 564	6 312	6.324	30 500	40 00
Year	8 787	7.413	8 721	7 222	30 500	30 10

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9 619	7 836	9 449	7 661	48 329	54 000
February	10 045	7 814	9 875	7 639	47 000	54 000
March	10 300	7 461	10 130	7 286	47 000	54 000
April	9 459	6 890	9 289	6 715	54 632	54 000
May	9 362	7 314	9 192	7 114	54 000	54 000
June	9 371	8 021	9 201	7 791	54 000	54 000
July	8 643	8 688	8 473	8 338	54 000	54 000
August	8 360	8 985	8 190	8 635	54 000	54 000
September	8 136	9 442	7 966	9 092	54 000	54 000
October	7 983	8 801	7 813	8 451	54 000	54 000
November	7 847	8 491	7 672	8 141	54 000	54 100
December	7 685	8 163	7 510	7 813	54 000	56 050
Year	8 901	8 150	8 813	7 890	52 413	54 180

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35 95	$37 25	$30 95	$33 95	$30 95	$33 95
February	36 37	37 25	30 95	33 95	30 95	33 95
March	37 37	37 25	33 49	33 95	35 91	33 95
April	42 23	36 15	38 00	32 95	40 00	33 95
May	46 94	36 20	42 84	33 00	43 00	34 00
June	54 22	36 30	50 05	33 10	50 14	34 10
July	57 45	36 60	53 80	33 10	53 95	34 40
August	54 17	36 60	50 37	33 40	53 95	34 40
September	46 40	36 60	42 24	33 40	48 58	34 40
October	37 28	36 60	33 95	34 40	33 95	35 40
November	37 25	36 60	33 05	34 40	33 95	35 40
December	37 25	36 60	33 05	34 40	33 95	35 40
Year	$43 57	36 67	$40 62	33 70	$40 83	34 45

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Jan. 28
Alaska Gold M.	3¼
Alaska Juneau	1¾
Am.Sm.&Ref.,com.	71
Am.Sm. & Ref., pf.	106
Am.Sm.Sec., pf., A	91
Am. Zinc	11½
Am. Zinc, pf	39
Anaconda	59
Batopilas Min.	1¼
Bethlehem Steel.	61
Butte & Superior.	18
Butte Cop. & Zinc	6
Cerro de Pasco	31¾
Chile Cop	17¾
Chino	33½
Colo. Fuel & Iron	36¾
Crucible Steel.	54½
Crucible Steel, pf	90
Dome Mines	12
Federal M. & S.	9
Federal M. & S., pf	34
Greater Nor., ore ctf	37¼
Greene Cananea.	44¼
Gulf States Steel.	54
Homestake	95½
Inspiration Con	44½
International Nickel	26½
Kennecott	32¾
Lackawanna Steel.	67
Mexican Petrol.	169¼
Miami Copper	23¼
Nat'l Lead, com.	66½
National Lead, pf.	108½
Nev. Consol	16¾
Ontario Min	6¼
Ray Con	20½
Republic I.&S.,com.	71½
Republic I.&S., pf.	101¼
Sloss-Sheffield	60
Tennessee C. & C.	‡13
U. S. Steel, com.	92¾
U. S. Steel, pf	115
Utah Copper.	70
Va. Iron C. & C.	‡57

BOSTON CURB*	Jan. 28
Alaska Mines Corp.	‡.12
Boston Ely.	.95
Boston & Mont.	49
Butte & Lon'n Dev.	.12
Calaveras.	1¼
Chief Con	3¼
Contact.	‡ 05
Corbin	‡.25
Cortez	13
Crown Reserve	42
Crystal Cop	19
Eagle & Blue Bell	2½
First Nat. Cop	‡1⅛
Houghton Copper	30
Intermountain	‡ 05
Iron Blossom.	45
Iron Cap	15
Majestic	20
Mexican Metals	25
Mines of America.	‡ 75
Mojave Tungsten.	04
Nat. Zinc & Lead	09
Nevada-Douglas	22
New Baltic	1
New Cornelia	‡16
Oneco	20
Pacific Mines.	‡ 35
Rex Cons	‡ 05
Yukon Gold.	70

SAN FRAN.*	Jan. 28
Alta	02
Andes	03
Best & Belcher.	01
Caledonia	02
Challenge Con.	03
Confidence	03
Con. Virginia	05
Gould & Curry	01
Hale & Norcross	02
Jacket-Cr. Pt	03
Mexican	10
Occidental.	40
Ophir	09
Overman.	01
Savage	03
Sierra Nevada	05
Union Con	10
Utah Con.	‡ 01
Belmont	2 60
Jim Butler	35
MacNamara.	30
Midway	33
Mont.-Tonopah.	14
North Star	06
Rescue Eula	07
West End Con	1 25
Atlanta	04
Booth	13
Comb. Frac	‡ 02
Florence	13
Jumbo Extension	13
Kewanas	05
Nevada Hills	03
Nevada Packard	05
Round Mountain	32
Silver Pick	04
White Caps	13

COLO. SPRINGS*	Jan. 28
Cresson Con	4 93½
Doctor Jack Pot	04½
Elkton Con	04¼
El Paso	‡ 14
Gold Sovereign.	‡ 02
Golden Cycle	‡ 77½
Granite	18
Isabella	05
Mary McKinney	07
Portland	1 00
United Gold M.	15
Vindicator	42

BOSTON EXCH.†	Jan. 28
Adventure.	‡ 60
Ahmeek.	17½
Algomah.	‡ 30
Allouez.	43
Ariz. Com.	11¼
Arnold.	‡ 20
Bingham Mines	‡9½
Boonanza	‡ 10
Butte-Balaklava	‡ 21
Calumet & Ariz.	59½
Calumet & Hecla.	426
Centennial	‡12½
Copper Range	42
Daly West	‡2½
Davis-Daly.	5¼
East Butte.	9¼
Franklin.	‡3½
Granby.	‡79
Hancock	‡5½
Hedley.	‡12
Helvetia	‡ 20
Indiana	‡ 80
Isle Royale.	‡24½
Keweenaw.	1½
Lake.	3¼
La Salle	‡2
Mason Valley	‡2½
Mass.	‡4
Mayflower	2⅛
Michigan	‡3
Mohawk.	52
New Arcadian	1¼
New Idria	‡10
North Butte.	‡10¼
North Lake	‡ 55
Ojibway	‡1¼
Old Dominion.	‡34
Osceola	‡52
Quincy	58
St. Mary's M. L.	‡42
Santa Fe	‡ 25
Seneca	13¼
Shannon.	‡2¾
Shattuck-Ariz	‡14½
So. Lake.	‡1
So. Utah	‡ 10
Superior	5
Superior & Bost	‡2
Trinity	2½
Tuolumne	82
U. S. Smelting.	45
U. S. Smelting, pf	45
Utah Apex	2¼
Utah Con	8
Utah Metal	1¼
Victoria.	‡2
Winona	90
Wolverine.	18
Wyandot	‡ 50

N. Y. CURB†	Jan. 28
Big Ledge	75
Butte & N. Y.	‡½
Butte Detroit	‡ 01½
Caledonia	30
Calumet & Jerome	1/16
Can. Cop. Corpn	2
Carlisle	‡2
Cashboy	‡ 07
Con. Ariz. Sm.	1½
Con. Coppermines	5¼
Goldfield Con	21
Goldfield Merger	06
Greenmonster.	½
Hecla Min	4¼
Howe Sound	‡3¼
Jerome Verde	‡ 50
Louisiana	‡1/16
Magma.	26
Marsh	04
McKinley-Dar-Sa	‡ 47
Milford	‡ 75
Mother Lode	32
Nixon Nevada	41
Ohio Cop	‡1/16
Rawley.	‡½
Ray Hercules	2
Richmond	‡ 56
Rochester Mines	28
St. Joseph Lead.	‡12
Standard S. L.	¼
Stewart	‡ 16
Success	11
Tonopah	13
Tonopah Ex	2¼
Tribullion	⅛
Troy Arizona	‡ 10
United Eastern	4 1/16
United Verde Ext.	‡35½
United Zinc	1¼
Utica Mines	‡ 08

TORONTO*	Jan. 28
Adanac	18
Bailey	04
Beaver Con	41
Chambers Ferland.	09
Coniagas	2 00
Hargraves	03
Kerr Lake	15 37½
La Rose	35
Lake Shore	90
Min. Corp. of Can.	1 50
Nipissing	8 75
Peterson Lake	08
Temiskaming	31
Wettlaufer-Lor.	03
Davidson	‡ 60
Dome Exten	22
Dome Lake	20
Hollinger	6 00
McIntyre	1 02½
Newray	12½
Porcu. Crown	30
Teck-Hughes	25
Vipond	20
West Dome	13

* Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

February 8, 1919

Volume 107 *Number* 6

SMELTING PLANT AT NAMTU

Operations of the Burma Mines, Ltd.

By A. B. Parsons*

An interesting description of Burmese life, traditions, and customs, and the operations of one of the most important mining properties in the East. As a future lead-silver-zinc producer, Burma Mines, Ltd., is likely to attract considerable attention. Extensive equipment is now in operation, and the property is the principal source of lead and silver for the needs of the Burmese government. There are large reserves of high-grade ore; and as profits since the inception of the company have been returned for reinvestment, its ultimate success on a large scale would seem as deserved as it is probable. Data with regard to mining operations in Asia are published infrequently, and the following paper will be read with more than passing interest.

WITH a well-authenticated record of having been worked intermittently since the fifteenth century, during which period they have yielded millions in fine silver to the Chinese, and with the prospect of being one of the world's premier lead-silver-zinc producers in the near future, the mineral properties of the Burma Mines, Ltd., present features of considerable interest. Operations center about Namtu, Northern Shan States, Upper Burma, where the smelting and power plants, mill, foundry, railroad shops, and general offices are situated. Namtu is about three days' journey inland by rail from Rangoon, one day beyond Mandalay, and only about 60 miles from the western frontier of China. It lies almost on the Tropic of Cancer, and is about the same distance from New York whether one travels via the Atlantic or by way of San Francisco and the Pacific.

To this geographical isolation and great distance from its base of supplies is added the further complication of a strange, uncultured population, having peculiar traditions and habits of life, and a country unsuited in its natural state to European habitation. It is difficult to comprehend the variety of problems that confront a company operating under such conditions—problems of which the average operator has no conception. Experience has shown that the more nearly independent and self-contained a property is, the more smoothly will its operations proceed. To accomplish this end the company engages in a great number of activities, not directly connected with mining, but which tend to minimize, as much as possible, dependence on the outside world.

---

*Mining engineer, Butte & Superior Mining Co., Butte, Montana.

Despite the mine's isolation and the added difficulties of getting supplies of any kind, and particularly machinery, due to the war, the company is now supplying the Indian government with practically all the lead required for the manufacture of ammunition, together with much of the refined silver needed for coinage purposes.

COMPANY HAS EXTENSIVE AND VARIED INTERESTS

The company owns and operates a 50-mile railroad, its own iron mine and limestone quarries, and, from about 50 square miles of forest adjacent to the railroad, it cuts sufficient fuel to operate the railroad and supply smeltery requirements, a total of about 7,000,000 cu.ft. annually. Approximately 10 000 natives are employed, supervised by a staff of about 100 "Europeans," a term which locally includes both Australians and Americans, the actual Europeans, in fact, forming a small minority. The direction of the enterprise, including the recent development and the plans for the future, has been in the hands of an American engineer, T. E. Mitchell, until recently resident manager for the company.

The mine itself is at Bawdwin, the northern terminus of the company railroad, about 13 miles above Namtu. There is a rise of nearly 1500 ft. in the journey from Namtu to the mines, and the trip up the canyon is remarkable for its exceptional scenic features. There are indications that the Chinese mined and smelted silver ores here even before the Christian era. If this is the case, the present Bawdwin—which, incidentally, means "silver well"—was, quite possibly, the scene of the world's first successful silver-smelting operations. At any rate there are authentic records at Mandalay which show productions prior to the year 1500. The details of Chinese metallurgy are not thoroughly understood, although there is ample proof that results were obtained.

PRIMITIVE SMELTING METHODS USED BY NATIVES

The smelting was carried on in scores of small furnaces built of mud and sand, something after the fashion of a modern cupel test. The heat was derived from a charcoal fire on grate bars directly over the "test." After once getting a lake of molten lead, pulverized ore was sprinkled over the surface, small quantities at a time. During the interval between ore additions, a "slaggy" product containing about 60% lead, and mixed with bits of charcoal that had dropped through the grate bars, was skimmed from the surface. There was practically no silver in this skimmed mixture. After a quantity of ore sufficient to afford a convenient amount of silver had been treated, the remaining lead was taken off as an impure litharge, leaving the refined silver on the test. This completed a cycle of operations.

In mining the ore the mountain sides were gophered with hundreds of small adits, scarcely large enough for an ordinary white man to enter on his hands and knees. No indication of the use of explosives has been found, and the work was doubtless most tedious. That an almost countless number of coolies was engaged is indicated by the thousands of Chinese graves that dot the adjacent hillsides. The mines were finally abandoned by the Chinese in 1868, after a million tons of the best silver ore had been mined and treated. The jungle around Bawdwin was entirely cleared by these early-day operators, doubtless for fuel purposes, and the hills are still bare.

LEAD IN ANCIENT SLAG DUMPS FIRST ATTRACTED ATTENTION

The first practical step toward the recovery of the immense quantities of lead in the slag dumps left by the Chinese was taken in 1904. In this year the Great Eastern Mining Co. began investigating the property, its interest being taken over, however, in March, 1906, by the Burma Mine, Railway and Smelting Co. Extensive sampling of the slag, with a conservative estimate of 115,000 tons available, appeared to warrant the construction of a smeltery at Mandalay, with a narrow-gage railway to connect Bawdwin with the Mandalay-Lashio branch of the Burma Railways.

The country to be traversed by this railroad was rugged and heavily wooded, so that the construction cost was high—and the cost of maintenance, owing to heavy grades, short curves, and tropical rains, has been still greater. However, the road was completed, and the furnaces were blown in at Mandalay in February, 1909. In two and a half years 40,000 tons of lead bullion was produced entirely from Bawdwin slag. In 1911 the smeltery equipment at Mandalay was moved to its present site, and the town of Namtu, where the narrow-gage railroad crosses the Namtu River, was started. This move was in anticipation of the ultimate exhaustion of the slag, which would make mining operations and a roasting plant essential. For the next few years the smeltery was run mainly on slag with a small proportion of ore, and a base bullion, carrying silver in quantity varying from 10 to 30 oz. per ton, was shipped away for refining.

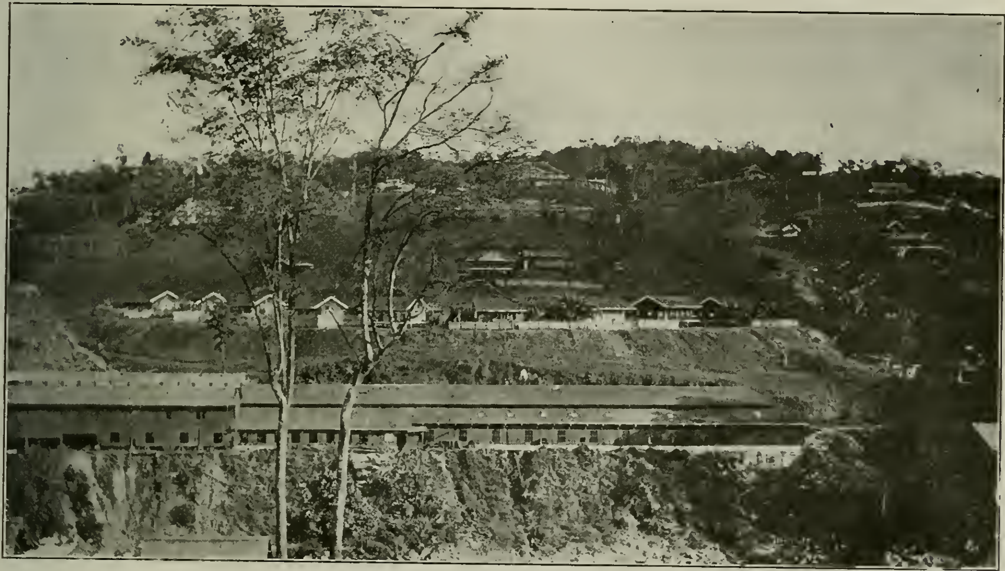
At this time there were less than a dozen white men in this section of the country. There was considerable malaria in the wet season, and conditions were anything but suitable for Europeans. A. R. Oberlander and Edgar Malloy, both from the Murray plant of the American Smelting and Refining Co., were the leading spirits in conducting operations, and both are still at Namtu. Oberlander is personal assistant to the resident manager, and Malloy is smeltery superintendent.

STRANGE DISCOVERIES MADE IN OPENING OLD WORKING

During this period, development work at the mine was prosecuted in rather lethargic fashion, principally by enlarging, extending, and crosscutting from the "D. C." tunnel. "D. C." is an abbreviation for "Dead Chinaman," and has been used to denote this particular tunnel because of a number of human skeletons encountered when white men first explored it. One old section of the property is styled the "Jail Workings" in commemoration of the unearthing of a skeleton accoutered with manacles, presumably welded on during the life of the victim. Finally, what is now known as the Chinaman orebody was penetrated, and it soon gave promise of being a huge deposit. Vigorous development work, including an extensive campaign of diamond drilling, gradually demonstrated the wonderful possibilities of the mine.

Briefly, these were the conditions in October, 1913, when a new company, styled The Burma Corporation, was organized, providing new capital with a view to developing an immense producing mining property. Four important things were to be done: (a) to put the mine in condition to produce tonnage; (b) to overhaul and add to the smeltery; (c) to discover and open available iron-ore deposits and limestone quarries, and (d) to make living conditions reasonably comfortable, and to minimize the danger from malaria.

The largest single piece of work undertaken was the driving of a main haulage and drainage tunnel 7400 ft. long to tap the workings 500 ft. below the D. C. tunnel level. It is really an adit 8 ft. by 10 ft. in the clear, double tracked and electric lighted, and soon to have motor transportation to replace the mules now used. Considering various difficulties and the amount of bad ground encountered, the work was accomplished in good time by native miners working under practical shift foremen from Butte, Mont. It was completed in September, 1916, and was ceremoniously named the Tiger Tunnel, by the Lieutenant-Governor of Burma.



EUROPEAN RESIDENCES AT NAMTU

The ore deposit is a replacement in a fine-grained, dark-colored silicified rhyolite, the impregnated zone being more than 100 ft. wide at certain points. The walls are not well defined, but in a general way the orebody approaches the vertical. The best ore, assaying as much as 50% lead, 25% zinc, and 50 oz. of silver, is found in the core of the deposit, the tenor diminishing as the limits on either side are approached.

The ore is an intimate and complex mixture of sulphides, with no uniformity in the proportions of lead and zinc, even in adjacent sections. This condition makes the mining of those classes of ore answering metallurgical requirements a particularly difficult matter. A fault at the south limits of the present workings cuts off the orebody, and to date its extension has not been discovered beyond this point. Along the strike the vein has been prospected and developed for about 2000 ft., and the northerly limit has not been reached, although there is a change in the ore, more or less copper being found at the north end. No effort has as yet been made toward proving ore below the Tiger Tunnel level, although there is no reason to question the downward extension of the orebody, with no diminution in the grade of material, there being no secondary enrichment.

The silver probably occurs as argentite in sub-microscopic mixture with galena, an interesting feature being the uniformity in finding approximately one ounce of silver for each per cent. of lead in all grades of ore, regardless of the amount of zinc. The following table gives a number of typical ore analyses:

ANALYSES SILVER-LEAD-ZINC ORE, BURMA MINES, LTD.

	Silver, Oz. per ton	Lead, Per Cent.	Zinc, Per Cent.
Silver-lead ore, No. 1	47.6	50.0	19.2
Silver-lead ore, No. 2	54.4	50.4	24.1
High-zinc ore, No. 1	11.0	11.2	38.8
High-zinc ore, No. 2	15.5	13.6	40.7
Zinc-lead ore	38.5	33.9	36.3
Second-grade ore	11.8	22.5	7.0

An idea of the immensity of the deposit may be had from considering a single block of 2,000,000 tons, 75% of which is pure sulphide.

SYSTEMS OF MINING USED

At the outset square-setting was the only method of mining employed, but satisfactory results have recently been obtained in some places with a timberless rill system of stoping, and the applicability of other cheap methods is being determined. Timbers, of native wood cut in the vicinity, and squared at the company's sawmill, are used exclusively. The wood is hard and heavy, but is brittle, does not take weight well and is really not satisfactory, being used only because it is the best available.

Ingersoll-Rand Jackhamers and B. C. 21 stopers are used for breaking ore in stopes, and do good work in the comparatively soft ground. The tunnel was driven with water Leyners, and these machines are still used in development work. Nobel's "Gelanite," 50% strength, is used exclusively for blasting operations. The present rate of production is about 300 tons, but so far as the physical condition of the mine itself is concerned, 2000 tons could be mined daily. This is the tonnage planned for the plants now under construction.

DETAILS OF METALLURGICAL EQUIPMENT

The original smelting plant comprised three blast furnaces, two 48 by 160 in. and one 48 by 96 in. at the tuyeres, and a Parsons steam turbo-blower. At present the equipment includes, besides these furnaces, a crushing plant, five 26-ft. Godfrey roasters, 19 Huntington and Heberlein sintering pots, one Dwight & Lloyd machine, and a complete refinery which turns out refined lead and a silver bullion of 997 minimum fineness. The installation includes dross furnaces, desilverizing kettles, Faber du Faur tilting furnaces for retorting, and cupels for silver refining, according to the standard practice of Parke's process. The refinery and the greater part of the roasting plant are comparatively recent additions.

The feature of the smelting operations is perhaps the high zinc content of the blast-furnace charge. Despite continued efforts to mine ore containing a minimum of zinc in proportion to lead, the slag regularly assays 16 and 17% zinc and has often been as high as 20%. The present roasting capacity is not sufficient for the elimination of sulphur to the desired extent, without too great a sacrifice in the tonnage put through the furnaces. Excessive sulphur, in addition to the "high" zinc, further complicates the problem of furnace operation, and three months is the maximum length of campaign before a furnace must be blown out, dismantled, and entirely cleaned out. In addition to the zinc, the slag analyses average approximately 14% lime, 24% silica, and 34% iron oxide. An inferior grade of coke comes from India. The ash averages 22% and the sulphur is high, though not so bad as Japanese coke in this particular. The latter was tried, but the Indian product was found to be preferable.

IRON-ORE FLUX OBTAINABLE NEAR BY

The problem of obtaining adequate iron ore for fluxing purposes has been solved. The supply was almost exhausted some time ago, but recently new mines have been opened, and several years' supply is now available. The two principal sources at present are Thondaung and Mampwe, where a sufficient tonnage is minable with comparative facility. A desirable grade of limestone is obtained from various quarries conveniently situated on the company railroad, and a "gossan" ore, capping material at the mines, containing 60% silica and 5% lead, is shipped to the smeltery to supply silica in the charge. The matter of transportation is really the only problem in connection with the question of fluxing materials at this time.

The final and an important feature in the program for large-scale operations was that of waging war on malaria, and creating conditions suitable for European habitation. It was thought that the clearing of the jungle growth, and the draining of spots where water might accumulate, would go a long way toward eliminating the fever. The theory is that the zone of operation of the malarial mosquito is limited to a certain radius from its breeding place, and results seem to have verified that assumption. An area extending several hundred yards beyond the outlying bungalows has been cleared and drained, and to this action is largely attributed the reduction in the proportion of fever patients from something like 40% to less than 5%. A sanitary engineer, operating in conjunction with the medical department, is responsible for jungle clearing, as well as for sewage and garbage disposal and the maintenance of proper conditions as to water supply.

LIVING CONDITIONS ON THE PROPERTY

Among the improvements which tend to better conditions generally a few may be enumerated. There are about 75 bungalows for Europeans, most of which are equipped with electric lights, bath rooms, screened front and back porches, and a kitchen in a separate building at the rear; a large mess house and modern dormitory for Europeans who have no families with them; a club house with piano, library, billiards, and other features; a similar club house at Bawdwin; and a provision store with a large assortment of high-grade "tinned" eatables. One is astonished at the things that can readily be obtained in a tin or a bottle. There is an ice plant and a plant for the bottling of distilled aërated water; and a bakery is being built. There are native bakeshops, but it is impossible to induce the bakers to adopt hygienic methods.

In addition to the accommodations enumerated, the company is preparing to go into the laundry business. The native "dhobe," or laundry man, uses a stone for a washboard, and when he has worn one smooth, he looks for a new one. He usually gets the clothes fairly clean, but it is a healthy garment indeed that can survive many trips to the "dhobe."

At the native town of Panghi, near by, a bazaar is held every fifth day, when fresh vegetables, fruits, and meat can be obtained cheaply. The company conducts a market where better meat can be purchased. Two Americans who own a farm a few miles from Namtu have a contract to supply beef. The natives make meat out of animals whose utility in transportation lines has been outlived, and it is atrocious stuff. A basket of very good vegetables can be obtained from Maymyo, a hill station and the summer capital of Burma, with an express charge of only 16c. Everything considered, living conditions are good and the cost is not excessive.

NATIVE LABOR IS FICKLE AND UNRELIABLE

The methods of handling native labor have features characteristic of the Orient and are of some interest. In the dry season, extending from October till the following May, labor is plentiful, largely because of the influx of good coolies from China. During the rainy season, which covers the remainder of the year, many of these go back to their homes to raise rice, and there is continual difficulty, due not so much to numerical shortage as to the failure of those who are on the payroll to come to work. The company is doing everything it can to improve living quarters and conditions, and thus induce the Chinese to stay the year around.

Wages are, of course, extremely low—and the value of the service rendered is correspondingly small. A coolie, as all common laborers are called, is paid the equivalent in Indian currency of from 24 to 40c. per day, the danger and disagreeable features of the work at which he is engaged being the principal controlling factors. Native "bosses" are numerous. They go under a variety of names and are paid 60 to 90c. Mechanics, or "fitters" as they are called, carpenters, masons, and native office men get about the same, that is from 60 to 90 cents.

The labor is admittedly but unavoidably inefficient. In the first place, a coolie never makes a move on his own initiative, and he cannot, apparently, attend to more than one thing at a time. A multiplicity of duties, no matter how trifling, confuses him, and he looks after nothing. The result is that it is generally necessary to have a great many more men than ought really to be used, particularly in plant operation. A coolie is absolutely irresponsible, and cannot be relied upon to come to work. As a sudden "touch of fever" is always an available and valid excuse, he cannot well be disciplined. This makes it necessary to carry an excessive number in a given department to insure against being short-handed about every third shift. A good "gaung," or coolie foreman, is sometimes a help, but he has little influence over his men.

The contract system is used on many kinds of work. Development driving at the mines, cutting fuel wood in the forests, bedding ores, breaking up sintered material at the smeltery, and various other work where a unit price can be figured, is done under contract. Masonry and framing timber are contracted also; and, incidentally, the carpenters as well as the masons are quite skilful at their work and are not as inefficient as the coolies.

Language Is as Varied as Costume

There are at least nine distinct languages in common use around the property, but the European who acquires Burmese, Shan, and Hindustani, with perhaps a little Chinese, can get along tolerably well. Though many of the natives know several languages, and are quick at picking up English, the great bulk of them know but one, and often cannot understand the other coolies they are working with. The confusion attending this Babelistic condition is equalled only by the variety of costume worn by the natives at work. The laws of country, tribe, and caste seem strictly to be adhered to, and the ideas gleaned from the pictures in one's school-days geography are substantiated in detail. Starting with practically nothing, and passing by devious stages up to the most voluminous, flowing robes—one finds them all. And what one would guess to be holiday regalia is nothing of the kind—simply a substitute for overalls and jumper. According to the inexorable decree of caste, a brick never must be laid except by a man wearing a full beard and sufficient drapery and flowing headgear for the adornment of a church bride. And it never is. A coolie invariably wears something on his head and also, invariably, nothing on his feet.

Plans for the company's future are concerned largely with metallurgical development. A concentrator of 2000 tons' daily capacity is under course of construction, and most of the machinery is either on hand or en route from the United States. The equipment includes rolls, tube mills, jigs, and tables in the crushing and concentrating departments; and extensive experimentation indicates that flotation will unquestionably play a prominent part in the scheme of concentration. The problem is, obviously, one of differential separation of the very fine and very intimately mixed sulphides of lead and zinc. However, no conclusion has been reached as to the most effective combination of processes, nor has the matter of flotation apparatus been determined thus far, although these questions are now engaging the entire attention of the mill staff.

Experimental work on a large scale has demonstrated the technical success of a treatment involving roasting, leaching, and electrical re-precipitation of the zinc. The deciding factor here will doubtless be the question of power, there being some uncertainty as to the possibility of obtaining sufficient at a cost low enough to make the process economically available. Field work with a view to discovering and making preliminary surveys of possible hydro-electric projects is under way. A number of good-sized rivers within a reasonable distance have been little explored by white men, and it is possible that a source of cheap power may be found.

Hydro-Electric Power Plant Proposed

Negotiations have already been consummated with the government of Burma for the utilization of the Mansam Falls, in the Namya River, on the Mandalay-Lashio branch of the Burma Railways. A transmission line 40 miles long will carry a dry-season minimum of about 3000 hp. The equipment is being purchased, and the installation will be pushed with all possible speed. Power for lighting, for the mine compressor plant, and for a few motors around the smeltery is now supplied by two 1000-hp. Diesel engine-generator units. The completion of the Mansam project will afford ample power for the mill, mine, and miscellaneous requirements, but some other source must necessarily be found to supply power for an electrolytic zinc plant. As an alternative, it is possible that a zinc plant may be built at tidewater, the neighborhood of Calcutta being under consideration as combining various advantages from different points of view.

Eventually a more modern lead smeltery may be built at Mandalay, or possibly in the vicinity of Rangoon. The supply of wood fuel will, according to present calculation, be inadequate after two or three years, and a move to bring the plant nearer to a coal supply may be made. The haulage of coke and flux complicates the by no means negligible traffic problems of the company's winding, narrow-gage railway, and this may be one of a number of factors which will decide the permanent site of the smelting works.

The exploration parties looking for water power are accompanied by geologists; and a general survey over a large area is being made. The stories of other old mines once worked by the Chinese, in circulation among the natives, are probably not without foundation in fact. At any rate, the country is very generally "mineralized" and there seems every possibility of important discoveries being made.

Burma Mines, Ltd., is a British organization, being one of a number with which H. C. Hoover was connected in pre-war days. Hundreds of thousands of pounds have been invested, with profit up to date going back into the property, so that financial success is as deserved as it seems certain. A. F. Kuehn, of London, and Lawrence Addicks, of New York, are consulting engineers for the company. It is through the kindness of Mr. Kuehn and Mr. Mitchell, the late manager, that I am able to give these few details of mining and metallurgical operations in a remote corner of the world.

The Federal Trade Commission

Methods of the Federal Trade Commission in conducting its meat-packing inquiry were revealed at the hearing on Jan. 23 before the House Interstate Commerce Committee on legislation to regulate the meat industry in accordance with the commission's recommendations. Levy Mayer, counsel for Armour & Co., was on the stand discussing the constitutionality of the bill and the commission's inquiry.

"When the Federal Trade Commission took testimony and found a verdict of guilty against the packers, do you mean to say your clients were given no chance to reply?" asked Representative Sanders, of Louisiana.

"None whatever," Mr. Mayer said.

"You don't mean to say that when a witness took the stand to give damaging testimony against your clients you were not allowed to question him?"

"I was not allowed to participate in the hearing at all."

"You were not allowed even to establish the credibility of the witness?"

"No."

"Then what credence can we give to these findings?" continued Mr. Sanders.

"None whatever."

"Do you mean to say the Federal Trade Commission undertook to investigate a great industry without giving the industry a chance to present its side?"

"Absolutely none," Mr. Mayer said. "I made three trips to Washington to plead for the opportunity, but they refused and gave no reason. They sent scores and scores of examiners to go through the files of Armour & Co. and took many letters."

"Of course, they took all the letters to show the context?" Mr. Sanders interrupted.

"They did not," Mr. Mayer answered.

The witness said a mistaken inference drawn from one letter referring to an agreed price on lard compound was due to the failure of the commission to take other letters which would have explained that the price was fixed by the Food Administration and not by the packers.

"It is the most remarkable thing I ever heard of in my life," Mr. Sanders remarked, as he finished his questioning.

"If you can regulate private industry such as the packing plants, then you can regulate the manufacture of hairpins, rubber boots, everything," said Mr Mayer, "and it won't be long before you have every dissatisfied element of the community appealing for the great panacea of Congressional legislation."

The licensing provision of the bill was declared the most drastic because it entrusted to one man, the President, the right to issue and revoke licenses. Mr. Mayer said the power given the Government to purchase and publish market newspapers staggered the imagination, and might lead to powerful political influence.

Engineers Represented in Washington

To provide for united action upon matters of common concern to engineers, the Engineering Council has recently organized a National Service Committee, and has established an office in the national capital. This action was based upon a tentative plan for representation of engineers at Washington, submitted to the Council at a special meeting on Nov. 21, 1918, by Philip N. Moore, of the American Institute of Mining Engineers. The present member societies of the Engineering Council are the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the United Engineering Society, and the American Society for Testing Materials.

The Engineering Council, through this National Service Committee and its Washington office, intends to accomplish the following general purposes, this committee acting always under the direction of the Council and within limitations fixed for it:

1. To indicate those public services which may best be performed by members of engineering societies, and, when desired, to offer the proper men for such services.
2. To speak authoritatively for the Engineering Council before committees of Congress and departments of the Government on all public questions of common interest to engineers, within such limitations as the Council may set from time to time.
3. To give promptly wide circulation among engineers to authentic information regarding pending legislation and executive actions which may affect the interests of engineers in any way.
4. To gather opinions of engineers on these matters.

The Engineering Council's aim is disinterested usefulness to the nation and the profession—not advocacy of any selfish ends—by giving unbiased information and counsel on technical matters, chiefly when asked. A modest start is being made. The work will be enlarged only as a real demand for the services of the committee develops.

The members of the National Service Committee have been chosen so as to represent different parts of the country. The appointees are the following: Chairman, M. O. Leighton, member A. S. C. E., Washington, D. C.; C. B. Burdick, member A. S. C. E., Chicago, Ill.; George F. Swain, member A. S. C. E., Boston, Mass.; Philip N. Moore, member A. I. M. E., St. Louis, Mo.; L. D. Ricketts, member A. I. M. E., Warren, Ariz.; Andrew M. Hunt, member A. S. M. E., San Francisco and New York; Andrew M. Lockett, member A. S. M. E., New Orleans, La.; W. C. L. Eglin, member A. I. E. E., Philadelphia, Penn.; Bancroft Gherardi, member A. I. E. E., New York.

The Washington office is at 502 McLachlen Building, 10th and G Streets.

The Smelting and Refining of Cobalt Silver Ore*

By SYDNEY B. WRIGHT

THE shipments received at the Deloro Reduction Co.'s works from the operators in the Cobalt and Gowganda districts consist of high- and low-grade silver-cobalt ore in lump form, jig and table concentrate, and ore residues such as those produced by the Nipissing Mining Co. and the Mining Corporation.

SAMPLING

For sampling purposes the ore is ball-milled to about a 20-mesh product, a 14% cut being drawn by a Snyder disk machine as the bulk sample. After a second Snyder cut, the sample, now constituting about 2% of the original ore, is transferred to the sampling floor, where, after thorough mixing, it is coned and quartered into two samples, which are then quartered separately.

Reserve samples of these original pulps are sealed and retained for umpire purposes, until settlement has been made for the shipment. The control samples are ground to pass a 100-mesh screen, scales being separated as usual for assay. The requisite number of assay samples is drawn for the shipper, smelter, and independent assayer, and the certificate of the last named governs in settlement for the shipment.

Metallics or nuggets are removed from the ball mill after the carload or lot has been crushed, and are melted down to base bullion in an oil-fired crucible furnace. The silver content, as shown by assay, is added to the total silver indicated as contained in the milled pulp, and settlement is made accordingly.

SMELTING

After the ore is sampled, it is transferred to bins, from which it charged to the blast furnace. The charge is so calculated as to furnish a practically neutral slag, and, on account of the large quantity of fines present, the furnace is run generally at a blast pressure of only 6 to 8 oz. It was considered probable that by briquetting the fines the capacity of the furnace would be increased, but the test runs made on these lines did not produce the desired metallurgical results. The ore, and reverts from other sections of the plant, are therefore mixed wet and charged to the furnace in the form of a stiff mortar. This sinters fairly well before the smelting zone is reached, the actual flue dust produced amounting to about 6% of the ore and slimes charged. The products of the smelting operation are speiss, from which a quantity of base silver is liquated in the case of high-grade runs; slag, and arsenic fume, which is collected in baghouses of the regular type.

DESILVERIZING THE SPEISS

The speiss produced contains, approximately, Co, 22-25%; Ni, 16-18%; As, 25%; Fe, 18%; S, 7%; Cu, 1% and Ag, 1000 to 1200 oz. per ton.

This speiss product is ground in a ball mill until the whole passes a screen with 40 meshes to the inch. The ground material is then roasted until it contains only 10% of arsenic. The roasting is done in a furnace of the reverberatory type, which is equipped with a mechanical rabble having water-cooled arms. The chloridizing is done in a Bruckner cylinder.

The chloridized speiss is washed with water and then agitated for one hour with a cyanide solution containing the equivalent of 20 lb. KCN per ton. The silver is precipitated from the solutions by means of aluminum dust, one part of which deposits about eight parts of silver in Deloro company practice. It is interesting to note that the cyanide actually regenerated in this precipitation is practically equal to the theoretical quantity formerly present in the double silver salt. The precipitate now goes to the silver refinery, and the desilverized speiss residues go to the oxide plant.

SILVER REFINING

The base silver, liquated in the form of bottoms from pots of speiss, averages about 800 fine, the remainder consisting of arsenic and antimony, with some cobalt, nickel, iron, copper, and bismuth. This bullion is refined by melting it in an oil-fired Schwartz furnace, which is equipped as a small converter. As soon as the charge is in a molten state, the furnace is tilted backward into blowing position, and the metal is blown for about three hours. During the first half hour of this period the oil is shut off from the burner, the heat of the reaction being sufficient to keep the metal molten for that length of time. After a short further heating, the charge is poured into ingot molds.

The silver bullion thus obtained averages from 992 to 995 fine, and is brought up to commercial grade (996 and better) by remelting with silver precipitate from the cyanide plant. This operation is performed in a second Schwartz furnace. The gases from these furnaces are drawn through coolers and passed to a small baghouse. The fume is rich in silver, carrying about 800 oz. per ton, and consists essentially of arsenious oxide, with some antimony and bismuth oxides. All bullion slags and the fume are eventually re-charged to the blast furnace.

The gases from the blast furnace, the roasters, and chloridizers are drawn through flues and coolers before reaching the baghouses which collect the crude arsenious oxide. The temperature of the gases entering the baghouses is regulated at a maximum of 250° F. by means of a thermostat operating a damper in the main flue; when the temperature rises to 250° F., cool air is immediately drawn in.

REFINING THE CRUDE ARSENIC

The crude arsenic that is collected in the baghouses is sent to refining furnaces, which are coke-fired reverberatory hearths. The arsenious oxide that is formed is volatilized and condensed in chambers that are emptied at intervals of 10 to 14 days. The products from these chambers are pulverized and packed in barrels by means

---

*Abstracted from *Trans.* Can. Min. Inst., 1918, p. 992.

of Raymond equipment. The clinker or slag drawn from the refining hearth contains all the silver that was formerly present in the crude arsenic. This slag goes back to the blast furnace.

Oxide Plant

It is necessary now to return to the desilverized speiss residues which contain the cobalt and nickel content of the ore. The metals in this material are present principally in the form of oxides, so that the first treatment is that of sulphatizing, to render the cobalt and nickel soluble as sulphates. The sulphatized speiss is charged to tanks, in which the mass is agitated with hot water, during which process the sulphates are dissolved. The liquors thus obtained are then freed from copper and iron before being passed to the precipitation tanks.

The cobalt and nickel are separated by fractional precipitation with hypochlorite solutions, the nickel being finally precipitated as hydroxide by means of milk of lime. The hydroxides of cobalt and nickel thus obtained are filter-pressed, washed, and dried, after which treatment the oxides are either pulverized and packed for the market, or are transferred to the metals department for reduction to the metallic state.

Metals Department

For the purpose of reduction, the oxides are mixed with charcoal and reduced to rough metal in oil-fired furnaces. After separation from excess carbon by means of a magnetic separator, the rough metal is melted in electric furnaces and converted into shot form by pouring into water.

The 50-kw. electric furnaces used are of the single-phase, top-and-bottom-electrode type, lined with magnesite, and have a capacity of 100 lb. of cobalt or nickel metal per hour.

Smelting Tin Ore in Mexico

By Bennett R. Bates

Tin ore occurs in small quantities at numerous places in Mexico and indeed is rather widely distributed, but to date no single important deposit has been found. The ore for the most part is stream tin, cleaned up in "bateas" by the natives from the gravels found in the steep precipitous gullies of the sierras, the very topography of which does not lend itself to single large deposits. Whether large or more important deposits occur down the streams has not, as yet, been determined. Such stream tin is found in the mountains near El Cubo, Guanajuato; and recently while the Tajo mill was being rehabilitated for the Cubo Mining and Milling Co. a small furnace was built, metallic tin was produced, and babbitt metal and solder were made on the ground.

The furnace shown herewith in operation, built by the natives, was similar to the early shaft furnaces used in Cornwall, and closely resembles that described by Agricola. The furnace proper consisted of a short vertical shaft about 6 in. square by 30 in. deep. Charcoal fuel was used, charging alternate layers of charcoal and ore. Both ore and fuel were wetted before charging, and the charge was frequently sprinkled to keep the top cool. Air was supplied from two hand bellows, the blast entering through tuyeres placed just above the floor of the furnace and directed downward and toward the tap hole, which was always kept open, the molten tin trickling in gushes.

Charcoal consumption was approximately 3 lb. to 1 lb. of ore treated. The recovery was about 67% metal. No assays were made, but from previous data at hand the product was assumed to assay 94 to 97% tin. The total cost of the resultant metal was 35 to 40c. (U. S. currency) per lb. By using standard formulas, excellent babbitt metal and solder were produced.

An endeavor was made to stimulate the ranchers to a greater production, in the hope of aiding in relieving the shortage of tin in Mexico City, but difficulty was experienced in supplying even the local Guanajuato district. Mexico City was able to find a considerable amount of tin in small lots here and there throughout the republic, which helped greatly to tide over the general tin shortage during 1917.

A MEXICAN TIN SMELTERY

References to the smelting of tin in the manner described may be found in "Tin Mining and Smelting at Santa Barbara, Guanajuato, Mexico," by A. H. Bromly. *Trans.* A. I. M. E., Vol. 36, 1906, p. 227; and in "Metallurgy of Tin," by Henry Louis, p. 80.

Defective Mine Drills

By A. L. H. Street*

Plaintiff, as an employee engaged in operating a drill in defendant's mine, did not assume the risk of being injured through breaking of the drill because it had been welded, if the welding was defectively done and he was not apprised of that fact. This was one point decided by the U. S. Circuit Court of Appeals, Ninth Circuit, in the recent case of Bowden *vs.* Gold Hunter Mining and Smelting Co. (*252 Federal Reporter, 388*).

As a separate defense to liability for the accident, the defendant company also unsuccessfully relied upon a claim that the plaintiff had executed a release covering his injuries. The court held that, where an injured worker gives a release at a time when it is mutually supposed that the injuries are of minor character, the release will not hold good as against other and serious injuries afterward developed from the same cause.

---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

The Chilean Nitrate Industry During 1918

By DONALD F. IRVIN*

PERHAPS the most notable event in the second half of 1918 was the centralization of both purchase and sale of Chilean nitrate by the Allied governments and the Chilean government.

Since this arrangement has been in force the price has been stationary at 13s. for ordinary, and 13s. 6d. for refined, per Spanish quintal of 101.4 lb. Profit per quintal on this basis is more than normal, but it must be remembered that the present cost of production is, in many cases, higher than the pre-war selling price on the Pacific Coast. New construction work and the maintenance and repairs on all plants have been greatly curtailed during the war, so that the oficinas will doubtless have to make a large outlay in this respect as soon as freights and prices justify the work being started.

The nitrate needs of the Allies have been met by large-scale contracts, carried out by the joint purchasing board of the Allies, known as the "Nitrate of Soda Executive," through its agency in Chile, and the Chilean government, acting for the sellers. The purchase of 680,000 tons of nitrate to cover consumption for 1918 was a remarkable transaction.

Future Conditions Uncertain

At the present date—the end of November—there is much anxiety as to what will be the amount and price which the Allies will decide upon for their 1919 purchases. Conflicting forecasts are common, and vary in character from the pessimism which claims that "Allied purchases in 1919 will be practically nil, due to unused stocks in the munition plants, and large available sources of supply from the synthetic nitrate plants in Europe and the United States," up to the simple faith which was recently exhibited by a member of the Chilean Senate who averred that he "felt no alarm for the financial prospects of his country, as its fate was lodged securely in the care of the Almighty."

Since hostilities have ceased in Europe the nitrate producers are busily trying to orient themselves, but reliable landmarks are hard to establish. A grave situation in the matter of sea freights may occur through the resolution announced from Washington by the Shipping Board, since the signing of the armistice, to the effect that all vessels are to be withdrawn from the South American trade routes and kept in transatlantic service until sometime next spring.

Formation of a Technical Society in Chile

An interesting and promising step is the recent formation of a scientific and technical society to encourage improvements in technique, and to provide, by means of regular meetings and the publication of a bulletin, for an exchange of views and data on nitrate mining and treatment and to serve, likewise, as an official spokesman for the industry.

This body, known as "El Instituto Cientifico e Industrial del Salitre," was founded by a number of Chilean and English nitrate operators, of well-known business and professional standing, and already has received government recognition. One of its first steps should be to provide authoritative figures for the cost of the most important artificial nitrate substances, per unit of nitrogen, laid down in the business centers of the world.

Alejandro Bertrand, the eminent Chilean chemical engineer, who was until recently the representative of the Chilean government in connection with nitrate promotion and investigation in Europe, is a member of this body, and has already issued valuable articles, containing authentic data from original sources, on matters concerning artificial nitrate manufacture in Europe. These articles have appeared in the publications of the "Asociación Salitrera de Propaganda."

The exchange value of the Chilean peso began to drop rapidly in September, falling from an equivalent to about 34c. U. S. currency, in July, to about 22½c. in November. This, of course, had an immediate effect on the economic life of the country.

German Influence Counteracted When Chilean Prosperity Is Threatened

In June, Germans and German sympathizers in Chile caused an acute though short-lived situation in the nitrate business resulting from an attempt to paralyze activity by legal action in the Chilean courts at a time when the results would have caused the greatest danger to the Allies. Various German firms (owners of oficinas) sued to recover from certain English firms a large amount of fuel oil due them on pre-war contracts drawn up in Chile. This oil was obtained by the English importers from American oil companies, and was shipped from either Californian ports or from Tampico, Mexico.

The English companies did not deliver this oil to the Germans, because of the "Trading With the Enemy Act"; and the amount due per contract but undelivered to the Germans had reached about 16,000 tons at the time of the lawsuit.

In default of the oil, the Germans obtained an injunction on the sale or delivery of this to any other persons until they were given what they claimed. In the meantime, one of the two large oil storage tanks, owned by the English company in Iquique, burned to the ground. The remaining tank was of relatively small size.

The Germans could not get the oil from the English, nor, had they been able to do so, did they have enough storage room for such a quantity at their oficinas. It was also impossible for them to market without Allied permission any nitrate they might produce. The English, according to the injunction, could not make any other disposition of the oil, and without the necessary fuel oil the local railway and the nitrate plants which are served by it in the Iquique district were on the verge of a disastrous shutdown.

At this stage the American oil producers allowed it to be known that, unless the injunction was immediately removed, no more American oil would be shipped to Chile. The effect was magical. The Chilean government set aside the court action, and no further trouble was experienced. Local fuel supply in Chile, as in other South American countries, is scarce and of poor quality.

---

*Mining and mechanical engineer, Antofagasta, Chile.

so that there is an almost complete dependence on foreign fuel. American and Mexican oil wells supply the bulk of the requirements, especially so far as the nitrate industry is concerned. A stoppage of fuel imports into Chile would have caused a crisis in the nitrate industry and a general financial panic in the rest of the country—a condition that the Chilean government did not dare to risk.

NITRATE PRODUCTION RESPONDS TO STIMULATION

The statistical situation of the nitrate business may be summarized as follows, according to the data of the "Asociación Salitrera de Propaganda":

EXPORTATION OF SODIUM NITRATE FROM CHILE

	Tons of 2000 lb.
June, 1916, to July, 1917	3,156,051
June, 1917, to July, 1918	3,210,596

At the present writing there are 140 oficinas at work, including several that have just been completed. Their tonnage of caliche handled daily varies from 250 or 300 to 2500 tons. A common capacity is about 750 to 1000 tons.

Abnormal conditions continue in the vicinity of the German-owned oficinas. The plants are, in most cases, given over to caretakers, and all work is stopped. There is a persistent rumor that the largest nitrate-producing organization—the Cia. de Salitres de Antofagasta—is negotiating for the purchase of the most valuable part of the German oficina holdings, situated in the district of Toco. The oficina Augusta Victoria, in the Boquete district, was said to count the ex-Kaiser of Germany as a heavy stockholder.

DISMANTLING AND REËRECTION OF OFICINAS

Recent construction among oficinas has been limited, though several idle plants were dismantled and reërected on new ground in other districts. One interesting example of this is the case of oficina Ghyzela, in the Taltal district, which was dismantled and transported by rail, about 350 miles, to Tarapacá and reerected as oficina Santa Laura. The same company has built oficina Brac, in Tarapaca, and Lina, in Antofagasta. It is interesting to note that the latter two are both owned by Jugo-Slavs. Oficina Christina, in Aguas Blancas, is a new plant just starting up; and the Du Pont Nitrate Co. began work in December at its new plant at oficina Peña Grande, in Tarapacá, from which a large production is expected, as it will work on a rich deposit.

PENYON SYNDICATE ACQUIRED CONSIDERABLE INTERESTS

Steps have been taken recently to renew operations on a large scale in Aguas Blancas, at the Penyon property, which has been the field of activity of a New York group. In 1916 and 1917 a considerable amount of examination work was carried out on this property. Huntington Adams, of New York and Antofagasta, has acted as the local representative of the syndicate interested in the purchase of the ground.

The development of treatment methods continued during the year in various forms at several localities, but in most cases was confined to endeavors to improve the means of handling slime, or to undertake production of nitrate of potash from the mother liquors of the oficinas. At the Agua Santa property in Tarapacá, managed by J. T. Humberstone, the Butters filter which was installed in 1915 is still in operation, handling a slime pulp. W. R. Grace & Co., at the company's oficina Paposo, have put in a Burt filter, to handle a mixed pulp of coarser material than that usually recognized as a filter slime. Oficina Peregrina, in Toco, now has a Butters filter in operation, the construction of which was begun about two years ago.

The Cia. de Salitres de Antofagasta is now putting into service an Oliver filter to handle slime derived from the regular boiling treatment; and at oficina Celia, in Antofagasta, the Gibbs process plant has been at work since December, 1917, using weak solutions in a scheme of treatment which involves Dorr equipment and an Oliver filter. The pregnant solutions are afterward evaporated in an economical type of evaporator (triple effect), and brought up to crystallizing strength. The liquors are then precipitated by cooling.

It is of interest to note that observations made by the designers of the Gibbs plant while inspecting the mechanical features of the salt works of Southern Michigan were of considerable help in the development of the final design of the evaporator they have adopted.

NEW PROCESS MAKES HIGHER NITRATE RECOVERY THAN SHANKS PROCESS

After a year's work this plant has justified its design by an increased recovery of nitrate and a reduction in the consumption of fuel oil. I. B. Hobsbawn, and J. L. Grigioni, the technical advisers to Gibbs & Co., are responsible for the general design of the plant and the scheme of treatment, and W. H. Merriam is in direct charge of the operations.

At oficina Cristina an interesting departure in caliche leaching is being adopted which can be summarized as follows: The contact of the dissolving solution with the lumps of caliche is carried on by means of a dripping and trickling action only. The level of the liquid in the dissolving vessel never rises high enough to come in contact with or submerge any part of the caliche being treated. This is done so as to avoid the formation of slimes, which vigorous boiling, in the ordinary treatment, is bound to produce. The liquor which accumulates in the bottom of the dissolving vessel is afterward cooled, and the fine crystals of precipitated nitrate are dried and washed on an Oliver sand filter.

Oficina Delaware continues its work, employing similar equipment to that used in oficina Celia, mentioned above, and has found it profitable to make nitrate of potash, using a recuperative refrigerating process on the mother liquor from the daily treatment.

APPARATUS ERECTED IS OFTEN IMPRACTICABLE

At various oficinas several other methods of treatment are being tested, or apparatus is actually erected, or idle, which varies from the not unreasonable to the ridiculous. High-speed centrifugals, for separating clayey slimes from pregnant solution (which were abandoned years ago in the metallurgy of gold and silver), still have devoted adherents in the nitrate fields. There is a motley collection of single-effect evaporators and specially designed vessels of peculiar form, intended to provide a high extraction and recovery, but often of futile character. The use of vibrating screens is generally increasing in an effort to make a clean separation of fine from coarse before starting leaching.

Mining methods have not changed much, though oficina Delaware has made a beginning by the use of a mechanical excavator (drag bucket) to remove loose overburden.

Bank-blasting, by means of the familiar electric blasting circuit and a grouped series of drill holes, has been successful at oficina Aurelia, where it was introduced by T. C. Peddar, as an innovation in caliche mining, which resulted in a decided reduction in cost of powder and also in labor. This method is naturally best adapted where the occurrence of the caliche permits the working of a long "face."

The drilling of the holes in some oficinas has been done by Jackhamers, driven by a portable compressor, in combination with a gasoline engine, mounted on a narrow-gage railway truck.

As a whole, prevailing treatment methods demand too close a sorting of the raw caliche to permit any form of mining which involves the breaking down and extracting of the material in mass, without regard to local variations of the caliche in tenor or physical character. Therefore economy may perhaps best be sought in modifying and cheapening the present methods of loading and haulage from the caliche beds to those oficinas that still use the older methods. The adoption of rational improvements in treatment is bound to permit a parallel advance in mining methods as well.

Gold and Platinum in Beach Sands

As a result of the unusual demand for platinum during the war period, and the decrease in supply, the United States was at one time confronted with a serious shortage of this metal, and the market price rose to four or five times the price in 1914. The Bureau of Mines therefore decided to investigate some of the more promising localities on the Pacific Coast where gold and platinum are known to be associated with such minerals as magnetite, chromite, and ilmenite, together with various siliceous minerals, the aggregate constituting what are commonly known as "black sands." The object was to determine whether any of these deposits are large enough, and contain sufficient gold and platinum, to be profitably exploited, and also to determine whether the base minerals present, especially the iron minerals, might be commercially utilized as a source of iron.

The investigation was entrusted to R. R. Hornor, metal-mining engineer of the Bureau of Mines, who proceeded to Marshfield, Coos County, Ore., and spent a month in the field of Coos, Curry, and Josephine counties, Ore., and Del Norte County, Calif. The results of the investigation are summarized in the statement that the deposits are disappointing both in regard to value and to quantity. They rarely contain enough gold and platinum, or occur in adequate quantity, to be exploited at a profit.

There are, it is true, a few favored places where small areas of the black sand show some precious-metal content, and these may become the site of small operations. The deposits in many places contain appreciable amounts of magnetite, chromite, and ilmenite, but these minerals are generally too scattered and too poor to constitute an important source of iron ore, especially in competition with the known deposits of magnetite on the Pacific Coast.

The first attempt at beach mining was in 1851 at Gold Bluff, Humboldt County, Calif., where gold was discovered associated with black and gray sands. This discovery was soon followed by others further north along the California and Oregon coasts. The period of greatest activity appears to have been from the beginning to the middle '70s, when the richest and most accessible of the old beaches were being worked. From that time until the present many futile attempts have been made to work both the present and the old beaches for the gold and platinum that they are supposed to contain. A few individuals, it is true, make a precarious living by working places along the coast where at certain times of the year the tide and storms effect a rough concentration of the sands; but wherever an attempt has been made to work the sands on a large scale, failure has invariably been the result of the operators' efforts.

Black-sand mining in the past has offered a fruitful field for unscrupulous promoters, and has been especially alluring to men having little knowledge of mining or mining methods. These swindlers usually claim to have wonderful machines or processes for extracting gold and platinum from the sands, and make the most extravagant claims for the processes or machines. Some of these process men were so bold as to claim that they could recover gold and platinum where the metals could not be detected by any scientific method. As a result, the Pacific Coast is strewn with the wrecks of many kinds of experimental machines and of plants that bear evidence to the credulity and childlike simplicity of those who had been induced to invest their money in schemes for treating the sands and in connection with which there was no hope of success.

Technical Paper 196, "Notes on the Black Sand Deposits of Southern Oregon and Northern California," has just been issued by the Bureau of Mines. Copies of this report may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C.

Foreign Mineral Resources

The U. S. Geological Survey has just issued a circular letter calling the attention of engineers and others to the fact that it has recently been collecting information relative to the developed and undeveloped mineral resources of the world.

Owing to the large volume of material obtained, the nature of the records and the continual additions that are being made, publication is impracticable. In order to make these records available, George Otis Smith, the director of the Survey, has permitted files to remain open for the benefit of mining engineers and geologists who are studying the resources of and the conditions in any foreign country.

J. B. Umpleby is in charge, and may be consulted in regard to the material that is available. Some reports have been given to the Survey in confidence, and these, of course, cannot be made available to the public, but there is a large amount of useful data which may be consulted, and those interested in foreign enterprises, especially in little-known territory, would do well to consult with Mr. Umpleby as to what information is available.

Oxy-Acetylene Welding and Cutting*

OXY-ACETYLENE welding is the process of uniting metals through fusion, by means of exceedingly high heat concentrated in a gas flame, without having recourse to pressure or hammering. This gas flame is produced by the burning of an intimate mixture of oxygen and acetylene in an especially constructed torch. As distinguished from soldering or brazing, the oxy-acetylene process forms a welded joint with parts united in one homogeneous piece, material similar to that worked upon being used for furnishing additional metal where needed. In the case of a soldered or brazed joint, a metal is used as a binder, and this metal differs in composition and characteristics from the parts to be joined, which do not fuse in the process, as their point of fusion is below that of the binder. In forge welding, the heat applied is sufficient only to bring the parts to a plastic condition—not to a molten state, as in torch welding—and the joining is effected by hammering or compression.

An oxy-acetylene flame consists of two parts: a small inner luminous "cone," bluish-white in color, and a larger enveloping non-luminous flame. The temperature at the apex of the cone is the hottest produced by burning gases, estimated to be about 6300° Fahrenheit.

SUPERIORITY OF ACETYLENE GAS

For welding work, the superiority of acetylene over other gases is due to its high carbon content and to the fact that it is endothermic, that is to say heat-absorbing, in its formation. Energy stored in formation is given off again in the form of heat by the acetylene upon dissociation. It is calculated that there are 1475 heat units produced by the combustion of 1 cu.ft. of the gas. Though theoretically two and one-half volumes of oxygen are needed to burn completely one volume of acetylene, the ratio in which the gases need be employed is one volume of oxygen to one volume of acetylene, the remainder of the necessary oxygen being taken up from the air. In actual practice this proportion of one to one is approximated, and the flame yielded by such a mixture is the correct flame—the so-called "neutral" flame. By increasing or diminishing the proportion of oxygen, flames known as "oxidizing" and as "reducing" may be obtained, the appearance of the cone changing as the proportions are modified.

METHOD OF GENERATING ACETYLENE

Acetylene is produced by the reaction between calcium carbide and water in especially constructed generators of various types. As a matter of economy, the gas is usually generated upon the premises. It is, however, also obtainable in cylinders, in which case it is dissolved in acetone. This volatile liquid has the property of absorbing 24 times its own bulk of acetylene at normal temperature and pressure, and an equal quantity for each additional atmosphere of pressure applied. After purification and drying, the gas is forced into cylinders thoroughly filled with some porous material which has been previously saturated with acetone, and the pressure is increased to the point desired, generally to about 250 lb. per sq.in. at normal temperature. The use of dissolved acetylene is resorted to only where portability is a necessity, or else where the generation of gas on the premises is not warranted.

In the early days of the acetylene industry the gas was liquefied, but it was soon found that in this state it was unstable and likely to explode through jar or concussion when compressed to two atmospheres. Its use in this form was therefore abandoned. It is of interest to note in this connection that in England compressed acetylene may be used in tanks, provided they are filled with material of 80% porosity and of sufficiently fine mesh to prevent dissociation of the gas.

ELECTROLYTIC PROCESS USED TO OBTAIN OXYGEN

Oxygen is generated either by the electrolytic process, which consists in dissociating the components of water, hydrogen and oxygen, by the passage of an electric current; or by the liquid-air process, which consists in liquefying air, and then separating oxygen from its component, nitrogen, by taking advantage of the difference in their respective boiling points. Though other methods of obtaining oxygen may be satisfactorily employed in localities remote from centers of supply, the two methods mentioned have the largest use by far, as they insure purity of product and economy of operation. Oxygen is placed on the market in seamless drawn-steel cylinders of from 100 to 250 cu.ft. capacity, compressed to a pressure of about 1800 lb. per sq.in. at 60° Fahrenheit.

The two gases are supplied at pressures much higher than are required for work, and, to insure a steady flow at any desired pressure, regulators are provided which reduce and control the pressure of each gas independently. Two gages are made use of for each gas, one showing the pressure of the gas in the cylinder or in the supply pipe, as the case may be, and the other the pressure at which the gas is being used in the torch.

TYPE OF APPARATUS

In apparatus of different makes the points of difference lie mainly in the varying construction of torches and generators, the principles guiding their use being practically the same. To meet different working conditions torches are made in various sizes and are provided with a number of interchangeable tips for producing flames of different size. The torches in use in this country may be subdivided into two general types:

Medium-pressure Torches—Those types which are designed to make use of acetylene supplied at about the same pressure as the oxygen.

Low-pressure Torches—Those types based on the injector principle, which use acetylene at a pressure of a few ounces and oxygen at a much higher pressure.

Acetylene generators may be subdivided into:

Pressure generators, delivering the gas at a pressure of more than 1 pound, and not to exceed 15 pounds.

Low-pressure generators, delivering the gas at a pressure of less than 1 pound.

Generators are also distinguished as carbide feed or water feed. Though there are various types of water-feed generators in Europe, generators in this country are of the carbide-to-water type, in which carbide is dropped into the water. Modern generators of all types are automatic in their action, the carbide or water feed being regulated by the flow of gas, and are provided with a number of safety and "fool-proof" devices which render their operation and handling safe.

---

*Abstracted from bulletin No. 11, issued by the Federal Board for Vocational Education.

FACTORS INFLUENCING WELDING OPERATIONS MUST BE UNDERSTOOD

In addition to a mastery of the fundamental principles of welding, in the application of the process it is essential that the characteristics of each metal concerned be well understood and always borne in mind. Careful consideration of expansion and contraction in all stages of the work, and of oxidation in its manifold aspects, depending on the metal under treatment, are vital fundamentals. The range of metals which can be successfully treated by the oxy-acetylene welding process is wide, including cast iron, wrought iron, steel, aluminum, copper, bronze, brass, lead, zinc, silver, and gold. Glass has likewise been successfully welded.

CUTTING WITH THE OXY-ACETYLENE FLAME

In addition to welding, the oxy-acetylene flame is adapted to cutting metals with accuracy and rapidity. Steel or wrought iron can be cut into any shape at a speed varying from 4 to 20 in. or more per min., depending on thickness, effecting a saving in time, labor, and cost as compared with other methods. The process is a chemical one. Steel heated to a certain temperature will actively combine with oxygen. This is demonstrated by the familiar experiment of burning a steel wire by dipping it, when red hot, into a jar of oxygen. The procedure consists in heating the object to be cut until it assumes a cherry-red color and then directing a strong jet of oxygen along the path of the desired cut, causing the metal to oxidize rapidly. The oxide or slag thus formed, which has a lower fusing point than that of the metal itself, runs off or is blown off, continually exposing fresh surfaces of the metal, which it pre-heats, to the oxygen and leaving behind a clean cut resembling the appearance of a cut made with a saw. It is important to note, however, that this behavior of the slag is confined only to the oxides of wrought iron and steel (cast iron cannot be cut, owing to its oxide having a higher fusing point than the metal proper), and therefore those are the only metals lending themselves to the cutting process.

As the rôle of acetylene in cutting is purely that of a heating agent, other gases may be employed in its stead. One of these is hydrogen, which is successfully used, and in heavier work is in some respects better than acetylene. The welding torch is not practicable for cutting purposes, and a specially constructed cutting torch is made use of, which differs from the former in that it is equipped with an additional outlet for supplying the oxygen needed for oxidation.

AUTOMATIC WELDING AND CUTTING MACHINES

Automatic welding and cutting machines have been devised and are in successful operation which replace the skill of the welder on jobs calling for the continuous or repeated performance of a single operation. They have the advantage of manipulating the torch in an absolutely steady manner. The conception of welding machines dates back to about the time the welding torch came into use. Attention was first directed to their possibility by some manufacturers who, having to weld a series of identical objects, devised mechanical means for doing the work. Though the Europeans have been pioneers in this field and were the first to make pipe by this process, practically all of the machines in this country are of American design and construction.

There are at present various welding and cutting machines run by electricity at variable speeds which are used to turn out pipe at the rate of about a yard a minute; to weld barrels, transformer cases, radiator sections, and similar material; to cut holes in rails; to cut out circular shapes; to cut intricate forms out of sheet steel, one or more at one operation and on any desired scale; and for a variety of other work which, on account of its uniform character, does not call for the exercise of ingenuity or resourcefulness.

In cutting, the automatic machine has the advantage over the welder, through its absolute steadiness in manipulation, in that it executes a smooth, clean cut along the lines laid down in the design. A recent device is a cutting machine designed to be attached by means of magnets to steel surfaces, such as ship bulkheads. The cutting is done after the plates have been put in place, instead of the old way of cutting and then installing them.

British Gold Committee's Report

The report of the Gold Production Committee, appointed by the British Treasury, consisting of Lord Inchcape, chairman; Sir Thomas Elliott, Sir Charles Addis, and W. H. N. Goschen, has been published. In summary, the result of the inquiry elicits the following facts and opinions:

1. That taking the period of the war as a whole, the production of gold in the British Empire exceeded the production during the corresponding period immediately preceding it.

2. (a) A decline appears for the first time during the war in 1917. In 1917, as compared with 1916, there was a reduction in the value of gold produced in the Empire of £3,429,415, made up as follows, the figure for Australasia being an official estimate:

Transvaal	£1,183,141
Rhodesia West Africa	484,677
Australasia	906,600
Canada	777,914
India	77,083
Total	£3,429,415

(b) In 1918 a further fall of £4,652,207, as compared with the 1917 production, is expected, made up as follows, the figures for Australasia and Canada being estimates not based on any ascertained figures, none being available in London:

Transvaal	£1,827,163
Rhodesia West Africa	734,299
Australasia	1,401,400
Canada	674,686
India	14,759
Total	£4,652,207

(c) That the decline in the Transvaal in 1917 was due to a combination of shortage of explosives and shortage of labor, of which the shortage of explosives owing to the war was the more important, and in 1918 mainly to the shortage of labor not attributable to any large extent to the war.

(d) That the decline in Australasia in 1917 and 1918 was normal, and due in the main to natural causes, but that it was accelerated by the increase of costs and decrease in labor efficiency caused by the war.

3. That up to the date of the appointment of the committee, the treatment of low-grade ore in the Transvaal had not, to any extent which can be determined, been reduced by the war.

4. That from the point of view solely of gold production, the abandonment of the treatment of low-grade ore in favor of that of higher grade will not within any reasonable period reduce the total output of the Empire, and that the continuance of the working low-grade mines which are unable to operate at a profit to themselves is therefore not a matter of great importance to national interests.

5. The committee is not prepared to recommend any bounty or subsidy for the purpose of stimulating the gold output of the Empire. Gold is the standard of value. No more can properly be paid for it than its value in currency.

The Canada Copper Corporation, Ltd.

According to an interim report, dated Dec. 20, 1918, progress made in the construction, for the Canada Copper Corporation, of the concentrating mill at Allenby, British Columbia, situated 4.5 miles by rail south of Princeton, has been most gratifying. There is a reasonable promise that the plant will be under roof in the course of the next few weeks. Delivery of machinery has begun, and its installation will proceed forthwith. At present a force of about 160 men is employed on construction—all that is required for the work in hand. This force, however, will be added to as progress warrants. Foundations for the mill are practically complete; the machine shop, carpenter shop, and warehouse are in use. Coarse-ore bins of 3000 tons' capacity are completed. The construction of the main pumping plant at the river is proceeding, and the installation of the pipe line from this plant to the mill has been finished. The organization for the permanent operation of the plant is practically accomplished.

The completion, at the Copper Mount mine, of the two main haulageways on the 3945 level and on the 3170 level, respectively, has been previously reported. The principal heavy underground work at the mine which remained to be done was the driving of a main raise to serve as a means of connecting the upper workings and the tunnels. This work consisted of driving a zigzag ore-pass in six connecting sections, each at an angle of approximately 55°, the upper one being broken through to the 3945 level. Alongside this ore-pass a vertical shaft was raised, connecting the 3170 level with the surface, and to serve also as a means of distributing supplies and workmen to the different levels and to the surface, where the mine camp has been established. The vertical distance driven was 804 ft. This shaft is connected at intervals with the ore-pass to afford access thereto. All this work was completed since April, 1918, and there remains to be done only the permanent timbering and installation of the hoist, before operations begin. This hoist is on the ground.

In view of the fact that ample ore had been developed to supply the mill for many years, the mine was shut down in September, sufficient development work having been done to quickly place the mine in a position to supply tonnage to the mill on its completion. The mine camp is completely closed down. Certain surface improvements will be entered upon soon, such as the installation of further compressor equipment, which is on hand, and the erection of a limited amount of additional housing capacity, the material for which awaits construction.

Ore bins and a coarse-crushing plant will be built at the mouth of the main transportation level, from which the ore will flow into railroad cars. The excavation for this plant is completed, and the large jaw crusher and two large gyratory crushers are on hand. The earlier mining operation will probably consist principally of open-cast work.

As there did not appear to be any reason why further work should be at this time continued for the purpose of developing additional ore, the ore reserves remain as previously reported, namely, 10,000,000 tons assured and 2,000,000 tons probable, averaging 1.74% copper and 20c. per ton recoverable in gold and silver. The expectancy of developing considerable additional ore remains the same, and a substantial area is still to be prospected to confirm known possibilities.

No material changes have been made in the plans of the mill as previously outlined. Two units of 1000 tons each, of the 3000-ton mill, are actively in course of construction. Provision of living quarters is complete. The building program at the mill, including the erection of staff quarters, is complete, and need not be augmented until such time as the work of increasing the capacity of the mill is undertaken.

In the last report stockholders were advised that a contract had been entered into with the Kettle Valley Ry., a subsidiary of the Canadian Pacific, for the construction and operation of a railway to connect Princeton with the mill at Allenby and the mine at Copper Mount. Also, that an agreement had been reached with the Okanogan Power Co. whereby it was to construct and operate a transmission line to serve the company's operations. The railway is approximately 14 miles long, and the power-line extension from Greenwood 103 miles. Both of the companies named are engaged in this work, the grading for the railroad having been practically completed to a point approximately one mile beyond the mill. The bridge across the Similkameen River is nearly complete, and the laying of rails on that part of the road up to the mill has begun. The power company, having established several construction camps along the line, is engaged in clearing it. It advises that it has placed orders for copper and insulators. This line will be, in total length, 180 miles, making it one of the longest transmission lines on this continent. It is designed for 100,000 volts. The officers of both companies advise that they will be in a position to offer service when the mill is ready to operate.

The operation of the company's old properties and smeltery in the vicinity of Greenwood having been brought to a conclusion, the general office was moved from Greenwood to Allenby, and the previously existing headquarters at Greenwood have as a consequence been closed.

The Eight-Hour Day Defined*

This monograph is intended to clarify discussion of the eight-hour day. It is devoted to comparison and analysis of the different senses in which the term is used, and of the principles on which the demands for each type of a so-called eight-hour day are based. In particular, it aims to bring out the distinction between the "straight" eight-hour day as predicated on considerations of health or public policy, and the "basic" eight-hour day, which is largely a problem in wage adjustment. In presenting this analysis, there is no intention of expressing an opinion as to what constitutes the proper length of workday. This is a matter on which the National Industrial Conference Board is assembling evidence by major industries, for some of which it has already issued its findings, based on available evidence.

DISCUSSION of the eight-hour day is characterized by much vagueness and confusion because of the different senses in which the term is used. The phrase has no clearly defined or universally accepted significance. It has at least three separate meanings:

1. A straight eight-hour day under which overtime is eliminated or even prohibited, except in extraordinary emergency.
2. An eight-hour shift with three work periods daily of eight hours each for as many different sets of workers. This arrangement may extend over six or seven days of the week.
3. A basic eight-hour day in which eight hours is made the basis or measure for service or payment, but under which overtime is permitted.

These definitions reveal the distinctions which exist between the different meanings of the so-called eight-hour day. When the straight eight-hour day is meant, overtime is prohibited and the work-week contains 48 hours, or, if a Saturday half holiday is observed, only 44 hours. Under the eight-hour shift system, overtime is practically eliminated by the nature of the arrangement; if the industry operates continuously seven days in the week, the work-week totals 56 hours. In the case of the basic eight-hour day, the *nominal* work-week may consist of 48 or 44 hours, dependent upon the observance or non-observance of the Saturday half holiday, but, as overtime is permitted, no limit is imposed on the number of *actual* hours per week.

In discussing these distinctions it should be recognized at the outset that a "straight" eight-hour day with overtime prohibited differs from a "basic" eight-hour day with overtime permitted, not only in the number of work-hours but also in principle. This applies equally to consideration of the straight 48-hour week and the basic 48-hour week.

THE STRAIGHT EIGHT-HOUR DAY

The eight-hour day in its rigid sense with prohibition of overtime is founded on the theory that such limitation of work-hours is demanded on grounds of health and social advantage. The contention is also often made that the straight eight-hour day is more productive than a longer workday. With these underlying premises for limitation of hours of work, overtime is inconsistent. Clearly, if the health of the worker or his social rights demand that he shall work not more than eight hours per day, permission of overtime labor, except in extraordinary emergency, is illogical. If the straight eight-hour day is really more productive than a longer workday, overtime is absurd.

The social grounds on which the eight-hour day is advocated do not permit of precise measurement. The factor of leisure is clearly not adapted to statistical evaluation. In regard to the health and wellbeing of workers, except for industries subject to peculiar health hazards or unusual physical or mental strain, only vague generalizations are available. The contention that a straight eight-hour day increases output lends itself better to the test of definite measurement, but clear distinction must be made between hourly output and total weekly output. In occupations where hours were previously unduly long, reduction has at times been followed by an increase in hourly output. But such an increase frequently does not mean an increase or even maintenance of total weekly output. Obviously, the economic result of the straight eight-hour day must be ascertained by measuring the total production achieved.

The straight eight-hour day has been brought about chiefly by legislation. It was first applied to women and children; later it was extended to men in certain hazardous occupations. Still later it was made applicable to employees on public works or contracts for the state, and last to certain private enterprises. At present an eight-hour day is established by law in many of the states to govern the hours of labor of men and women in public employment, or in private employment on contract work for national, state, or municipal governments. Fourteen states enforce the eight-hour day for miners. Eight states enforce it for men employed in smelting operations. Eleven states apply it to men in certain other private employments, most of which involve special hazards.

Federal legislation providing for an eight-hour day in certain Government contract work existed prior to 1892, but the provisions were vaguely worded, and their practical application was uncertain. By an act of Aug. 1, 1892, however, Congress definitely adopted the principle of a straight eight-hour day for laborers and mechanics employed by the Government or contractors or sub-contractors upon public works. The hours of work in such cases were definitely limited to eight in any calendar day, except in case of extraordinary emergency. A later act of June 19, 1912, commonly referred to as the Federal Eight-Hour Act, provided for the insertion in certain classes of Government contracts of a more specific condition. No laborer or mechanic was to be required or permitted to work upon the subject-matter of such contracts more than eight hours in any calendar day. A penalty of $6 a day for each mechanic or laborer illegally employed in excess of such hours was imposed. The eight-hour day enforced by this act was a straight eight-hour day.

The eight-hour shift system is in accord with the motive of the straight eight-hour day. Essentially, however, it is an arrangement for securing greater efficiency in production. It is quantitatively determined by the fact that, as the calendar day consists of 24 hours, the only practicable choice in a continuous industry lies between two shifts of twelve hours each or three shifts of eight hours each. In many occupations requiring continuous activity or high nervous tension, the twelve-hour shift has proved excessive; hence the system of three shifts of eight hours each has been adopted as the only alternative.

---

*Abstracted from Research Report No. 11, issued by the National Industrial Conference Board.

This system does not involve any organized overtime. Though its adoption may be based in part on the same grounds as are urged for the straight eight-hour day, it is a product of industrial organization and not of legislative enactment. Its effect upon output is radically different from that of the straight eight-hour day, and, as a wage measure, it differs from the basic eight-hour day. As against either of these arrangements, the eight-hour shift system obviously increases total production and lessens production cost by offsetting the burden of idle machinery and other overhead expense.

THE BASIC EIGHT-HOUR DAY

The basic eight-hour day, on the other hand, is essentially a wage issue. Eight hours of work are taken as a convenient standard by which to measure service, any hours in excess of these in a calendar day being paid for as overtime, usually at higher rates, but sometimes on a pro-rata basis. That the basic eight-hour day is primarily a matter of wages is clearly recognized in the Adamson law, which provides that "eight hours shall, in contracts for labor and service, be deemed a day's work and the measure or standard of a day's work *for the purpose of reckoning the compensation for services*[1] of all employees."

The phrase "for the purpose of reckoning compensation for services" obviously means that this legislation relates to wages, though the fact that overtime is permitted under it removes the act from the category of legislation primarily designed to protect the health or social welfare of workers. Its effect was similar to its intent. The railroads, faced with the alternative of changing their methods or paying for overtime, found the latter policy the cheaper, especially in their freight service. That this legislation is recognized as a matter of wages is shown by the report of the Eight-Hour Day Commission, appointed in pursuance of the Adamson law to report upon the operation of that statute, which states: "The same payment is now made for a minimum day of eight hours as was formerly made for a minimum day of ten hours. . . . The increase in pay which the observance of the law brings to the employee is chiefly in the form of payment for more hours of overtime at an increased rate per hour."

The practical effect of this legislation was to make overtime operative at the end of an eight-hour period without generally shortening hours of work. The wage previously paid for ten hours of daily service is now paid for eight hours, which means, of course, an increase in the hourly rate. This increased hourly rate, however, applies alike to regular and to overtime work; overtime is not penalized by extra rates.

The eight-hour day, whether straight or basic in character, implies as a corollary a certain length of work-week. The straight eight-hour day naturally leads to the 48-hour week, with eight hours of work for six days, and with overtime beyond 48 hours prohibited save in emergency. The practice of working only half a day on Saturday at times leads to a compensating lengthening of hours of work during the first five days of the week so as to offset the loss on Saturday. But where the Saturday half holiday is coupled with the straight eight-hour day for the first five days of the week, the work-week is automatically reduced to 44 hours. Where the Saturday half holiday is observed there is sometimes a sentiment in favor of entire cessation of work on that day, thereby creating a nominal 40-hour week. Thus, the straight eight-hour day in combination with the Saturday half holiday has a tendency toward a five-day week.

The basic eight-hour day implies a nominal 48-hour or 44-hour week, according to whether or not a Saturday half holiday is observed. But overtime is permitted and paid for at overtime rates if the work on any day extends beyond eight hours. In some cases overtime rates are paid for Saturday afternoon work.

In contrast with the basic eight-hour day, granting overtime rates every day for any overtime work on that day, even though no work or only partial work is done on subsequent days, the basic 48-hour week allows overtime rates only after a total of 48 hours has been worked during the week at regular rates. Thus, overtime may have been worked on one or more days, but if an equal amount of time has been taken off on other days, no extra allowance for overtime will be made at the end of the week. To prevent any day's work being unduly extended, overtime rates are sometimes made to apply to each specific day when overtime beyond a certain limit is required. Several decisions of the National War Labor Board contain this provision.

The basic 48-hour week differs sharply from the basic eight-hour day in principle. By requiring 48 hours of work before overtime rates are paid, it robs overtime largely of its premium advantage. For the same reason it lessens the incentive to the worker to take time off unnecessarily. In consequence, the basic 48-hour week tends to become less a measure for adjusting wages than one for securing efficiency.

DISTINCTION BETWEEN THE STRAIGHT AND THE BASIC EIGHT-HOUR DAY

Clarity in discussion of the eight-hour day issue depends ultimately on recognition of the fundamental distinction between the straight and the basic eight-hour day. Recognition of this difference is equally essential to intelligent discussion of the work-week. Most aspects of the eight-hour shift system also admit of similar distinction.

In practice, the essential difference between the straight eight-hour day and the basic eight-hour day arises in connection with overtime. The straight eight-hour day under no circumstances encourages overtime, and, as enforced by legislation, prohibits it. The basic eight-hour day allows overtime, under penal rates which are intended to discourage it. Their practical effect, however, is to encourage what they are designed to prevent. In principle the straight eight-hour day is a matter of social policy based on regard for the health, welfare, and leisure of the workers. The basic eight-hour day is a measure of service and reward. The former regulates hours of service; the latter is a form of wage agreement.

---

[1] Not italicized in original

This essential difference is in a measure reflected in the methods by which limitation on work-hours has been brought about. Legislation has been the most general method for the introduction of the straight eight-hour day. Such legislation has usually been promoted by those who give weight to social considerations, whereas action by employers or by labor unions has generally favored the basic day. In any event, labor organizations have repeatedly opposed legislative limitation of hours of work, on the ground that such legislation would weaken their economic strength. Thus the American Federation of Labor, at its conventions in 1914 and 1915, defeated resolutions favoring the enforcement of a straight eight-hour day by law. The Adamson law for railroad employees, providing for a basic eight-hour day, was, on the other hand, forced by the demands of organized labor.

The basic eight-hour day with premium rates for overtime theoretically and practically violates the principle of the straight eight-hour day. The laborer who demands the eight-hour day on grounds of recreation, home life, and intellectual development, but who welcomes overtime, shows that to him the eight-hour day is in reality a question of earnings. To be consistent, advocates of the straight eight-hour day should oppose the basic eight-hour day. As matters stand at present the social need for recreation and home life is made the basis for a provision which, instead of shortening hours, merely increases wages. The straight eight-hour day thus becomes a fiction; the basic eight-hour day becomes an artificial means for demanding increased compensation.

Helium for Ballooning

Major-General Squier, Chief Signal Officer of the Army, told the American Institute of Electrical Engineers recently that one of the greatest scientific achievements of the present war from a technical standpoint is the production of helium in balloon quantities. This gas is non-inflammable and has about 92% of the buoyant effect of hydrogen. It first was obtained in minute quantities by Ramsay in England about 20 years ago by heating certain radioactive minerals, in which it occurs, because it is a disintegration product of radium. Its pre-war scarcity may be understood from the fact that, up to two years ago, not more than 100 cu.ft. ever had been obtained, and the usual selling price was about $1700 a cubic foot.

Notwithstanding so discouraging an outlook, some one in the British Admiralty had imagination enough to propose the large-scale separation of helium from certain natural gases in Canada that contain about one-third of 1% of it, and experiments were undertaken at the University of Toronto. Soon after the entry of the United States into the war, the Bureau of Mines, learning of the problem from a British confidential memorandum, persuaded the Signal Corps and the Bureau of Steam Engineering of the Navy to approve and finance jointly an experimental program on a large scale. Thanks partly to the unusually rich sources in this country, and partly to the skill of the two commercial companies whose services were enlisted and to the enthusiasm of the Bureau of Mines staff and Mr. Carter, of the Navy, who for a time represented the Army as well in the project, such success was achieved that at the cessation of hostilities there was compressed and on the dock ready for floating 147,000 cu.ft. of nearly pure helium, and plants were under construction to produce at least 50,000 cu.ft. a day at an estimated cost of not more than 10c. a cubic foot.

Mining Concessions Granted in Siam

The completion of the Siamese Southern Ry. extension has directed considerable attention to the mineral-bearing area traversed by this railway, according to Vice-Consul Hansen, at Bangkok, writing on Sept. 2, 1918. The Siamese Royal Department of Mines issued 80 mining leases during the last year, and it is reported that Australian, French, and Danish companies have secured valuable concessions. The total output of metallic tin during the year amounted to about 142,000 piculs (9,466 short tons), and 12,000 piculs (800 tons) of tungsten ore was also recovered. There was no activity in the mining of other metals during the year.

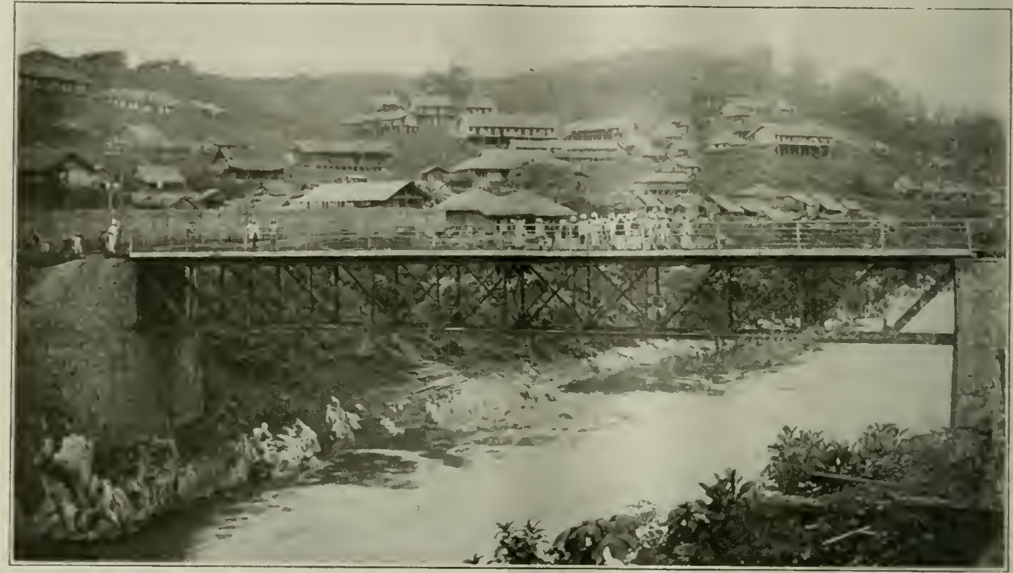
Antimony and Tungsten in Hunan

Hunan Providence produces about 95% of the antimony output of China, according to Consul N. T. Johnson at Changsha, the remaining 5% coming from the provinces of Kwangtung, Kwangsis, Yunnan, and Kweichow. The Hunan ores are the purest. They are reputed to be practically free from arsenic, carrying from 20 to 64% antimony. An effort is being made to concentrate the smelting of antimony ores in China near the place of production, and it is believed that with proper organization the country will be able to maintain its position as the world's foremost producer of antimony.

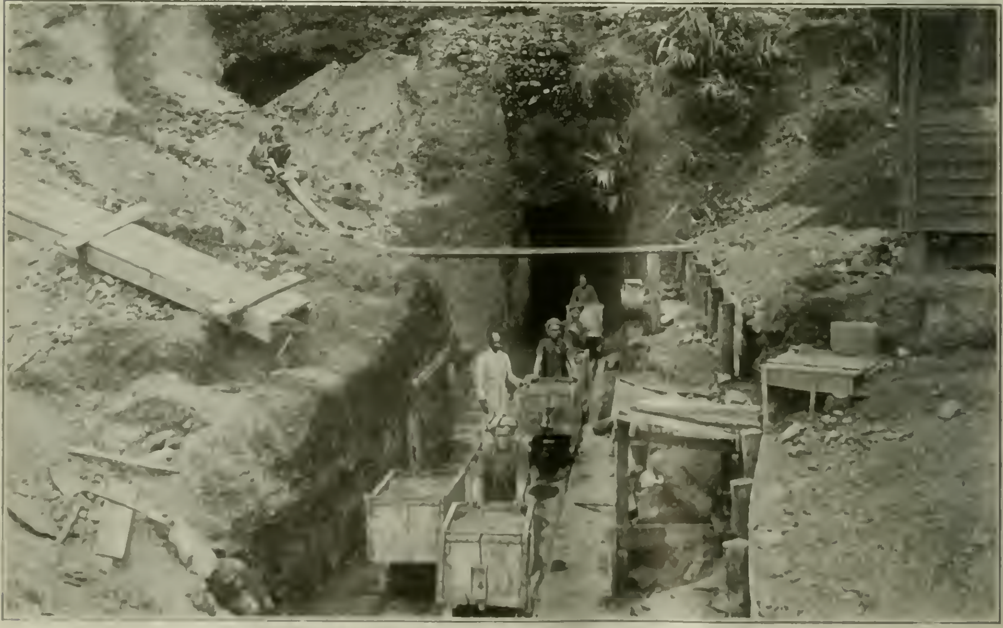
Deposits of wolframite occur in the southern part of Hunan Province not far from the boundary. The metal appears to occur in veins and outcrops among the hills in the district. The crumbled ore is found in the detritus at the foot of the hills and in the gravels of the streams. By reason of the high specific gravity of the ore, it is easily separated from the soil and gravel by a washing process known to the country people, who find it easy to collect the ore and peddle it to dealers in nearby towns. A number of Chinese companies have endeavored to secure exclusive rights to the extraction of this ore in southern Hunan. On account of the high price commanded by tungsten during 1917, a great effort was made by the Chinese to secure supplies for shipment, but development of the deposits was greatly hindered by the distance from transportation facilities, by disturbed conditions in the district in which the mines are situated, and by the active opposition on the part of the registered Chinese firms claiming monopoly rights to develop the mines in question.

Copper in Bulgaria.—For high prices for copper, Bulgaria commends itself to the most extravagant imagination. According to the Salonica correspondent of the London *Times*, a Bulgarian deserter reported that he had recently been sent to Nish to buy a small quantity of copper for the repair of regimental utensils, and had been obliged to pay about $13 per lb. for it.

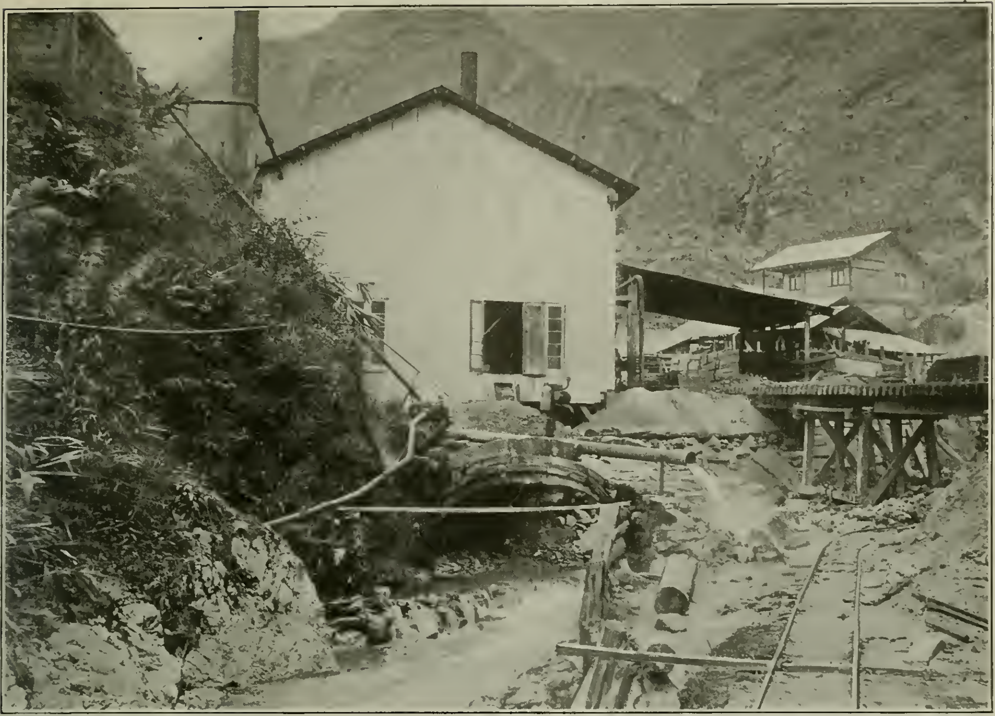
Scenes From Mining Camps of India



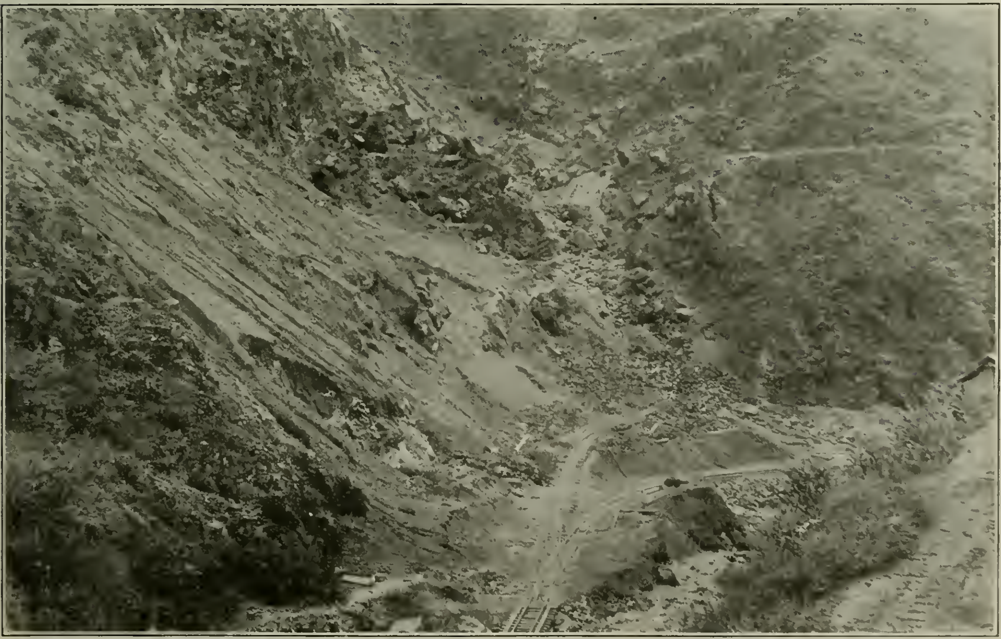
NAMTU BRIDGE AT BAWDWIN, UPPER BURMA, INDIA



PORTAL OF "DEAD CHINAMAN" TUNNEL OF BURMA MINES, LTD., UPPER BURMA, INDIA



OLD POWER PLANT AT BAWDWIN OF BURMA MINES, LTD., UPPER BURMA, INDIA



BAWDWIN GOSSAN QUARRY, SHOWING OXIDIZED OUTCROPS MINED FOR SILICA FLUX

What Is Bolshevism?[*]

THOMAS CARLYLE cried years ago, half in wrath, half in despair, "Oh, if men only would think!" No man in his time pondered more upon the idiosyncrasies of his fellow-men than did this old Scotch philosopher, and no man has described human society in the chaos of fermentation as he has done. It was quite evident to him, as it is to many of us, that men as a rule do not give thought to matters beyond their daily tasks, for if they did false philosophies would be laughed into the oblivion of ridicule soon after birth.

Bolshevism is a nebulous, mysterious thing to most people. It is a chameleon in appearance, now seeming to be an integration of human Slavic elements assuming form, radiating energy, and discovering a voice, at another time a pitiable crying to mankind for brotherhood and human sympathy; and again it appears like a hive of bees swarming unintelligently as to their destiny, but compelled to readjust themselves within their environment. At still other moments it appears to be nothing more than the scum brought to the surface by the fermentation of a nation.

Bolshevism is the ideal of the ignorant dreamer of dreams, of impracticable folk and of all those who would reap where they have not sown. It is vividly illustrated in that parable in the New Testament which tells of a certain householder who, requiring men to work in his vineyards, went into the market place to hire them, first in the early morning, then at the third hour of the day, again at the sixth and ninth hours, and, finally, at the eleventh hour. As will be remembered by all who have delighted in the naïveté of this sympathetic story, when evening came the paymaster gave each man a penny for his day's work, without regard to the number of hours he had worked, and each of us has shared the righteous indignation of the men of the early morning who cried out, saying, "These last have wrought but one hour, and thou hast made them equal to us which have borne the burden and heat of the day."

Every man can make his own application of this parable. To the man who thinks, however, the following question arises inevitably, viz.: Is a social condition possible wherein the man of the eleventh hour shall rank equally with the man of the early morning, or is it conceivable that society could attain to such a beatific condition that the loafer should share on the same basis with the toiler, and the ignorant and shiftless with the educated and ambitious?

Yet Bolshevism demands this, demands it with the disingenuous insistence of childhood, and either raves when its foolish proposals are rejected, or strikes out savagely with its animal strength to acquire by brute force what it cannot gain by idealistic sophistry.

It has been revealed within the last six months that Bolshevism boiled down to a substance leaves nothing but a slime. Even the new oil flotation process for extracting the last grain of metal from the ore would fail to find anything in it which would float on a bubble. In sentiment it is an appeal that Lazarus shall be fed at the rich man's table, but in practice it is a brutal savagery which, like a wild beast, kills and tortures to vent its bestiality.

Now that Bolshevism has lit up the sky with its lurid flames, men will see more clearly, and, it is hoped, give themselves up to a little serious thought. They should know first that "isms" of this kind of the men of the eleventh hour are merely indigestive gas, a complaint, however, which demands the services of an intelligent physician, not a quack. They should also realize that the visible regulator of not only material but human destiny in this world is our good old friend Mother Nature, that she had been on the job many, many millions of years before men appeared on this planet, that she is most decidedly not fickle in her purposes, but continues constantly and with the utmost patience to work along well-defined lines, and that the broad highway of natural development is individualism demanding expression in every living thing, and constant to itself in every chemical or substance. The law of the survival of the fittest is in many ways a harsh law, but it is the law of nature, conceived to be her fundamental law by the first man who reasoned.

The law of natural selection is exceedingly unsentimental. Nature wastes no tears on the individual, or the species of plant or animal which she discards for unfitness, and yet no one has been so absurd as to apologize for her severity. Mankind has existed long enough to appreciate that nature's laws are wise. But many men of an imaginative intelligence differentiate man from nature, put him in a place apart, and maintain that all of nature's laws do not apply to him; that he has by reason of his mental development become a social being, and not an individualist, as are the trees and rivers; that international brotherhood and not individual development should be the Mecca of his social aspirations. They fancy, or, as they dignify it in the terms of their philosophy, "consciously believe" that a social state is possible in which the men of the early morning and the eleventh hour men shall share alike, when the strong shall bear lovingly the burdens of the weak, and when the man bursting with initiative shall sit in the public park with his brother the loafer and glorify Karl Marx.

Justice and truth are as pitiless as they are honest. Individualism is a natural law, cold and stern. Bolshevism appeals to men because of their weaknesses, their purely human inconsistencies. It is seized upon by some as an instrument to create delusive melodies. It expresses a desire to place men in high offices who will make every so often a general jail delivery of wealth, a Kitchenistic blood-letting of those men of the early morning who are so hated because of their intelligence and their love of labor. It is so good to feast on the fruits of the other man's vineyard. It is so delightful and so sweetly sentimental to be able, by the power of office, to say to the men of the early morning: "Is it not lawful for me to do what I will with mine own?"

Russia, a land red with murder, a State writhing like a sorely wounded python under the stabs of dreamers gone mad, self-styled lovers of mankind come into sovereign power, a country where intelligence hides in the most secret places to escape the assassin, its only crime being intelligence—this sanguinary Russia is Bolshevism come into autocratic control of the lives and affairs of a great people, and, thank God, a Bolshevism written on the blackboard of the world for all men to see, the sum, the difference, the product, and the quotient of Nihilism and anarchy. Let the picture of it and words descriptive of it stand there as a reminder to mankind that no matter how high the lowly are exalted in Semitic philosophy, experience and tradition teach that a nation's greatness is merely the sum of the progress of its individual citizens, and that a citizenry of ciphers will never add up to anything.

---

[*] An article by "F. S." in the Providence *Journal*.

American Gold Committee's Findings

The findings of the committee appointed in July, 1918, by the Secretary of the Interior to investigate the gold-mining situation in the United States, consisting of Hennen Jennings, chairman; J. H. Mackenzie and Charles Janin, of the Bureau of Mines; and H. D. McCaskey and F. L. Ransome, of the United States Geological Survey, are now published and may be summarized as follows:

Statistics of production dating from the discovery of America in 1492 show that the annual average output was small until 1850, when the discovery of gold in California and Australia marked the beginning of large gold production. The figures show a slight decline from 1855 to the opening of the mines in the Transvaal in 1887; then there was a large increase in the yearly output until 1910, since which date there were irregular fluctuations until 1915, when a marked decline took place.

Though the increase in the output of gold has been rapid during the last 25 years, it has not kept pace with the outputs of coal, iron, copper, or petroleum, or with the rapid growth of bank deposits.

The present decrease in gold production demands serious consideration, because the maintenance of a sufficient gold reserve is essential to the security of the national finances and credits of the country. The United States is at present in the most favorable position with regard to gold reserves, holding over $3,000,000,000, or more than one-third of the gold stock of the world, but it has contracted debts on a gold basis to many times the amount existing before the war.

The principal causes of the decline in gold mining in this country are (1) the shortage of labor and higher wages caused by the war, (2) lower efficiency of available labor, (3) the great increase in the cost of supplies, and (4) higher cost of power. In addition, the depletion of certain deposits and the lower grade of ore mined in others have tended to reduce outputs.

Bankers and political economists nearly all agree that the gold standard should be maintained in principle. Since the outbreak of the war, prices of all commodities have increased greatly except that of gold, which as the standard of value is fixed at $20.67 per ounce. Thus the purchasing power of gold has decreased while the prices of other commodities have increased.

The great increase in the cost of gold mining has tended to discourage new enterprises and curtail existing operations. Many mines have been compelled to close and await more favorable conditions. Those mines that have continued operations have been able to do so only by practicing the most rigid economies and by the curtailment of development work. The average operating cost of producing a dollar's worth of gold at the large and most favored quartz mines in 1917 was 70c., as compared with 57c. for 1915. Gold mining under present conditions offers little inducement to the investment of capital.

Various means of stimulating the production of gold in the United States have been proposed, including the payment by the Government of a bonus on newly mined gold. The committee does not believe the adoption of a bonus system would be beneficial at this time.

The United States Employment Service can, if properly authorized, be of great help in diverting labor to the gold industry. Gold mining has been officially declared an essential industry, and, in the opinion of the majority of the committee, should rank in this respect with other preferred industries. Exemption from draft and deferred classification of gold labor has already been granted to a certain extent by the War Department.

The furnishing of supplies to gold mines at pre-war or cut prices does not seem to be feasible.

The elimination of the excess-profits tax on gold mining, and the encouragement of a maximum output thereby, might result in larger revenues than with the tax standing, as larger dividends paid to shareholders would mean greater revenue for general taxation. As the profits of a gold mine, no matter how large, cannot be ascribed to war conditions, but, on the contrary, are diminished by them, the remission of this tax is just.

Gold mining, as an essential industry, is entitled to preferred classification for railroad freight, and similar charges, and should receive the benefit of any modification of freight rates granted any other preferred industry.

When electric power is used, gold mines should have a high-class rating with regard to power consumption, and power should be curtailed only when necessary.

The privilege of free export and of sale to manufacturers would stimulate production and aid gold mining, and also might be a safeguard against inflation.

The committee suggests that gold and other mining companies might properly be required by law to furnish to the Government, with such frequency as may be desirable, statistics of their costs, production, and profits, and these should be available for publication.

The Government should, through the Bureau of Mines, assist in improving methods of mining and metallurgy of gold ores, particularly in the treatment of complex and low-grade ores. A wide field of work is presented here.

Some aid in reducing costs might be obtained by coöperative buying of supplies by mining companies through central agencies in each state or district, but the organization of a general system of coöperative buying would be difficult.

Possible methods of maintaining the visible gold reserve, apart from mine production are (1) the curtailment of the use of gold for manufactures, and (2) making a call on the public to turn in hoarded gold.

Further relief might be obtained by amending the War-Minerals Bill to include gold, and by voting an appropriation to be used in the search for new deposits.

Consul General Skinner cabled from London on Jan. 15 that an order in council of Jan. 14 modifies the previous order prohibiting the importation of foreign coins and authorizes for the present the importation of gold and silver coins.

Details of Practical Mining

Without drawing invidious comparisons between the various types of miners' lamps, there are undeniably characteristics in the different makes that do not conform to all requirements. That the lack of these features may be supplied by certain ingenuities is well demonstrated by the improvements that are described as being applied to a "Wolf" lamp. Usually to make improvements to a device or a machine requires the services of a first-class shop, but in this instance it was possible to make a satisfactory change simply and with the addition of materials that are to be found at any mine.

The value of a permanent center indicator requires little demonstration, and although, in this instance, the description of the indicator which we present specifies that the appliance is for installations requiring large shafting, it may be said that its use need not be confined to that alone, for true alignment in small shafting is also most desirable.

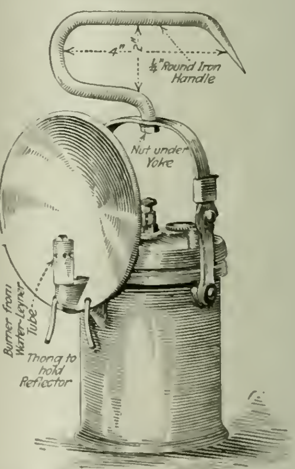
Any operator whose fortune, or misfortune, it has been to conduct small-scale operations knows the exigencies to which his work is sometimes subject. The mine may be so situated that needed materials are not available at the moment; the machinery may possess complicated parts, the replacement of which may require considerable time, and other contributing factors may hinder the operator. An idea that serves as a temporary or permanent substitute is generally a boon to the mine superintendent. It is not to be assumed that the big operator escapes, for in the article "Emergency Grouting With Sulphur," we have an instance in which it was not lack of material, facilities, or labor, but a question of the time element involved which made emergency methods imperative.

Economy and safety can be secured in underground electric haulage systems by means of a proper section insulator. Many mines make use of a separate mounting of the knife switch, which, when thrown in circuit, energizes the trolley in a drift or portion of the mine workings. But this practice will fall more into disfavor as the adoption of modern devices, which eliminate delay as well as offer the economy of cheap installation, continues.

Improving a Miner's Carbide Lamp

The hook usually furnished with the "Wolf" miner's carbide lamp, and fastened to the yoke of the upper part of the lamp by a swivel, is good enough when the lamp is to be hung up and left in one position; but when the user is climbing ladders and crawling through stopes, the swivel hook offers a decided disadvantage, as there is always the tendency for the lamp to twist, so that the flame frequently swings under the hand of the carrier, often resulting in either a bad burn or the dropping of the lamp. One manner of overcoming this disadvantage was by removing the swivel furnished with the lamp and attaching the handle shown in the accompanying illustration. This contrivance consists of a combination hook and handle, made of $\frac{1}{4}$-in. round iron and about 2 in. high by 4 in. long. It is fastened firmly to the yoke by a small nut, and does not permit the lamp to revolve; the pointed end makes it possible to hang the lamp where the manufacturer's hook will not take hold.

One means of preventing the reflector from being knocked from a lamp, and an improvement that permits its easy removal when refilling, is the following: Two small holes are punched near the bottom of the reflector, as shown in the illustration, and a leather thong or cord is passed through them and around the under side of the burner-pipe. The ends of the cord should be two or three inches long, and allowed to hang free.

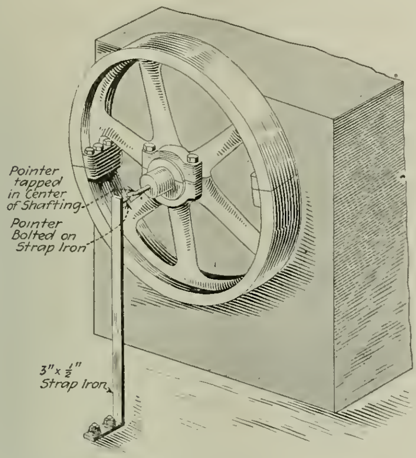

4"
2"
$\frac{1}{4}$" Round Iron Handle
Nut under Yoke
Burner from Water-Leyner Tube
Thong to hold Reflector

IMPROVEMENTS AND REPAIRS TO THE WOLF LAMP

Burners are frequently lost or broken, and usually when no others are available. In such cases a burner can be quickly made by plugging the hole for the burner-shank with a piece of lead having a single small hole punched in it. Another type of burner may be made from a 1-in. section of Water-Leyner tube, by squeezing one of the ends together, and punching a small hole in it. The tube will fit snugly in the burner hole. By bending this piece of tube outward, the lamp will throw a horizontal flame instead of a vertical one, and this is advantageous in protecting the hands, as the flame is not so easily put out in wet places and offers the best and most lasting marker on the walls of mine workings for sampling and surveying purposes.

Permanent Center Indicator

A permanent center indicator for large machinery shafting, and one that may be cheaply and quickly installed, is shown in the accompanying illustration. Caution should be taken to insure its being placed upon a solid foundation, preferably one that is not subject to vibration by the motion of the machine itself.


Pointer tapped in Center of Shafting
Pointer Bolted on Strap Iron
3"x 1/2" Strap Iron

PERMANENT CENTER INDICATOR FOR LARGE SHAFTING

Emergency Grouting With Sulphur

By Carlos E. Holley[*]

The use of sulphur in grouting machinery foundations is not common, although there are times when it can be used to good advantage. The following experience demonstrated the efficiency of sulphur in one instance: The Colby Iron Mining Co., at Bessemer, Mich., depended on a single engine-driven generator to supply current for haulage, lighting, and some of the hoisting. The generator engine had become loose on the foundation and had worked down in the cement until it was out of line and causing trouble. It was not practicable to close down the machine for the period necessary to grout the foundation with cement, so, as a substitute, grouting with sulphur was decided upon.

At 7 o'clock on a Sunday morning the engine was closed down, jacked up, and lined up on wedges in the usual way. The foundation was then cleaned off as much as possible with compressed air, a shallow dam was built around the engine bed and molten sulphur was poured in. This hardened in a few minutes and made a neat-appearing and a durable job, and the machine was ready for operation again by 3 in the afternoon. It has now been in use for three years and is as solid as ever.

As this was our first job of grouting with sulphur, we had a few difficulties on the start. We overheated the first ladle, which caught fire and drove us out of the engine house. The sulphur is thick and syrupy when overheated and does not run well, but by keeping the ladle covered and avoiding overheating sulphur can be melted without fumes and will run freely. For work of this character I would not hesitate to use sulphur on any job where cement could be used; in fact, it has several advantages over cement. It will adhere to an oily foundation, will set quickly, and is not affected by oil. I do not recommend it for general application, because of the labor and cost, but its desirability for emergency use should not be forgotten.

Mine Section Insulator, With Switch

By N. A. Wahlberg[*]

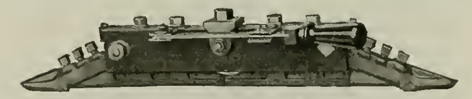
In mines every cross entry should have a section insulator situated in the cross-entry trolley wire, on tangent as close as possible to the main entry. As most cross-entry trolley wires are used during but a small part of the time, it would aid in promoting safe operating conditions.

A common practice is to employ section insulators which have no switch attachment, so that it is necessary to have a knife switch connected in the circuit so that the cross-entry trolley wire may be energized. The knife switch is usually mounted in a box to protect it from moisture and dust, and there are several standard types.

Such an arrangement requires considerable amount of labor and material and is disadvantageous, as the locomotive may get stalled with the trolley wheel on the insulated part of the section insulator when the locomotive is pulling a load. Considerable delay will be experienced in case there is insufficient room to turn the trolley pole, and it is often necessary to detach several cars to enable the locomotive to get over the dead section in the overhead.

Mine operators have demanded a combination of section insulator and knife switch which would eliminate delays of this nature in their haulage service, and the type of section insulator as depicted in the accompanying illustration was developed to meet the requirements of the case and has proved successful in a number of installations.

A section insulator should not permit of any leakage whatever if the switch is open. Its construction should be mechanically strong, yet not so heavy as to add unnecessary weight in case the local conditions are such that it cannot be supported direct by means of mine suspensions from the mine roof. Two supporting lugs with longitudinal adjustment are preferable. Where conditions do not permit of using two supports and space is limited, a swivel boss in the center is desirable, as the section insulator can be easily installed without turning the complete device. The runner of the section insulator should never obstruct the passage of the trolley wheel, regardless as to whether the switch is open or closed.



SECTION INSULATOR PROVIDED WITH KNIFE SWITCH

---

[*] Box 58, Bessemer, Michigan.

[*] General engineer, Westinghouse Electric and Manufacturing Company.

Correspondence and Discussion

Enlightening America About Mexico

I was glad indeed to read what the *Journal* has recently published concerning the conditions that have prevailed in Mexico for the last five years, and to realize that it is making a sincere effort to state the facts in connection therewith. I hope that through its columns the American people may be correctly informed.

There is no occasion for vilifying, vituperating or condoning acts of Mexicans or of foreigners. If the *Journal* will tell the unadorned facts, they will speak for themselves. Unfortunately, this can seldom be done by individuals without incurring personal risk.

It must be realized that the American public has not only been kept in the dark, but it has been systematically deceived in regard to conditions. Mining men who have been repeatedly run out of the country by one group or another of bandits, barely escaping with their lives, dare not tell the American press, for they know that such interview would be clipped by some agent and forwarded to the ruling faction at the point where the outrage was committed. This would lead to destruction of the property represented by the unfortunate engineer, or to the assassin's bullet when he returned.

The boards of trade in the cities near the border have scarcely done what they might toward spreading the truth. They have been too willing to listen to the speeches of Mexican officials engaged in whitewashing Mexican conditions, and, by innuendo, blaming Americans for exciting Mexicans to violence. All of which has tended to keep our people in ignorance of what was going on south of the Rio Grande, so that looting of American properties and even assassination have gone unchecked for five years.

I trust that the *Journal* will continue to publish authentic information as it comes to hand, not only for the sake of Americans, but for the sake of nine-tenths of the natives of this unhappy land, who are peace loving and who would be industrious and orderly if they only had a fair chance.

A MANAGER IN MEXICO.

Chihuahua, Nov. 27, 1918.

The Chrome-Ore Situation

In the Jan. 11 number of the *Journal* I note that F. F. Sharpless, in writing on the question of "Chrome Ore in 1918," again suggests that the Government of the United States repudiate its obligations to the chrome-ore producer. In a previous letter, Mr. Sharpless had inferred that a request for justice would be construed as indicating a lack of patriotism.

The cloak of patriotism has been used too often to cover blunders or inefficiency in various governmental departments, and it is well to remember that the chrome producer is not responsible for the present condition of the chrome industry. Government representatives requested, as a patriotic duty of its citizens, that every effort be made to discover, develop, and produce chrome and various other ores, in order to free ships for the transportation of troops and supplies. It was also implied that legislative steps would be taken to protect those engaged in the production of these ores for a reasonable length of time, as England has done.

The war fortunately ended sooner than expected and before the necessary protective measures were passed. Does this relieve the Government of its obligation to those producers who acted in good faith? Does Mr. Sharpless suggest that it was lack of patriotism which induced miners of chrome ore to open up deposits which they knew could not be worked except on the basis of the schedules of prices published last June? Does Mr. Sharpless question their right to an equitable deal after they had to expend the amounts required for roads and development, trusting in the good faith of the Government that some provision would be made for their protection? It was poor business on their part, perhaps, but they believed that the United States needed the ore immediately, and they did not wait for Congress to act. Time was too precious—or at least they were led to believe that it was.

Now that the harm is done, Mr. Sharpless says in effect. "Be a good sport. Forget it; and mark it up to a profit and loss account." It seems to me to be beneath the dignity of the Government to seek to evade the responsibility, which its representatives incurred, in such a manner.

Does Mr. Sharpless object to the present measure before Congress which is needed for the purpose of validating orders given by Government representatives, before the armistice, by telephone, and which were accepted in good faith? How does the position of the chrome producer differ from that of the manufacturers? Mr. Sharpless admits that the authorities in Washington acknowledge, to a certain extent, a moral responsibility toward the prospector and small producer.

We could not have won the war nor achieved what we did if the authorities had not cut the red tape and acted as responsible business men do—by taking each other's words as their bonds. Mr. Sharpless certainly cannot mean to suggest that the Government's word is worthless now that the emergency is past.

Menlo Park, Calif., Jan. 20, 1919. CARR B. NEEL.

[The *Journal* does not, necessarily, champion the views of any of its correspondents, but these are published so that the subject may be seen from all angles. It has, however, consistently taken the position that any artificial interference or control in the production of metals would lead to trouble out of proportion to any benefit that might be derived. Not only was this advice given to those who desired Government interference, but to those who would be affected by it.

We are in favor of justice, whether it be toward an individual interested in mining or toward a public uninterested in the production of any specific metal. If the Interior Department is prepared to say: "We made specific statements that were wrong, and specific promises that we cannot fulfill," then the public, through the Interior Department, ought to make good. We are not yet advised that the Interior Department has made any such statement.—EDITOR.]

Must the Prospector Go?

The writer of the article under the above heading which appeared in the *Journal* of Jan. 2 has a clear conception of the typical prospector of the last half century, who, though he may change in appearance, will not disappear so long as there are free lands on which to roam. Gold he is after, but gold is only an incident in his life. He may not know it, but it is the free air of heaven, the blue haze of the distant mountain, the cool spring in the shade of a cottonwood, the fragrant odor of the sage, the aroma of the balsam boughs of his camp—it is these that call him, it is for these that he will suffer the tortures of the damned on the hot dry desert; for these he will endure the pangs of hunger or the misery of frozen hands and feet. If he strikes gold, the pains are less poignant. If he strikes nothing, there is no despair, for there is another summer ahead.

Years ago mining development followed the happy strike of the prospector, but the industry has outgrown its parent and is today calling for a prospector who thinks of andesite and rhyolite, of the diorite dike, and porphyry-lime contacts. He is not a picturesque character. The burro is too slow for him. His equipment is more likely to be a Ford, with an outfit that means work, and his music is the tap of hammer on steel, rather than the tap of the red-head in a dead cottonwood branch.

If by "prospector" we mean one who searches for minerals, we need him just as much or more than ever, but the man whom the industry needs today is one with some knowledge of ore formation, not necessarily a college man—preferably not a college man—but one who has consciously or unconsciously studied the veins and rocks of some district until he knows how to interpret the signs of nature. The ideal prospector of today must be an optimist, full of energy and wise in woodcraft, and must possess some real knowledge of the earth's crust. He must not be a dreamer or lover of nature, or the chances are that he will drift back to the original species. A college graduate does not usually fill the requirements. To start with, he is inclined to be pessimistic. Few college men are woodwise or trail-wise; discouragement comes too easy, and they are likely to go off into geological researches of great interest but of little practical value, so far as immediate results are concerned.

As long as there are Government lands, we need the prospector, and he has a chance for a handsome reward. We will need him after these free lands are gone, but the same inducements will not then exist. He will always be needed, because the fact that ownership of land ultimately becomes vested in private hands does not preclude the development of mineral on that land. Important operations have been going on of late years on lands that have long been privately owned. Iron, lead, zinc, copper, sulphur, coal, and many other metals are being worked on lands which our Government ceded years ago. So far as the mining industry of the United States is concerned, it will continue to grow and expand or languish, regardless of the prospector and the ownership of land, but growth will depend upon the demand for metals and the market value of the ores here and abroad.

As has recently been shown in the cases of manganese and chrome ores, when the demand for these metals suddenly became insistent, and a good price was offered, the prospector and operator appeared—the best that our country could produce. When such mines have shut down, it will be not for the reason that we lack prospectors or that they have gone to other lands; it will be for an unpoetic, economic cause—the minerals can be produced cheaper in other countries than is possible in the United States. ENGINEER.

New York, Jan. 11, 1919.

Graphite Mining in New York State

In a paper in the Jan. 18 issue of the *Journal*, under the title "Graphite Mining in New York State," by D. H. Newland, we find the following statement: "Flotation was adopted as a substitute for the buddles, but just how successful this process proved I am unable to state, as sufficient work has not been done to afford the basis for an accurate estimate."

In this connection we are pleased to advise that as engineers we reconstructed the buddle plant of the American Graphite Co., a subsidiary of the Joseph Dixon Crucible Co., at Graphite, N. Y., during the summer of 1918. This plant went into operation in September, 1918, and has been in steady operation ever since. With reference to its efficiency, we quote as follows from a letter written on Nov. 23 by the superintendent of the American Graphite Co.: "In response to your inquiry as to how the flotation system installed by your company is doing, I am happy to advise you that its performance is most satisfactory and that we are highly pleased; that it is causing us no trouble whatsoever; the recovery of graphite is excellent; grade of concentrates high; and labor costs very low." The plant has now been in continuous service for about five months and has proved superior in all respects to the old system of buddle treatment.

THE GENERAL ENGINEERING CO.

Salt Lake City, Utah, Jan. 24, 1919.

Concerning Hoisting Records

In the *Journal* of Nov. 23, 1918, page 903, a correspondent states that, at the Orient No. 1 coal mine, Franklin County, Ill., the average hoisting record for a period of six days was 5149 tons per eight-hour shift, from a 600-ft. shaft; maximum, 6008 tons. He adds, "this is the state record, if not the world's."

During a visit to the Kimberley Diamond Mines, South Africa, before the war, I found at one of the shafts, 1500 ft. deep, that it was quite usual to hoist (in two compartments) 7000 tons per nine-hour shift. Underground, the ore was dumped automatically from the cars into shaft-pockets, from which it was loaded into 11-ton skips. ROBERT PEELE.

New York, Jan. 16, 1919.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Missouri Seeks Tariff on Zinc

Representative Dyer, of Missouri, has urged the lower house at Washington to act favorably on the following resolutions, adopted by the House of Representatives of Missouri:

> Whereas the zinc-mining industry of southwest Missouri is the greatest metal-mining industry in the entire state; and
>
> Whereas that industry is now crippled to the extent of the closing down of 95% of all the mines in said district, said closing down of the mines being occasioned by the vast importations of zinc ore into the United States from foreign countries, amounting in the last four years ending June 30, 1918, to 825,000 tons, being approximately three times the normal pre-war production of the entire Joplin district, including Kansas, Oklahoma, and Missouri; and
>
> Whereas there are now approximately 350,000 tons of zinc ore on the docks in Australia awaiting shipment; and
>
> Whereas Mexico has a potential power of production of at least 150,000 tons annually, which must find its market in the United States; and
>
> Whereas zinc-ore concentrates have also been imported into the United States in the last three or four years from 15 different countries, representing every continent and grand division of the world: Now, therefore, be it
>
> Resolved by the House of Representatives of the State of Missouri, That we believe it to be the patriotic duty of the Legislature of the State of Missouri to memorialize the Congress of the United States by special resolution, asking that there be at once incorporated into the pending revenue bill a provision providing for a protective tariff of 2c. per lb. on the metallic contents of zinc ore, in order to keep out further importations of zinc ore, and allow the zinc-mining industry of the United States to live and be again built up to its normal condition.

Copper Employee Delegates at Capitol

As a result of conferences with both the operators and the workmen in Western copper mines, the Secretary of Labor expects to draw up a series of conclusions which he hopes will be helpful to all concerned. For the last three weeks, Secretary Wilson has been calling quietly to Washington a number of Western copper operators. After having made himself familiar with the situation as it appears from their viewpoint, he called a meeting Jan. 31 and Feb. 1 of delegates representing the employees in copper mines, mills and smelteries of Arizona, Montana, and Utah. The delegates were as follows:

> H. S. McCluskey, member of the executive board, International Union of Mine, Mill and Smelter Workers; Lester Scott and Tom O'Connor, Miami, Ariz.; Willis Miller, Globe, Ariz.; P. M. Vargas, Morenci, Ariz.; C. R. Clifford, Clifton, Ariz.; Antonio Lopez, Metcalf, Ariz.; L. E. Hart, Verde, Ariz.; J. K. Field, Clarkdale, Ariz.; A. D. Chisholm, Jerome, Ariz.; Sam Verran and James Walker, Bisbee, Ariz., Robert Leggitt, Douglas, Ariz.; J. C. Lowney, organizer, International Union of Mine, Mill and Smelter Workers; George Tucker, J. C. McMullen, P. Delaughrey, James O'Brien, J. Mahoney, and John Buckley, Butte, Mont.; H. Whitmore, A. Hodges, and H. E. Gallagher, Great Falls, Mont.; C. M. Reynolds, James Walsh, and Thomas E. Carey, Anaconda, Mont.; F. S. Dunn, Joseph Lee, George W. Fahy, O. A. Henney, D. O. Jacobs, and J. E. Munsey, Salt Lake City, Utah.
>
> The conference was attended also by Hywel Davies, Federal Labor Administrator for Arizona; Joseph Lord, Federal Commissioner of Conciliation for Arizona; W. D. Ryan, Western representative of the Bureau of Mines; W. M. Knerr, State Labor Commissioner of Utah, Eugene Meyer, Jr., Treasury Department, and Felix Frankfurter and H. L. Kerwin, assistants to the Secretary of Labor.

Will Pool Facts on Foreign Minerals

The suggestion by George Otis Smith, Director of the U. S. Geological Survey, that American mining men pool their information descriptive of the mineral deposits and resources of other countries has met with hearty response from more than 100 of the larger mining and metallurgical companies. The Survey already has an important nucleus around which to gather additional information as to foreign mineral deposits. Arrangements have been made with the State Department to secure the annual reports and other publications of mining companies throughout the world. A questionnaire is to be sent out through the consular service which it is expected will bring in certain pertinent facts with regard to mineral possibilities in other countries.

This is the first attempt ever made by the Government to gather systematic detailed information with regard to the sources of mineral supply with which American mines must compete or on which American industries must depend. England and Germany have gathered such information for many years.

War Contracts Bill Amended

The Senate, on Jan. 29, accepted without a roll call the amendment of Senator Henderson to the bill providing for validation of war contracts. The amendment provides for relief of producers of war minerals. The only important change made in the Henderson amendment was the striking out of the words "the production of which was requested or demanded by the War Industries Board, the Shipping Board, the Department of Interior or other agency of the Government." In lieu of the foregoing, the following was inserted:

> the production of which by any claimant or claimants was requested or demanded by personal solicitation of or personal inducement to such claimant or claimants made by the War Industries Board, the Shipping Board, or the Department of the Interior.

Senator Wolcott, who proposed this change, spoke as follows in support of it:

> Let us suppose that somebody embarked upon a plan of business expansion and laid out money, not as a result of any inducement offered by any Government department or any Government agent, but simply in response to some sort of general propaganda that was carried on by the Government in the form of publicity, advertisements, urging people to produce and work and get busy to help win the war; and let us suppose that a person induced by that very indefinite solicitation embarked upon that program, as I say, of business expansion, and lost by the operation. It occurs to me that that individual ought to receive no remedy under this bill. Therefore it seemed to me that the amendment as drawn was entirely too broad, and the amendment which I have offered to the amendment is designed to limit the remedies which might be availed of under the amendment offered by the Senator from Nevada.
>
> I will say that my purpose was not by any means to extend this remedy, but rather to restrict it, and I think the language that I have drawn to an extent undoubtedly does restrict it.

Senator Henderson was not in favor of accepting the amendment, but did so to allow the bill to go to conference. The principal opposition to the Henderson amendment was voiced by Senator Frelinghuysen.

New York Meeting of A. I. M. E.

Preparations are being made for the meeting of the American Institute of Mining Engineers, to be held in New York, Feb. 17-20, by the committee on arrangements, under the chairmanship of Allen H. Rogers. Out-of-town members who expect to attend have been advised to make their hotel reservations well in advance; otherwise it may be difficult to secure accommodations.

On the opening day, Feb. 17, the Institute of Metals Division will meet both morning and afternoon, there being simultaneous sessions on "Industrial Organization." A session on "Petroleum and Gas" has also been arranged for the afternoon. At 4: 30 p.m. a memorial service to Dr. Rossiter W. Raymond will be held in the auditorium.

The annual business meeting of the Institute will take place at 9: 30 a.m. on Feb. 18. The sessions of the morning will be on "Principles of Mine Taxation," "Industry, Democracy, and Education" and on "Iron and Steel." The board of directors will meet at noon, afterward entertaining the officers of the Canadian Mining Institute and other distinguished visitors at a luncheon at the Engineers' Club. "International Co-operation in Mining in North America," and a "Uniform Mining Law for North America" will be the subjects of the afternoon sessions, a discussion of "Iron and Steel" also being on the afternoon program. A memorial service for the men who died in the war will be held at a special meeting at 4: 30 p.m.

The National Research Council will hold a session at 10 a.m., Feb. 19, a simultaneous meeting on mining milling, and geology likewise taking place. In the afternoon, there will be a joint session with the American Institute of Electrical Engineers on the subject of electric welding. The president's reception and annual banquet will take place in the evening at the Hotel Biltmore.

Various features for entertaining the members and their guests have been provided. Among these is an all-day excursion to the Federal shipbuilding plant, at Newark, N. J., during which the launching of a ship will be witnessed. A special program has been arranged for the ladies.

The following papers are to be presented on nonferrous metallurgy and metallography at the sessions of the Institute of Metals Division:

"Effect of Temperature, Deformation, and Grain Size on the Mechanical Properties of Metals." By Zay Jeffries.

"Volatilization of Cuprous Chloride on Melting Copper Containing Chlorine." By S. Skowronski and K. W. McComas.

"Automatic Copper Plating." By J. W. Richards.

"Two Instances of Mobility of Gold in the Solid State." By E. Keller.

"Die Castings and Their Application to Our War Program." By Charles Pack.

"First Year of Leaching at New Cornelia." By H. A. Tobelmann and J. A. Potter.

"Electric Furnace Problems." By J. L. McK. Yardley.

"Comparison of Grain-size Measurements and Brinell Hardness of Cartridge Brass." By W. H. Bassett and C. H. Davis.

"Manganese Bronze." By P. E. McKinney.

"Metals and Alloys From a Colloid-Chemical Viewpoint." By Jerome Alexander.

"Standards for Brass and Bronze Foundries and Metal-Finishing Processes." By Lillian Erskine.

At the session on Feb. 17 on "Industrial Organization" the papers to be read are:

"Employment of Mine Labor." By H. M. Wilson.

"Use of Cripples in Industry." By J. P. Munroe.

"Mental Factors in Industrial Organization." By T. T. Read.

"Prevention of Illness Among Employees in Mines." By A. J. Lanza.

"Psychology Tests in Industry." By Robert M. Yerkes.

"Need of Vocational Schools in Mining Communities." By J. C. Wright.

Professional Lecture, "U. S. Employment Service." By I. W. Litchfield.

Topical discussions will also be held on the subjects of "Housing" and "Americanization" at this session. The papers to be read at the session on "Petroleum and Gas" are as follows:

"Results of Cement Plugging for Exclusion of Bottom Water in the Augusta, Kansas, Field." By H. R. Shidel.

"Water Troubles in the Mid-Continent Oil Fields, and Their Remedies." By Dorsey Hager and G. W. McPherson.

"Natural-Gas Storage." By L. S. Panyity.

"Petroleum Hydrology Applied to Mid-Continent Field." By R. O. Neal.

"Economic and Geologic Conditions Pertaining to the Occurrence of Oil in the North Argentine-Bolivian Field of South America." By S. C. Herold.

Papers, scheduled for the "Iron and Steel" session comprise:

"Does Forging Increase Specific Density of Steel?" By H. E. Doerr.

"Flaky and Woody Structures in Nickel Steel Gun Forgings." By C. Y. Clayton, F. B. Foley, and F. B. Laney.

"Static, Dynamic, and Notch Toughness." By Samuel L. Hoyt.

"Development of Grain Boundaries in Heat-Treated Alloy Steels." By R. S. Archer.

"Water-Cooled Equipment for Openhearth Steel Furnaces." By W. C. Coffin.

"Prevention of Columnar Crystallization by Rotation During Solidification." By H. M. Howe and E. C. Groesbeck.

"Basic Refractories for Openhearth." By J. Spotts McDowell and H. M. Howe.

"The Shimer Case-Hardening Process." By J. W. Richards.

"Metallographic Investigation of Transverse-Fissure Rails, With Special Reference to High-Phosphorus Streaks." By G. F. Comstock.

"Effect of Rate of Temperature Change on Transformation in an Alloy Steel." By H. Scott.

"Davidson Process of Casting Formed Tools." By J. E. Johnson, Jr.

The papers to be read at the National Research Council session are:

"Production of Ferromanganese in the Blast Furnace." By P. H. Royster.

"A Volute Aging Break." By Henry M. Howe.

"Effect of Cold-Working and Rest on Resistance of Steel to Fatigue Under Reversed Stress." By H. F. Moore and W. J. Putnam.

"Use of Manganese in Openhearth Practice." By Samuel L. Hoyt.

Report of Steel Ingot Committee, National Research Council. By Henry M. Howe, H. S. Rawdon, and F. H. Schoenfuss.

Mining, milling and geological subjects will be covered in the following papers, which also include those on coal and electrical welding:

"Notes on Certain Ore Deposits of the Southwest." By W. Tovote.

"Petrographic Notes on the Ore Deposits of Jerome, Ariz." By Marion Rice.

"Mining Methods at United Verde Extension Mining Co." By C. A. Mitke.

"Study of Shoveling as Applied to Mining." By G. Townsend Harley.

"Investigations of Aërial Transport in Mining Districts in South America." By G. M. Dyott.

"Fine Crushing in Ball Mills." By E. W. Davis.

"Problems Involved in Concentration and Utilization of Domestic Low-Grade Manganese Ore." By Edmund Newton.

"Anthracite Mine Costs." By R. V. Norris.

"Work of National Production Committee, U. S. Fuel Administration." By J. B. Neale.

"Distribution of Coal Under the U. S. Fuel Administration." By J. D. A. Morrow.

"Microstructure of Iron Deposited by Electric Arc Welding." By G. F. Comstock.

"Path of Rupture in Steel Fusion Welds." By S. W. Miller.

"Welding Mild Steel." By H. M. Hobart.

Chronology of Mining, January, 1919

Jan. 1—Anaconda company authorized $50,000,000 bond issue for equipping properties of Andes Copper and Santiago companies and for replacing invested earnings; Series A, or one-half, issued immediately.—Price-fixing agreements become illegal, except as permitted by Webb act.—United Verde Extension opened new employee's hotel at Jerome, Ariz.—Harvard's reorganized School of Engineering begins mining courses.

Jan. 2-4—Joint meeting at Denver of Colorado chapter of American Mining Congress and Colorado Metal-Mining Association.

Jan. 3—Appointment announced of H. C. Hoover as Director General of international relief commission.

Jan. 5—Special committee files report on gold production with Secretary of Interior.

Jan. 6—Arsenic and compounds removed from Export Conservation List.

Jan. 7—Petition of Minerals Separation to restrain Butte & Superior from dissipating assets denied by U. S. Supreme Court; Mar. 3 set for argument.

Jan. 8—Announced that Mineral Bank was to be established in Mexico City by British interests, to specialize in loans on mining property.—Old Dominion flotation mill at Globe, Ariz., forced down by throwing of bolt into electrical machinery, causing shutdown of company's mines and also those of Arizona Copper Company.

Jan. 10—Alaskan Juneau calls special meeting of stockholders to vote on $3,500,000 bond issue to retire floating debt and pay for altering milling plant.

Jan. 11—Application of Desert Power and Water Co. to increase rates for power supplied to Arizona mines denied by Arizona State Corporation Commission; temporary surcharge of 15½% allowed.

Jan. 13-15—Striking workmen at Morococha mines of Cerro de Pasco company, Peru, dynamite power lines, causing flooding of lower levels; Americans abandon camp.

Jan. 14—Annual meeting of Mining and Metallurgical Society of America at New York; H. H. Knox elected president for 1919.

Jan. 15—Shattuck-Arizona lead mill closed.—Copper Export Association files articles of incorporation with Federal Trade Commission and obtains permission to enter export trade under Webb law.

Jan. 15-16—California committee of the American Mining Congress meets at San Francisco to organize state chapter.

Jan. 16—Import restrictions on pyrites, graphite, graphite crucibles, iron ore, chrome ore, chromite, manganese ore and dioxide, copper ore and concentrates, and monazite sand removed by War Trade Board.

Jan. 17—Anaconda's sawmill plant at Bonner, Mont., destroyed by fire.—Perkin medal for chemical discovery presented to F. G. Cottrell at Chemists' Club, New York.—Boston & Montana Development Co. announces sale of $400,000 bond issue.—Unevida Gold Mining Co. brings action in New York Supreme Court to recover leases transferred by defendants to Comstock Recovery Lode Corporation.

Jan. 20—Calumet & Hecla and subsidiaries establish new working schedule equivalent to 75% of working time recently existing.—Control of distribution of raw materials in United States released by War Trade Board, except as to pig tin, tin ore and concentrates, jute, jute manufactures, and Egyptian cotton.—Congress informed by Senator Hitchcock that American potash industry has been protected against foreign competition by allotment of Alsace-Lorraine's potash to France and Belgium.

Jan. 21—Committee on investigation of smelting rates charged British Columbia mine operators by Consolidated Mining and Smelting Co. of Canada holds first session at Nelson, B. C.

Jan. 22—Santa Eulalia, Chihuahua, reported raided by Villistas; mining companies' safes looted as well as houses of Americans.

Jan. 23—Montana Legislature passes resolution asking Congress for relief for manganese industry in United States.—Chemical Alliance at annual meeting in New York votes to continue organization in present form.

Jan. 24—Committee on gold standard, appointed by Secretary McAdoo, reports special government or international action now unnecessary to stimulate production of gold.

Jan. 25—Committee of Copper Export Association sails for Europe to look into foreign situation.

Jan. 28-30—Committee of High-Grade Ore Producers' Association meets at Joplin, Mo., to consider organization of local chapters of American Mining Congress and American Zinc Institute.

Jan. 29—War-Contract Validation bill amended to provide relief for war-mineral producers.—Senate Foreign Relations Committee reports favorably on resolution to investigate American claims for destruction of property in Mexico since 1914.

Jan. 31—Delegates of grievance committees of copper companies' employees in Arizona, Utah and Montana confer with Secretary of Labor in Washington.

Fighting the Boche Underground

Capt. H. D. Trounce is the author of a very interesting book, entitled "Fighting the Boche Underground." that has just been published by Charles Scribner's Sons, New York ($1.50). Captain Trounce, who is an American mining engineer of British ancestry, could not resist the impulse to get into the fight early in the war. So he went over and enlisted in the British army, and, obtaining a commission in a mining regiment, served for 18 months in Flanders and in France, engaged in mining and countermining. When the United States entered the war, he obtained his release from the British service and entered the Corps of Engineers in the American army, and was engaged in equipping and training our mining engineering regiments.

In the book that he has written he has described his experiences while in the British service. He tells in simple, unaffected language how the mining operations were carried on. We have obtained a better idea of this interesting and important work from Captain Trounce's book than from anything else that we have read. We felt from beginning to end that the account was being given by one who had been engaged in the work, understood what he was doing, and was able to depict things in the right colors. Every mining engineer will be interested in reading this book.

January Mining Dividends

Mining dividends paid in January, 1919, by 27 United States mining and metallurgical companies amounted to $9,294,622, as compared with $7,443,402 paid by 32 concerns in January, 1918.

Canadian, Mexican and Central America companies paid $1,543,075 in January, 1919, and $1,215,065 a year ago.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Smelters, pfd. A	U. S.-Mex.	$1.50	$148,013
Am. Smelters, pfd. B	U. S.-Mex.	1.25	44,242
Arizona Binghamton, c	Ariz.	.10	200,000
Caledonia, l.s	Ida.	.01	26,050
Camp Bird, pfd., g	Colo.	.18	110,501
Champion, c	Mich.	6.40	640,000
Cresson Cons., g	Colo.	.10	122,000
Daly, l.s	Utah	.20	30,000
Eastern Talc	Vt.	.15	10,433
Golden Cycle, g	Colo.	.03	45,000
Homestake, g	S. D.	.50	125,580
Inspiration, c	Ariz.	2.00	2,363,934
Iron Blossom, l.s	Utah	.02½	25,000
Iron Cap, c	Ariz.	.25	36,225
Magma, c	Ariz.	.50	120,000
New Idria, q	Calif.	.25	25,000
Ontario, s	Utah	.50	75,000
Oroville Dredging, g	Calif.	.12	82.385
Phelps Dodge	U. S.-Mex.	8.00	3,600,000
Plymouth Cons., g	Calif.	.24	58,520
Portland, g	Colo.	.02	60,000
Shattuck Arizona, c	Ariz.	50	175,000
Tonopah Ex., g.s	Nev.	.05	64,140
United Eastern, g	Ariz.	.05	68,150
U. S. Smelting, com	U. S.-Mex.	1.25	438,894
U. S. Smelting, pfd	U. S.-Mex.	.87½	425,555
Vindicator, g	Colo.	.01	15,000
Wellington, g.s	Colo.	.10	100,000
Wolverine, c	Mich.	1.00	60,000

Canadian, Mexican and Central American Mines	Situation	Per Share	Total
Cons. Min. and Sm., c.z.l	B. C.	$0.62½	$261,936
Howe Sound, c	B. C.	.05	99,208
McKinley-Darragh-Savage, s	Ont.	.03	67,431
N. Y. & Hond. Rosario	C. A.	.50	100,000
Nipissing, g.s	Ont.	.50	600,000
Santa Gertrudis, g	Mex.	.24	364,500
Trethewey, s	Ont.	.05	50,000

The only holding company which paid in January was St. Mary's Mineral Land Co., which distributed $2 a share ($320,000), the same as last year.

Arizona Binghamton Copper Co. made its initial payment, and Caledonia began payment at the new rate of 1c. monthly, it having previously paid 3c. per month for about the last three years.

Tungsten Ore Production in 1918

The output of tungsten ores in 1918 was less than that of the preceding two years, and, according to Frank L. Hess, of the U. S. Geological Survey, was equivalent to 5065 short tons of concentrates, carrying 60% tungsten trioxide. The largest producing state was Colorado, with 1910 tons of ferberite. California produced 1781 tons of scheelite, and Nevada, 885 tons of scheelite.

A remarkable development of 1918 was the large production of scheelite in the Great Basin region from the contact metamorphic deposits, which altogether gave an output of 1413 tons. In the Eugene Mountains, about seven miles northwest of Mill City, the Nevada Humboldt Tungsten Mining Co. and the Pacific Tungsten Co. erected mills, which began work late in 1918. A 22,000-ft. pipe line, two pumping stations, and a 32½-mile power line were built by a mutual subsidiary company, the Mill City Development Co. A 3½-mile tramway, with a gasoline locomotive and steel cars, hauls the ore of the Mill City Mining Co. to the Pacific Tungsten Co.'s mill. Early in 1918 these companies shipped their ore to the mill of the Humboldt County Tungsten Mines and Mills Co. at Toulon, Nev., 60 miles southwest of their mines, for treatment. This company also treated ores from its own mines and from a number of other properties.

At Bishop, Calif., the Standard Tungsten Co. ran out of ore, and after re-treating a part of the tailings, closed its mill. The Pine Creek Tungsten Co. began active work on the development of a contact-metamorphic deposit about 25 miles northwest of Bishop, at an altitude of about 11,000 ft. The famous mine of the Atolia Mining Co., at Atolia, Calif., was the largest producer in the United States.

In the Boulder, Colo., field the tonnage of ferberite mined from the principal mines was about equivalent to that secured in 1917, but the output from the lesser mines was so much smaller that the total dropped nearly a third. The Wolf Tongue Mining Co. operated its Cold Spring mine and was the largest producer in the district.

In Arizona the production was equivalent to about 213 tons of concentrates carrying 60% tungsten trioxide, valued at $245,000, and included wolframite, hübnerite, and scheelite. The Yucca Tungsten Co. was the largest single producer.

The Homestake Mining Co. produced considerable wolframite from the replacement deposits at Lead, S. D. The production of other tungsten ores in the Black Hills was so small as to be negligible. A small quantity of scheelite was produced in Utah, and a little hübnerite was taken from Blue Grouse Mountain, near Deer Park, Washington.

California University Establishes Bureau of Occupations

The following letter was recently received from California, and speaks for itself:

Office of the Secretary
CALIFORNIA ALUMNI ASSOCIATION
114 California Hall, Berkeley, Calif.

Engineering and Mining Journal, January 25, 1919.
New York City.

We are trying to get jobs for engineers and technical men. That sums up in a sentence the whole matter of this letter.

With the signing of the armistice, our efforts have been turned as energetically as possible toward replacing men in civil life. We deal only with graduates and students. This is a comparatively narrow field, yet we find difficulties. Jobs are not plentiful, and we need the assistance of every alumnus and his active coöperation in telling us of openings. I have thought that possibly there might be some material in this which would be worth noting in the *Engineering and Mining Journal.* In a sense, this Bureau of Occupations, newly organized, is to constitute the selling organization of the university. We are going to try to place before employers the training and experience of our graduates in the most favorable way. Each year we expect to take a census of the classes and to report to men in the industries and professions all the material that is available. I feel that a genuine service can be rendered here not only to the applicant but to the business houses and to the state.

The facts above are general. Specifically, we need jobs. If you can help by publishing or by word of mouth, it will be deeply appreciated.

Sincerely,
(Signed) HOMER HAVERMALE.

Committee on Gold Standard Reports

Special Government or international action is not necessary to stimulate production of gold now that peace is in sight, the committee appointed by Secretary McAdoo to investigate the question of the gold standard reported on Jan. 24. The report says the principal problems arising out of fear that the gold standard throughout the world might not be maintained have been largely removed by the cessation of hostilities. In reporting a like conclusion, the Federal Reserve Board has said that "there is enough gold now in the world, if properly distributed, to provide the requisite banking reserve" to handle the interest and sinking fund charges on the public debts of any nation which will submit to the necessary taxation.

The Copper Situation

These are the salient facts in the copper industry of the United States as revealed Feb. 3 at the conclusion of a series of conferences between the Secretary of Labor and miners, called for the purpose of reaching an agreement on wages:

1. There now exists an unsold stock of copper in process from the mines to the refineries or in the finished form at the refineries of approximately 1,000,000,000 lb., representing over $175,000,000 tied up in stocks. This copper was produced on a scale of wages based on a minimum price of 26c. per lb. and for every cent received under that level producers will lose $10,000,000
2. Sales of copper since the signing of the armistice have not consumed 5% of the output of the mines.
3. A stock of copper is found to be on hand in France, England, and Italy, which, though small for war consumption, is a considerable amount for peace times, large amounts of scrap metals being for sale in connection with cancellations of munitions manufacturing programs.
4. Foreign governments having purchased their copper at 23½c. to 26c. per lb. are remarketing under government control stocks bought at those prices and meanwhile are discouraging and in some cases prohibiting imports of new stocks.
5. Copper producers had little copper sold ahead at the time the armistice was signed, as the needs of the United States and its Allies were taking close to 90% of the country's entire production, which was being supplied monthly.
6. A combination of the cessation of the export trade and the interval required to turn war industries into peace industries has brought about declining prices in copper as well as other commodities, and while prices are falling buyers lack courage to purchase.

The statement was made that accumulated copper stocks are being consumed, although for the moment the process is slow. It is pointed out that with the coming of peace northern neutrals and the Central Empires, as well as the rest of the world, will need copper. Also telephone and telegraph companies have a large amount of postponed construction work, which must soon be placed. With the coming of spring considerable general construction work may be expected, and orders will undoubtedly be placed which require copper. Emphasis was also placed on the need of giving credits to foreigners for the purpose of assisting them in making purchases here.

The statement issued after the conference disclosed that copper production in 1918 averaged 200,000,000 lb. a month, or about 2,500,000,000 lb. for the year, against a pre-war annual production of 1,500,000,000 pounds.

"When peace is proclaimed," the statement added, "and the necessary foreign credits are established in this country, sales may return to 150,000,000 lb. per month, but we can hardly expect sales to warrant a production of 200,000,000 lb. per month, as during the destructive consumption of the war.

"Advantage in operations in the near future will be confined to low-cost producers. The problem now before us is how best to safeguard the industry to insure continued operation and a living wage. The terms of the various sliding scales automatically regulate wages, according to the market price.

"Wages for January, 1919, on terms of the sliding scale, were paid on the basis of 30 to 32c. copper, although the December market price for copper was 26c., as fixed by the War Industries Board. Wages are, therefore, 50 to 75c. higher on a war basis than they would have been on a peace basis, according to the sliding scale.

"A reduction in the selling price of copper to 20c. would call for a reduction in wages of 75c. per day, or 25c. for each 2c. drop in the market. If copper drops to 18c. the reduction in wages would be $1 per day on the sliding-scale basis. Changing the sliding scale to a war basis advanced wages 50c. to $1 per day from the pre-war sliding scale rates."

After the conference it was announced that the results would be put before the miners' unions by their delegates. Approximately 30% of the workers in Arizona, Utah and Minnesota are said to have been laid off because of a falling off in the demand for copper.

Congress was urged in resolutions adopted Feb. 4 by representatives of the copper-mine workers of Utah, Arizona, and Montana to provide legislation for the extension of long-term credits to foreign countries to stimulate the copper market and relieve conditions in the industry characterized as critical. The resolutions also called upon the War and Navy departments to withhold copper stocks now on hand.

The workers, before concluding the conferences with Department of Labor officials, which had been in progress since Jan. 31, appointed a permanent committee to coöperate with managers of the industry in restoring normal conditions.

Sale of the surplus at the present market quotation of 18c., it was estimated, would mean a loss of $80,000,000 to producers. In view of conditions, department officials said, immediate measures of relief would be required to prevent further curtailment.

27th Engineers Coming Home

The 27th Engineers is now at Nantes, and expects to embark for home about Feb. 15. The service rendered by the mining regiment is almost concluded, and the men are now undoubtedly looking forward to the welcome that awaits them on this side.

The men of the 27th have the enviable privilege of recording their service in this unique regiment as part of their mining experience. As told last week, they have created a permanent organization of the 27th Engineers, and the majority of the men in the organization will probably esteem it more highly than any club or association they may ever enter. A rousing welcome is due them upon their return. In part this can be effected through the medium of the Comfort Fund, but the welcome that will count most will be the welcoming back to employment without delay.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$19,653.56
W. E. Defty	10.00
Alaska Mining and Engineering Society	111 00
W. H. Corbould	6.50
Dover Laboratory	2.00
Interest to Jan. 1, 1919	105 30
L. W. Strauss	10.00
Employees, Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January Interest	15.75
Total	$19,968 11

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Owing to the work of administering the Comfort Fund, contributions are acknowledged only in the columns of the *Journal*.

Editorials

The Economic Crime in Tin

THE War Industries Board dissolved on Dec. 31, 1918, but Mr. Armsby, Chief of the Tin Section, was obliged to remain in office to unravel, if possible, the complications that had been produced in tin. He has been conferring with the manufacturers of goods in which tin is used, in order to arrange for the allocation of the 10,169 tons purchased by the Inter-Allied Tin Executive under the direction of the United States Government and now held by the United States Steel Products Co. Mr. Armsby explains that the War Industries Board aimed to maintain a reserve stock of tin, and now desires that the United States Steel Products Co. shall not suffer any financial loss through a decline in the market. Mr. Cornish, representing one of the largest manufacturing interests, compliments Mr. Armsby upon the intelligence and patriotism of the War Industries Board in making the tin purchases, but himself demurs to taking over any proportion of the allocated tin.

The compliments that have been exchanged in this matter are something like sprinkling eau de cologne over a dead horse. Mr. Armsby has refused to disclose how much tin was held by manufacturers in this country at the time when the Inter-Allied Tin Executive was formed, but there is reason to suppose that it was large, and the War Industries Board should have known it. It is certain that the acuteness in the tin market had passed long before the American emissaries started for London, and there was probably no good reason for the adventure. The British have no sympathy for our predicament, for they say we Americans invented the pool and induced them to go into it. The plain truth of the matter is that our Government instituted a big gamble in tin, and lost. The *Journal* remembers distinctly that the probability of loss was prophesied at the time the thing was started.

The conditions that existed required that the tin purchases should be financed by some private party. The United States Steel Products Co. patriotically undertook to do the business. It finds itself now, a perfectly innocent party, holding the bag. Manifestly, it deserves and must receive proper relief.

There is just one straightforward, sound thing that can be done. This is for the Administration to go to Congress and say: "We entered upon a big gamble in tin, with the best of intentions (though perhaps with not the best judgment), for the sake of the great cause toward which everybody was coöperating. We, or rather an innocent third party whom we persuaded to aid us, are going to lose a great deal of money. Our plans were framed, however, in the interest of everybody, as we thought; so let Congress pass an appropriation for the relief of the innocent party that generously undertook to help us, and let everybody pay his share just as he is doing for other purposes."

Mr. Armsby is trying to do the wrong thing. He is trying to distribute the tin pro rata among those who used tin during 1918. But the people who used the tin directly are not the consumers. The manufacturer of babbitt metal, for example, is only a middleman. His product goes to manufacturers of bearings, but they, too, are only middlemen. The railway companies who use and wear out the bearings might be regarded as the ultimate consumers, but not so; the railways are selling public service, into the cost of which enters the metal traced back through the several manufacturers to the primary producers. Consequently, the ultimate consumer is the public, and it is the public that ought to pay.

We assure Mr. Armsby that any expedient of passing around the tin at cost price is uneconomic, and consequently unsound. We are now suffering the consequences of too many economic crimes. The more that they are continued, the worse will things be. It is unfortunate that there are public officials who are so blind that they cannot see that they are delaying the readjustment of business, and are delaying it dangerously. The idea that manufacturers, already overstocked with tin, ought to take 10,000 tons more, and pocket the loss in marketing it, is grotesque. To force such a procedure will be another economic crime that will add to national troubles.

The Railway Situation

THE daily press has set forth clearly Mr. McAdoo's plan for five years' Government control of the railroads, leading up to Government ownership. It has published the suggestions of the Interstate Commerce Commission advising the return of the railways to their various owners, in due course of time, after certain legislation has been enacted that will enable the roads to operate with greater economy and permit them to grow as the demands for railway facilities increase; and, finally, it has published the suggestions of the railway executives submitted to the Senate Interstate Commerce Committee on Jan. 8. These two sets of suggestions are similar in many respects. Both advise Government regulation of the issue of new securities, elimination of wasteful competition, pooling of equipment and terminals, and elimination of the confusion that has been produced by the numerous Federal and state commissions.

The railway executives go into further detail, asking for a Secretary of Transportation, regional boards to have jurisdiction over the roads within their district, the Interstate Commerce Commission to act as a court of appeal, and, in a broad but comprehensive manner, state the railway problems and their solution so far as they can be determined at the present time.

We call attention to the railway situation here, not because we assume that our readers have not noted the steps already taken, but to remind them that no business, no profession, is more vitally interested in this subject than are those professions and associations connected with mines and metals; and, being vitally interested, each mining engineer should exert all possible influence toward bringing about a solution of the railway problem satisfactory to the mineral industries.

A large proportion of the income of American railways is derived from the transportation of mine products in raw or unfinished form. This fact might perhaps be questioned by one who gains his impression of transportation by riding over our Western country, where thousands after thousands of acres are devoted to the raising of farm products, but it will readily be realized by one who travels between New York and Pittsburgh, through a manufacturing country, and who passes, en route, an almost continuous train of coal, metal, and metal products.

Of the details of the suggestions offered we have nothing to say at this time, but we would point out to our mining friends that they should show their interest in the question of thoroughly equipped and efficiently operated railways, managed so that they may handle promptly all mine products and supplies which are offered, and extending so as to reach every point where there is reasonable prospect of tonnage being developed. This, in turn, means that, however managed, the roads should be given an opportunity not only to grow up to the demands, but, rather, that railway facilities should, to some extent, exceed demands, in order that business may have an opportunity to grow up to them; or, in other words, that mining business may not be curbed or lay dormant through lack of transportation facilities.

Railway rates are of the highest importance to ore producers, because the freight rate imposed often determines what is and what is not "ore." Naturally, we desire low rates so that a greater tonnage may be indicated in our ore reserves, but rates are not so vital as are the means of transportation.

Scattered throughout our land from the Atlantic to the Pacific are thousands upon thousands of tons of minerals which cannot be designated "ore" solely because so situated as to lack rail transportation to industrial centers. Given conditions under which railways can persist and thrive, such deposits must ultimately become commercially available.

The question now before the country is how to make the roads most efficient. Mr. McAdoo thinks that the best results will be produced by turning them over to the Government. Those who have worked all their lives in the service of the railways, passing from brakemen, rodmen or freight agents, through the school of experience, until they have become operating heads—these men believe that greater efficiency may be accomplished under private ownership, with Government control, than under Government ownership and operation. The Interstate Commerce Commission, with the authority acquired by 20 years of experience, concurs.

There are many—shippers, owners of securities, railway laborers, and others—who will advocate Government control, and it behooves the men of the engineering and mining industries to distinguish between these two lines of action: whether it is better to support those who, as experts, have given their advice against Government ownership, or those who have had little to do with management, and who suggest the opposite course. Whichever way we see the light, we must let our servants in Washington—our representatives—know that we have thought about the matter, and expect them to carry out our wishes.

Parenthetically, we might add that Government operation does not mean continuity of operation, as recently evidenced by the failure of the Government to keep its transportation lines in operation around New York. True, war conditions may not be considered to prevail today. But we have something very close to war conditions with us. Every ship that is afloat ought to be moving, and not laid up in our harbors waiting for cargo while the Government pleads with its employees to "please go to work, and we will talk it over."

In Canada, fortune or misfortune has brought a number of the railways into government hands. A special to the *Post*, from Ottawa, under date of Jan. 8, says: "Many people who oppose Government ownership of our railways feel that, if political management can be eliminated from the railways, public life will immensely benefit by the abolition of the persistent lobbying and intrigue with which certain railway magnates have enveloped Ottawa for some decades."

We hope that our friends in studying this question will bear in mind the intimate relation always existing between government and politics.

"Let the Job Stand"

IT IS REFRESHING to read in the Washington dispatches of Jan. 30 to the New York *Times* sentiments that, of late, have seldom come from the capital. "Let the job stand," says Charles Piez, director-general of the Emergency Fleet Corporation, and announces that there will be no advance in wages in the Pacific Coast plants. This is in response to a strike called in the Seattle yards, and another proposed for the San Francisco yards at an early date.

Mr. Piez indicated that the Corporation was ready to take a breathing spell, during which the management would have time to look around and arrange for more efficient operation within the plants. Later, it was anticipated, the men would return and be ready to give their labor for value received. He further said that there would be a discontinuance of high wages unless increased skill and output justified it. In this connection he pointed out that "in an Atlantic Coast shipyard workmen today receive $2 for the same time that brought them $1 a year ago, whereas the average output has decreased one-third." . . . "A typical example on the Pacific Coast shows an increase of 70% in pay for hours worked and a reduction of 30% in average output." Thus there has been an actual rise in pay per unit of work done of 140 to 200% within the last year.

Under the circumstances, Mr. Piez suggests that it is "highly unwise for shipyard workers, in their own interests, to call strikes at existing wages." At Seattle the demand was for $1 per hour for all workers, skilled, semi-skilled, and unskilled.

We are in perfect sympathy with high wages and high salaries. We advocate no limit, if by skill or brains they can be earned, and we are glad to support legitimate efforts for their attainment. On the other hand, we strongly deprecate attempts by mass action or any other action to force payment for unearned service.

It strikes us that labor unions have recently accepted some rather poor advice. Prior to the signing of the armistice the shortage of labor placed the whip in the hands of the unions. That it was in many cases used to extract the last dollar, regardless of cost of living, is well understood and is amply proved by the decrease in efficiency above cited and the ever-present evidence that, in many plants, men were being paid a wage that allowed them to work for three or four days and then loaf for the remainder of the week. This was not alone Government experience, but, sad to relate, many another business has had the same story to tell.

The strike of the carpenters, and the breaking of their agreement with the Quartermaster's Department in November was both untimely and dishonest. It showed bad management on the part of the union advisers, among them W. L. Hutcheson, president of the Brotherhood of Carpenters, who supported the strikers in making a "scrap of paper" of their contract with the Government.

Union labor is losing an opportunity that may not come to it again in a long time, an opportunity to keep wages high by means of intensive effort and the elimination of waste. High wages are still being paid in those plants that are operating. Living is still high, but markets for manufactured products are poor. Here is the opportunity for labor leaders to impress a few simple facts on their followers, and urge them to get closer to the man who must provide the wherewithal to pay the wages—not further away from him. Labor leaders have been inclined to dig a trench between employer and employee, broader and broader, until the employer could not come across with the wages and the employee would not try to go across with the goods. That trench must be filled, so that both may meet and together face whatever fate has in store for them. It will be easier for all if labor leaders urge their men to coöperate with their employers, to the end that production will continue to warrant not only a living wage but one that will still leave a comfortable margin between income and outgo.

BY THE WAY

Gold weighing 1300 lb. passed through Anchorage, Alaska, recently on its way from Iditarod to Seattle, according to advices reaching the Department of the Interior, says our Washington correspondent. The treasure was moved from the interior camp on dog sleds in charge of Robert Griffis, a veteran Wells Fargo Express messenger. He receives $1.25 a lb. for delivering the gold to the agent of the express company at Seward.

"In the *Journal* of Dec. 7 was published a circular of a gentleman who wanted to buy mining properties containing practically every mineral listed in Dana's Mineralogy," writes Bela Low, of 25 Beaver St., New York. "In looking over some papers, I came across a letter which I received a few years ago while in Russia, and it occurs to me that it would not be a bad plan to introduce the aforesaid gentleman to my client in the interest of the revival of the Russian mining industry. Here is a literal translation of what the Russian gentleman offered to me: Seven claims of blister copper; two claims of iron and cast iron; one claim of bituminous coal; one claim of brass; one claim of platinum, together with lead, silver, cast iron and tin; one claim of diamonds, together with blister copper, and several lumps of diamonds."

Attention has been called to a recent decision of the Department of the Interior by the Arizona State Bureau of Mines in regard to an application received by the department for patent of a certain mining claim. This claim was located on lands after these had been withdrawn under the act of June 25, 1910, as amended by the act of Aug. 24, 1912. This amendment provides that lands so withdrawn shall at all times be open to exploration, discovery, occupation, and purchase under the mining laws of the United States, so far as the same apply to metalliferous minerals. A deposit of uranium, vanadium, and radium occurred upon the claim referred to. In the decision of the Interior Department it was held that location on such deposits was possible, but, in the nature of things, such deposits were not metalliferous minerals and as such could not be patented in the face of the withdrawal. This decision was based upon the fact that it is the salts of uranium, vanadium, and radium that are mined and used in a commercial way, and not the metals in a native state, and that they are similar in nature to potash or aluminum and are earthy, and, therefore, are not metals in the strictest sense.

Every trapshooting club is an embryo lead mine, needing only to be worked to return a rich profit, says the *Du Pont Magazine* for February. After three years of shooting over the traps of the Du Pont Club, Wilmington, Del., the grounds were mined and 23 tons of lead was recovered. The grounds at a Columbus, Ohio, gun club were mined several years ago. Twenty-six tons of lead were salvaged, one pound of shot being extracted from 60 lb. of dirt. The Elliott Shooting Park, at Kansas City, Mo., owned by Robert S. Elliott, the pioneer gun-club miner, yielded a quantity of lead worth $850 the first year it was mined. Two systems are used in recovering shot from the ground—the blower and the placer. The blower system is the simplest and the easiest to install. This method was used on the Du Pont grounds. The surface where the greatest amount of shot fell was scraped, one inch of sod and soil being removed to a shredding machine, where it was chopped up finely. A blower was attached to this machine, which was just strong enough to blow the soil out through a pipe. The shot, being heavier, fell into a trough and ran into sacks. The shot was reasonably clean and readily sold. The entire equipment was inexpensive, consisting of the shredder and the blower and a small gasoline engine to operate them. A force of four men kept the machine constantly supplied with dirt. The placer system is more complicated and more expensive to install, and a large supply of water is needed for its successful operation. This method is used by Mr. Elliott at his Kansas City park, but the immense amount of lead thrown on these grounds—more than 250,000 loads being fired annually—justified the additional expense involved in the undertaking.

Personals

Have You Contributed to the Association of the 27th Engineers?

H. Darling has been appointed manager of the Porcupine Crown mine.

Col. G. A. Burrell, recently of the Chemical Warfare Service, has opened an office as consulting chemical engineer in Pittsburgh, Pennsylvania.

Scott Lintner, of San Francisco, is now manager of the Ray-Broken Hill mines at Ray, Ariz., succeeding **George A. Laird,** who resigned in January.

Mark Workman, president of the Dominion Steel Corporation, of Sydney, N. S., will soon leave for Europe in connection with the business of the company.

C. F. Lomont, of Chicago, Ill., has recently been released from the Navy and has resumed his position as representative in the iron and copper districts of the Northwest for the Electric Service Supplies Company.

Clarence T. Emrich has resigned as chief chemist of the Old Dominion Copper, Mining and Smelting Co., Globe, Ariz., to accept the position of assistant superintendent of the International Smelting Co., at Miami, Arizona.

Colonel Ambrose Monell, who resigned from the directorate of the International Nickel Co. for service in the Army, has been reëlected to the board and to the executive committee, succeeding J. R. DeLamar, deceased.

Lafayette Hanchett, mining engineer of Salt Lake City, Utah, who has been assistant director of the United States explosive plants, is now consulting engineer for the Silver King Coalition Mines Co., operating at Park City, Utah.

Paul Hammerich, formerly manager of the Jacobs Asbestos Mining Co., and recently in charge of the interests of the Pennington Asbestos Co., at Robertsonville, Quebec, Canada, has been appointed asbestos inspector for several American firms.

Eugene P. McCrorken, until recently ensign, U. S. Naval Reserve Force, Bureau of Steam Engineering, Aviation Division, has returned to his former position on the editorial staff of the "Engineering and Mining Journal," having been discharged from the service.

Lawrence Eddy, recently mill superintendent of the Kennecott Copper Corporation's plant, Kennecott, Alaska, is now general superintendent of the charcoal iron furnaces and chemical plant of the Barnum-Richardson Co., at East Canaan, Connecticut.

Chester Naramore, chief petroleum technologist of the U. S. Bureau of Mines, Washington, D. C., has resigned to accept private employment. He is succeeded by **James O. Lewis,** petroleum geologist, who was formerly in charge of the experiment station of the U. S. Bureau of Mines, at Bartlesville, Oklahoma.

Edward Higgins, formerly engineer for the California Metal Producers' Association, has resigned to accept a position on the engineering staff of Bulkeley Wells, with headquarters in San Francisco. He is succeeded by **C. H. Fry,** who was formerly superintendent of the Yellow Aster mine, at Randsburg, California.

Thomas F. Cole has resigned as president of the North Butte Mining Co. He was one of the organizers of the company and served continuously on the board of directors and for the last seven years held the office of president. He will continue on the board. **Robert Linton,** who was first vice-president, in charge of mining and development operations, has been elected president

L. D. Ricketts, acting general manager of the Calumet & Arizona Mining Co and the New Cornelia Copper Co., visited Southwestern camps recently in company with a party including W. D. Thornton, of New York, president of the Greene Cananea Copper Co , William Wraith, of the International Smelting Co ; Frederick Laist, of the Anaconda Copper Mining Co.; W N. Tanner, A C Carson, and M B. Gentry.

O. P. Hood, of Washington, D C., registered at the New York office of the American Institute of Mining Engineers recently Others who registered there during the last week were R. G Wayland, of Chehalis, Wash ; David H Ladd, Detroit, Mich.; Benjamin LeR. Miller, Bethlehem, Penn., S H Patterson, Allentown, Penn.; W. E. Pratt, Fort Worth, Tex ; Lieut. E. J. Ristedt ; Jesse L. Jones, Pittsburgh, Penn., W. A Funk, Idaho Springs, Colo.; and Capt W. H. Bradley, Jr

Obituary

William Rattle, Jr., mining engineer and metallurgist and head of the firm of W. J. Rattle & Son, Cleveland, Ohio, died on Jan. 21, of influenza. He was 39 years old.

George N. Collins, mining engineer, formerly of Toronto, died in San Francisco, Calif., Jan. 18, aged 34 years. He had been connected with mining companies in the United States, Mexico, and South America for many years and was recently on the staff of the New York & Honduras Rosario Mining Co., at its mines near San Juancito, Honduras.

Rolla C. Carpenter, professor of experimental engineering, Cornell University, died on Jan. 19 at his home in Ithaca, N. Y., aged 66 years. He was in active charge of many engineering construction projects and was the author of several works on engineering. Mr. Carpenter had been a member of the American Institute of Mining Engineers for many years.

William Nicholls, superintendent of the Trout Lake concentrating plant of the Oliver Iron Mining Co., since 1908, died at Coleraine, Minn., on Dec. 18, 1918. He was one of the earliest concentrating men. Born in Gogignon, Wales, June 9, 1851, he came to the United States at an early age and after living at British Hollow, Grant County, Wis., a few years, went to the Lake Superior district, where he began work at the Quincy mill. Later he had charge of the Petherick and St. Clair mills, in Keweenaw County, and was superintendent of the Phoenix mill for 13 years. When the Phoenix closed, he moved to Lake Linden, where he was connected with the Calumet & Hecla mills for four years. He then went to Montana, where he had charge of the old Elling & Morris stamp mill at Pony, Madison County. Later he was superintendent of the Alta concentrator for the Helena & Livingston Smelting and Reduction Co., at Corbin and also had charge of the Comet and the Hope mills in Jefferson County. In 1893 Mr. Nicholls went to the Coeur d'Alene district, taking charge of the Helena and Frisco mill. He also rebuilt the Morning mill, at Mullan, Idaho, and was later superintendent at the Last Chance mill of the Federal company, at Kellogg. He was engaged by Dr. L. D. Ricketts to assist in the construction of the Old Dominion concentrator at Globe, Ariz., and operated the mill for a year after its completion, when he was secured by the Oliver Iron Mining Co. which was experimenting with an iron-ore washing plant at Coleraine, Minn. After a few months there, Mr. Nicholls went to McGill, Nev., where he took charge of the construction of the Nevada Consolidated concentrator. He then returned to Minnesota, where he was reëngaged by the Oliver company to plan and build the Trout Lake plant. He is survived by his widow, two daughters and a son, John Nicholls, of Globe, Arizona.

Societies

American Association of Engineers, New York Chapter, will hold an open meeting at the Machinery Club, 30 Church St., Feb. 10. W. H. Finley, president of the association, will address the meeting on "Engineering Organization and Its Relation to Public Service."

National Foreign Trade Council will hold its sixth National Foreign Trade convention at the Congress Hotel, Chicago, on April 24, 25 and 26, 1919. The formal call will be issued soon by the chairman of the council, James A. Farrell, president of the United States Steel Corporation.

Minnesota Joint Engineering Board, representing the affiliated engineering societies of Minnesota, held the regular quarterly meeting in St Paul, Jan. 25, with W H. Hoyt, of Duluth, newly reëlected president, presiding Coöperation of the engineer was the keynote of the meeting, and legislative matters with reference to the profession also came in for a large amount of consideration

Society of Industrial Engineers plans a national conference at the Hotel McAlpin, New York, Mar 18-21 The leading topics will include internal plant organization and also the elimination of fatigue There will be a discussion of labor by employers and labor leaders for the purpose of crystallizing the attitudes representative of both labor and capital toward labor problems at the present time.

Industrial News

Bradley, Bruff & LaBarthe has been retained by the Penarroya Mining and Metallurgical Co. of Paris to design a complete lead-melting and refining plant to be erected at Penarroya, Spain.

Draeger Oxygen Apparatus Co., of Pittsburgh, Penn., announces that its corporate name was changed on Jan. 7, and is now the "American Atmos Corporation." The charter of the company remains unchanged, except to the extent that it is authorized to manufacture various forms of breathing apparatus, regardless of whether dependent upon oxygen or not. The officers and directors of the company are the same as under the old name.

Trade Catalogs

WA-5 Air Compressor. Sullivan Machinery Co., Chicago, Ill. Bulletin 75-D; 6 x 9; 12 pp.; illustrated. Descriptive of straight line type with simple steam and air cylinders.

Drill Sharpener. Sullivan Machinery Co., Chicago, Ill. Bulletin 72-C; 6 x 9; 24 pp.; illustrated. Descriptive of the Sullivan drill sharpener, for hammer-forging drill bits and shanks.

WB-3 Air Compressor. Sullivan Machinery Co., Chicago, Ill. Bulletin 75-E; 6 x 9; 12 pp.; illustrated. Descriptive of the Sullivan air compressors, with simple steam and two-stage air cylinders.

Air Compressor. Sullivan Machinery Co., Chicago, Ill. Bulletin 75-G; 6 x 9; 12 pp.; illustrated. Descriptive of the Sullivan small, belt-driven air compressors, single-stage WG-3 and two-stage WH-3.

Portable Mine-Car Air Compressor. Sullivan Machinery Co., Chicago, Ill. Bulletin 75-I; 6 x 9; 8 pp.; illustrated. Descriptive of the Sullivan portable mine-car air compressors, motor driven. Class WK-2.

Asbestos—Asbestos and Mineral Corporation, Whitehall Bldg., New York, has issued Plate VIII of a series of illustrations showing varieties of crude and fiber asbestos. The specimens shown are selected from the company's collection, and the portfolio, when complete, will include 12 reproductions of photographs which are most artistic and of great value to those interested in asbestos.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloy (Bearing) Containing Cu, Pb and Sb. William D. Berry, New Brighton, Penn. (U. S. No. 1,286,921; Dec. 10, 1918.)

Concentrating Machinery—Head-Motion for Ore Concentrators. Charles C. Hebbard, Joplin, Mo. (U. S. No. 1,286,617; Dec. 3, 1918.)

Concentration—Magnetic-Pulley Separator. John P. Bethke, Milwaukee, Wis., assignor to Dings Magnetic Separator Co., Milwaukee Wis. (U. S. No. 1,286,611; Dec. 3, 1918.)

Crushing Mill. Thomas J. Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co., Boston, Mass. (U. S. No. 1,286,831; Dec. 3, 1918.)

Flotation, Process of Treating Copper Ores by Sulphitization and. Niels C. Christensen, Salt Lake City, Utah, assignor to Metallurgic Improvement Corporation, Salt Lake City, Utah. (U. S. No. 1,286,632; Dec. 3, 1918)

Flotation, Process of Treating Ores by. Niels C. Christensen, Salt Lake City, Utah, assignor to Metallurgic Improvement Corporation, Salt Lake City, Utah. (U. S. No. 1,286,631; Dec. 3, 1918)

Furnace Door Equipped With Electrode Supporting Means. Julius R Hall, Oak Park, Ill., assignor to Booth-Hall Co., Chicago, Ill. (U S. No. 1,286,604; Dec. 3, 1918)

Titanium Oxide, Pigment Made of. Louis E Barton, Niagara Falls, N. Y., and Henry A Gardner, Washington, D C., assignors to Titanium Alloy Manufacturing Co., New York, N Y. (U S. No. 1,286,916; Dec. 10, 1918)

Editorial Correspondence

SAN FRANCISCO—Jan. 30

The Production of Petroleum in California in December, 1918, was 8,543,476 bbl., or 275,596 bbl. per day. Field shipments totaled 8,434,463 bbl. The daily production in November averaged 277,618 bbl. The report for December is made by the Standard Oil Co. In the seven months from May to November, the reports were issued by the petroleum war service committee and published in the Standard Oil bulletin. The Standard company has resumed the monthly reports of production and consumption beginning with December. The January bulletin will report the production data for 1918, as follows: Total production, 101,637,870 bbl.; average daily production, 278,460; new wells completed, 589; total crude-oil stocks on Dec. 31, 32,042,923 bbl., a decrease from Dec. 31, 1917, of 407,542. The decrease in daily average production in the same period was 1117 bbl. There is nothing alarming in this report of decreased crude stocks and daily production. Government litigation is largely accountable for this condition, which might have been much worse, if there had been a diminution in output. Given a fair chance to go ahead without interference, California oil producers will do well. Government control during the period the United States was engaged in the war might have affected the oil industry badly had it not been in the hands of Mark L. Requa, whose practical and decisive action relieved the early anticipation of impending disturbance of the industry.

BISBEE, ARIZ.—Jan. 31

Readjustment of Wages has been deferred until after the joint meeting called for Jan. 31 at Washington. All over Arizona, both companies and men appreciate that present conditions cannot continue much longer, and both are looking toward mutual concessions that may avoid a shutdown of the larger mines for a period. Mine owners appreciate what they would lose in the disorganization of their effective working forces, and the more conservative miners understand that any disturbance or wage demands would work almost entirely against their own interests.

Establishment of a Miners' Home and Hospital for infirm miners and their wives is provided for in a bill recently introduced in the Legislature by Mr. Sealey, of Douglas. The measure calls for an appropriation of $250,000. Only indigents are to be admitted, and all realty is to be deeded to the institution by those admitted. In case of damage suits by inmates against employers, the hospital trustees are given the right to sue and the institution is given the right to collect. In the statehood act, a large tract of land was set aside by Congress to defray the cost of establishing such an institution.

The Larger Companies of the Bisbee District have laid off few men since the demand for copper lessened., The present wage of $6.10 for miners is on the basis of 33c. copper, compared with the nominal present quotation of 20c. As many men as possible have been placed on exploration and development work. Working forces are being increased though only returning employees are being taken on, especially those who have served in the Army. It is considered remarkable that only a small proportion of the men who enlisted from Bisbee have returned thus far. Out of 447 who went from the Calumet & Arizona, only 25 have come back to their old jobs.

WALLACE, IDAHO—Jan. 31

The Mineral Production of Idaho in 1918, according to final figures reported by Robert N. Bell, state mine inspector, was in round numbers as follows: Gold, 36,000 oz.; silver, 9,572,000 oz.; lead, 290,000,000 lb.; zinc, 51,000,000 lb.; and copper, 5,000,000 pounds.

The Bunker Hill & Sullivan Company, at Kellogg, has made many changes and additions at the smeltery and refinery during the last few months, having in view economy in operation and increased capacity. Although the management has made no announcement, it is believed that the company is planning further additions and eventually will manufacture commercial products of lead. It is recalled that in a public address at Kellogg, while the smeltery was under construction, F. W. Bradley, president, stated that the manufacture of lead pigments in connection with the Kellogg plant would in time be added to the company's activities, and, at a subsequent date, he announced that the company would erect a zinc-reduction plant with an initial capacity of 300 tons. Mr. Bradley, whose headquarters are in San Francisco, is now making an extended visit to the plant at Kellogg.

Suspension of Operations by Hercules and Tamarack & Custer, and curtailment of production by other mines of the district, have been followed by the charge made by the Burke miners' union that the mining companies had promised to reimburse all employees the full amount they had paid under contracts to purchase Liberty bonds in the event that they were unable to meet the payments through lack of employment, and that the promise was not being fulfilled. The charge was reiterated by the State Federation of Labor. As a matter of fact, the mining companies made no such promise. During the drive for the Fourth Liberty Loan, James F. McCarthy, chairman of the Shoshone County committee, who is also manager of the Hecla Mining Co., gave public notice that all men subject to draft who subscribed for bonds and who were subsequently called to the service would be relieved of their obligation if they so desired and have their payments refunded. This promise was made as county chairman, applied to all persons without regard to their employment, and was faithfully kept. As evidence of the unfairness of the charge made by the union, it may be stated that the mining companies have voluntarily reimbursed employees for payments made for bonds when the request has been made upon leaving the service of the companies. When the Tamarack & Custer closed down, the management notified employees that they could turn in their bond contracts and be reimbursed for payments made.

SALT LAKE CITY—Jan. 30

The Salt Lake Stock and Mining Exchange on Jan. 25 held its annual election of officers. B. W. Dixon was elected first vice-president and acting president; J. H. Deming, second vice-president; F. R. Woolley, third vice-president; G. P. Norton, treasurer; W. D. Nebeker, trustee for third term; W. H. Stenacker, caller; H. V. Altree, secretary; E. P. Carter, marker. On meeting, the new board chose James A. Hogle, of the brokerage firm of J. A. Hogle & Co., president of the exchange.

In the Litigation Over the State Occupation Tax to be levied against mining companies, and opposed through suits brought by the Utah Copper, Judge Mining and Smelting, Silver King Consolidated and 19 other companies, a brief supporting this measure has been filed in the district court by Dan B. Shields, attorney general, and Herbert Văn Dam, Jr., and Oliver C. Dalby, representing D. O. Larson, state treasurer, in answer to one filed a short time ago by the protesting companies.

Readjustment of Freight Rates on Ores and a possible return to rates approaching those of the ante-bellum period naturally appeal to operators in the Salt Lake region, facing high prices along all lines—except for metals—and seeking a way out. Whether or not such a reduction will be made is in the realm of speculation entirely. The question more readily presents itself now that there has been a reduction in freight rates on commodities from eastern and southeastern points—for a long time higher than rates to the Pacific Coast and to the intermountain region.

BUTTE, MONT.—Jan. 30

Assistance for the Manganese Industry in the United States was asked of Congress in a resolution passed unanimously on Jan. 23 by the Montana Legislature. Protection from foreign competition is sought.

The Anaconda Company has averted a crisis in the labor situation in Butte due to the oversupply of labor following the armistice. Being the owner of the Florence Hotel, a miners' lodging house capable of accommodating almost 1000 men, it threw open the doors of this hotel to all returned soldiers or sailors, where they may find lodging and board without cost until they have secured employment. The Y. M. C. A. also is participating in soldier and sailor relief and has secured the Murray residence, one of the spacious homes of Butte, its owner, T. J. Murray, turning it over in its entirety. A couple of hundred men are being housed there without cost. The "war chest" organization also has turned over its treasury to the civilian relief, and any soldier or sailor by submitting his discharge papers can secure a loan ample to carry him over, or, if he is married, sufficient to tide over his family. While the mines of Butte are operating at about 60% of normal, there is little suffering comparatively, despite the large number of idle men.

TONOPAH, NEV.—Jan. 28

Work on the Mayflower Property at Pioneer, Nev., owned by the Consolidated Mayflower Mines Co., was started last month after practical suspension since early in 1912, when the shaft and stope timbers were destroyed by fire. Control of the property has been acquired by a group of operators including J. H. Miller, co-owner, with Jesse Knight, of Utah, of the Lucky Boy mine, near Hawthorne, and a director of the Western Ore Purchasing Co.; W. J. Tobin, former president of the Mayflower and head of the Reorganized Pioneer Mines Co.; F. M. Manson, manager of the Western Ore Purchasing Co.; J. B. Kendall, for several years superintendent of the Goldfield Consolidated; and P. H. O'Neil, stock man and mine operator of California. Purchase was made from W. J. Tobin and C. M. Levy, the latter president of the Western Pacific R.R. Co., both retaining an interest. The mine is opened by an inclined shaft 530 ft. deep, and has produced a large quantity of shipping and milling ore from above the 400 level. Equipment includes a 15-stamp mill, a 90-hp. distillate engine driving a 15-drill compressor, a hoisting engine, a 60-hp. engine for driving mill, and all other necessary equipment in good order. In former operations coarse crushing left from $3 to $6 in the tailings, which were impounded. Mill capacity will be increased greatly by the addition of a ball mill, and it is planned to start milling within the next 60 days.

DENVER—Jan. 30

War-Mineral Producers in Colorado are following the activities of the executive committee of the war-minerals division of the American Mining Congress with great interest. Many Colorado operators take a gloomy view of the situation, although they hope for a favorable outcome of the effort to protect war-mineral industries from destruction as a result of the failure of the War-Minerals Act to function. It appears that bills have been presented to both houses of Congress, authorizing the Secretary of the Interior to make good the losses sustained in producing the various war minerals. Colorado tungsten producers are especially interested in the fact that the executive committee of the Mining Congress has secured the attachment of an amendment to the Chamberlain war-contract-validating measure now before the Senate, which amendment is designed to protect the tungsten industry, as well as the producers of manganese, magnesite, pyrites, chrome, and other steel-making elements in other Western states.

The Entire Assets of the Penn-Wyoming Copper Co. at Encampment,, Wyo., have been purchased by Morse Bros. Machinery and Supply Co., of Denver, Colo. The Penn-Wyoming company is the owner of the Saratoga and Encampment R.R., and the Ferris Haggerty and Doane-Rambler mines at Encampment. The various subsidiary companies purchased, and their respective bond issues, are: Ferris Haggerty Copper Mining Co., $1,000,000; Battle Lake Tunnel Site Mining Co., $750,000; Saratoga and Encampment R.R. Co., $750,000; Encampment Smelting Co., $500,000; Encampment Tramway Co., $350,000; Encampment Pipe Line Ditch Co., $100,000; Emerson Electric Light Co., $50,000; Encampment Water Works Co., $50,000; Carbondale Coal Co., $20,000; North American Mercantile Co., $22,000; and Encampment Town Lot and Land Co., $8,000. The Penn-Wyoming company was the successor of the North American Copper Co., taking over the latter's property in 1904, which it operated under adverse conditions until 1907, since when much litigation has arisen. The company's records show a production of 6,414,011 lb. of copper from 59,000 tons of ore. The tramway connecting the Ferris Haggerty mine with the smelting works at Encampment is 16½ miles long. The Doane-Rambler mine has been developed to a depth of 665 ft. from the surface. The geological features of the district are described in Professional Paper No. 25 by A. C. Spencer, of the Geological Survey, published in 1904. The purchasers expect to prove the value of the mines and have them operated if conditions warrant. The smeltery and concentrator at Encampment will be dismantled and sold, it being preferable to concentrate the ore at the mines, which will necessitate the construction of a mill, or mills, there. Water rights are available at both Ferris Haggerty and Doane-Rambler mines.

EL PASO, TEX.—Jan. 28

A New Mining Law for Texas has been drafted by a committee of the El Paso Mining Circle. The draft was approved at a meeting of the Circle at the University Club on Jan. 22, and will be submitted to the Legislature. The Federal provisions regarding discovering mineral in place, before location, and the law of apex and extralateral rights are eliminated in the proposed draft. The provisions of the present Texas mining laws, requiring the preliminary expensive survey and location work as initial steps before recording the notice and before the locator knows whether his claim is accepted by the Land Commissioner, are changed to more reasonable requirements. Annual assessment work, payment of 5% royalty on the net proceeds of the mine, instead of on the gross proceeds, and other provisions that will be agreeable to the claim owner, as well as the land department, are included. The provisions of the former "Richard Burgess," mining law, of 1913, regarding the method of acquiring claims on lands leased or sold with minerals reserved, are added to the new bill. Provision for acquiring patent to the claim when five years' assessment work or its equivalent is performed follows the procedure of the United States Federal laws. S. H. Worrell, dean of the Texas School of Mines and chairman of the committee that prepared the draft, and E. F. Knott were appointed to go to Austin to endeavor to secure the passage of the new measure.

JOPLIN, MO.—Feb. 1

A $100,000 Community Drilling Corporation is being organized by the business men of Webb City, Mo., as a means to revive interest in their particular section of the district. When ore prices reached a figure where sheet ground could not be mined at a profit, most of the mines in such ground closed down, and many of the mills were moved to the richer leases in the Oklahoma-Kansas section of the field. It is the belief of the Webb City business men that many soft-ground deposits are to be found near their town, and they purpose putting down at least 200 drill holes to test their theory. The movement is being backed jointly by the Commercial Club and the Mine Operators' Association, and sufficient stock already has been subscribed to assure success. It is planned to start six drills at work in about two months. In no case will royalties of more than 10% be paid to the landowner, nor will transfers of the leases for additional royalties in excess of 5% be permitted.

The Ore-Storage Warehouse Proposition is again creating interest, which has been aroused by the report of the special committee recently appointed by the Tri-State Operators' Association at Picher, Okla. This report, which was made at a meeting of the organization held at Picher, on Jan. 22, was to the effect that the Warehouse Association has made satisfactory arrangements for financing the proposition, that one of the warehouses has been completed and will be ready to receive ore on Feb. 1; that construction of two other warehouses is well advanced, and that, in the opinion of the committee, the warehouse plan might be made a valuable aid to the ore producers of the district. The organization merely accepted the report of the committee, no endorsement being suggested or asked. It is understood that the Warehouse Association has been assured enough business to justify the opening of the Picher warehouse on Feb. 1. The basis on which loans will be made is as follows: When ore is selling below $45 basis price, loan value will be 80% of $45, between $45 and $55, 75%; between $55 and $65, 70%; between $65 and $75, 65%; over $75, no per cent, but $50 a ton on the ore. The Picher warehouse has a capacity of 17,000 tons, and the warehouses to be erected at Douthat and Tar River will have capacity of 22,000 tons each.

The American Mining Congress organized an Oklahoma-Kansas-Missouri branch in Joplin on Jan. 29, following a dinner at which the principal guests and speakers were J. F. Callbreath, secretary of the American Mining Congress; Charles T. Orr, president of the American Zinc Institute; and R. C. Allen, tax commissioner with the Bureau of Internal Revenue. The meeting was the climax of a three-day session of mining men, during which Messrs. Callbreath and Allen were shown over the field and the various details of the organization of the branch chapter were worked out. It had been hoped also to organize a branch of the American Zinc Institute at this time, but, as the constitution of that organization does not provide for local organizations, this plan was abandoned for the present. The board of directors of the new branch of the Mining Congress selected to represent Missouri includes Edgar Wallower, D. D. Dunkin, T. F. Coyne, T. J. Franks and Howard I. Young; to represent Oklahoma, George Coleman, F. N. Bendelari, Victor Rakowsky, Charles E. Schwarz, and Marshall E. Draper; to represent Kansas, P. B. Butler, D. D. Muir, D. C. Corner, John H. Capelli, and J. W. Hoffman. A board of governors will be selected at a meeting of these directors to be held on Feb. 4.

DULUTH, MINN.—Jan. 28

Dismissal of Three Lawsuits against the Oliver Iron Mining Co., totaling in damages asked nearly $225,000, has been made by District Judge W. A. Cant, after the opposing attorneys had agreed upon an amount in settlement of the claims. The suits, brought individually by the Leon Iron Co., the Gilbert Investment Co., and the Higgins Co., involved alleged secret profits reaped by the defendant company at the Norman mine, near Virginia.

HOUGHTON, MICH.—Feb. 1

Prosperity of the Houghton District is indicated by the amount of bank deposits in Houghton County, which now aggregate $20,480,000, the largest on record. Building and loan companies report that, during 1918, hundreds of copper miners have paid off all indebtedness on their homes. There is no sign of bolshevism among the miners of this district. They have accepted without complaint recent reductions or curtailments that mean a smaller pay check, appearing to realize that the metal market situation necessitates such action.

CORDOVA, ALASKA—Jan. 5

Men Destined for the Kennecott Mines, before being taken up the line, will be quartered five days at a quarantine station established outside of Cordova by the Copper River & Northwestern Ry., according to the "Cordova Daily Herald." After their arrival at Kennecott they will again be detained five days. Since the outbreak of the influenza in Cordova, and the consequent cessation of travel, the mines have experienced a shortage of labor, and men will be sent there constantly through the establishment of these stations.

TORONTO—Jan. 21

The Ore-Dressing Laboratory of the Haileybury School of Mines is completed and is being given a trial run. Ore can be treated by amalgamation, gravity concentration, flotation, and cyanidation, using either a single process or a combination of processes, thus demonstrating the work in duplicate of the many mills in operation throughout the district, as well as affording wide scope for original tests. The equipment comprises a small jaw crusher, a battery of three light stamps, amalgamation plate, classifiers, tube mill, concentrating tables, agitators, thickeners and flotation machine. Douglas A. Mutch, now connected with the Coniagas mine, of Cobalt, is in charge of the initial demonstrations.

Ore Shipments From the Mandy Mine, at Schist Lake, Manitoba, during the last two years are given as follows by Dr. R. C. Wallace, Commissioner of Northern Manitoba: 1917—3300 tons shipped; copper, $261,360; gold, $6600; and silver, $6600. 1918—6000 tons shipped; copper, $624,000; gold, $12,000; and silver $15,000; total to date, $925,560. The copper produced totaled 1,188,000 lb. in 1917, and 2,400,000 lb. in 1918. There are 12,000 tons ready for shipment. The stoping of high-grade ore has been almost completed to the 200 level, and of low-grade ore 200,000 tons has been blocked out, averaging perhaps 8 to 10% copper; 20% zinc; 10 oz. gold; and 2½ oz. silver. It is expected that 15,000 tons will be shipped during the coming summer. Two hundred teams will be at work during the next three months hauling ore from Schist Lake to Sturgeon Landing. The Mandy company has taken over the water transportation outfits from the Ross Navigation company, and will itself handle the transportation in the summer.

VICTORIA, B. C.—Jan. 31

Vancouver Chamber of Mines at its recent annual meeting decided that an international mining convention would be held in the province, under the auspices of the organization, some time during this year. The date was not fixed, but it was thought important that the assembly should be made thoroughly representative of British Columbia and of the Pacific Coast states. Officers were elected as follows: Honorary president, William Sloan, Minister of Mines; honorary vice-presidents, Senator Shatford and Mayor Gale; president, A. M. Whiteside; vice-presidents, Lieut.-Col. E. G. Prior, Victoria, B. C.; and C. E. Cartwright; honorary treasurer, J. M. Ley; executive committee, Messrs. N. Thompson, G. T. Hodge, R. H. Stewart, J. M. Turnbull, S. J. Crocker, G. S. Pettipiece, I. Thomas, S. N. Miller, J. D. Kearns, H. P. McCraney, F. E. Woodside, B. G. Hawkins, W. E. Bland, A. B. Buckworth and G. S. Eldridge.

Establishment of an Iron and Steel Industry in British Columbia is the subject of a report credited to the British Columbia Advisory Committee for Scientific and Industrial Research, which has aroused the protest of many in the province. The report's general conclusion is that there is room for one large plant, provided it is assured of the whole Pacific Coast market, though conditions of manufacturing and market preclude, under present circumstances, the establishment of more than one plant. But the report is also quoted as saying—and this is what is vigorously objected to—that "there does not seem to be, however, much likelihood of the iron and steel industry ever being developed on the Pacific Coast to any large extent." In view of Dr. Alfred Stansfield's finding that apparently there is plenty of magnetite ore of the necessary purity for use in electro-smelting, and that efforts are being made to develop the iron-ore resources of the province, the latter statement is considered unjustified.

The Smelting Rate Investigation Committee, which held its first session on Jan. 21 at Nelson, B. C., for the purpose of inquiring into the rates charged by the Consolidated Mining and Smelting Co. of Canada, after taking the evidence of one witness behind closed doors, decided that it would visit the Trail smeltery and meet representatives of the management of the company, that necessary arrangements might be made for investigating the conditions relative to the operation of the plant. A circular is being issued by the committee for distribution among operators and mining men throughout the province, explaining that the inquiry has been opened and that evidence on the question will be welcomed from all who desire a hearing or are of the opinion that they have knowledge which will throw further light on the issue. In the meantime, further indication that the inquiry does not satisfy a faction of the operating miners of eastern British Columbia is furnished by a resolution passed by the Kaslo (B. C.) Board of Trade which reads as follows: "That this board place itself on record as not being satisfied with the appointment of a committee with limited power and authority for investigation into the matter of smelting rates and treatment of lead and zinc ores by the Consolidated Mining and Smelting Co.'s plant at Trail, and that we believe only by a Royal Commission can a complete and satisfactory investigation be made, and that copies of this resolution be forwarded to the Minister of Mines and the Federal Member."

MELBOURNE, AUSTRALIA—Dec. 17

A Power-Supply Bill has been introduced into the Victorian Parliament providing for the appointment of electricity commissioners who will inquire into and report on the steps which should be taken to secure the ultimate coördination or unification of all state or other electrical undertakings in Victoria; also to secure the adoption of such standards of plant and equipment, and of system, frequency and pressure, for the generation, distribution, and supply of electricity as will admit of the efficient interconnection of such undertakings. The immediate problem in Victoria is to provide in the most efficient and economical way for the steadily growing power requirements of industries. The principal inquiries will be in regard to the Morwell brown-coal deposits and to water-power resources.

The Price of Osmiridium in Tasmania was as low as £7 5s. per oz. prior to the war, but it rose gradually, until during 1918 nearly £14 was obtainable . In November, however, the market slumped suddenly to £14, and finally the metal became unsalable. One of the world's principal producing centers is on the west coast of Tasmania, namely the Savage River field. Practically the whole output is produced by fossickers (prospectors on a small scale) and recently as many as 400 men have been at work earning up to £20 per week each. Osmiridium has been found only in the wash, although a report recently was current that it had been discovered in the lode. This, however, does not appear to have been substantiated. The reason given locally for the drop in price is that a substitute has been found to replace osmiridium in the manufacture of pen points, but no definite confirmation is so far available on this side.

The Alleged Oil Fields of Papua (otherwise known as New Guinea) have been under development by the commonwealth government for several years, and although nearly £100,000 has been spent to date, little tangible result has been obtained. Extensive geological examinations have been made, but only 2000 gal. of oil has been produced. Speaking in the House of Representatives recently, Mr. Glynn, the Minister for Home and Territories, said that so far seven bores had been sunk to depths ranging from 242 to 1800 ft., and a rig had been erected for an eighth bore. Oil was struck in No. 1 bore at 224 ft.; in No. 2 bore gas only was found; in No. 3 bore there was a little oil at 320 ft.; in No. 4 bore gas only; in No. 5 bore a small production of oil; in No. 6 bore a little oil at 182 ft. and 295 ft.; in No. 7 bore oil was struck at 185 ft., with a flow of 20 gal. per day, but this was shut off to permit further testing at greater depths. Large quantities of gas were encountered at 1100 ft. The boring plants used on the first five bores, added Mr. Glynn, were found to be entirely unsuited for any depths over 300 ft., as the strata consisted largely of soft mud under considerable pressure, which filled the bore holes as fast as they were sunk, causing them to be abandoned. Bore No. 5 was redrilled, and the oil horizon was isolated by cementing, and a small production obtained—100 gal. weekly, diminishing to 8 gal. weekly. Because of the difficulty due to mud, work was suspended in No. 6 bore, and also in No. 7, owing to the failure of all efforts to drive the 4-in. casing deeper than 1760 ft.

Agitation in the Gold-Mining Industry for some measure of encouragement is taking definite form in the proposal to organize a gold producers' association. A conference has been called for the third week in January, when the following proposals will be discussed: That a gold producers' association with a central committee be formed to look after the special interests of Australian gold producers; that this association demand the removal of embargoes on the export of new gold. that the Federal or Imperial government pay a subsidy on gold production proportionate to the increase in working costs since 1914; that the Repatriation Department subsidize the employment of returned soldiers producing low-grade and otherwise unpayable gold ores; that the Repatriation Department subsidize tribute parties composed of returned soldiers; that the association organize the coöperative buying and distribution of all gold-mining stores; that the federal government subsidize the state railway departments to allow of the carriage of stores at reduced rates; that the Australian government be urged to encourage gold prospecting by (a) removal of restrictions on the organization of gold-mining companies; (b) subsidies to prospecting parties consisting of returned soldiers in west, north and central Australia; and (c) construction of dams, wells, water bores and other means of conserving water in west, north and central Australia to serve the gold and pastoral industries.

The Mining News

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Long drifts on 1400 and 1600 levels of Junction well advanced toward known mineralized ground near Denn line, though delayed by hard rock and ventilation problems.

COPPER QUEEN (Bisbee)—Loading about 5000 cu. yd. of overburden daily by steam shovel on Sacramento Hill. Best day's work 7000 cu. yd. Two shifts working. C. & C. shaft enlarged to 1000 level. Cutting large pumping station at 800 level; when station is equipped, will resume sinking to 1800 feet.

NIGHTHAWK (Bisbee)—South drift on 450 level following copper-oxide streaks with typical district indications of nearness of orebody.

HILLTOP (Dos Cabezos)—Large sum spent in development, including two working tunnels, one 3000 ft. long, and on modern power and compressor plant. Development of several orebodies progressing. J. O. Fife president and R. O. Fife general manager.

TEJON (Gleeson)—Closed down. Has been shipping copper ore.

Gila County

GIBSON (Bellevue)—Machinery ordered for 150-ton mill unit, to work estimated reserve of 1,000,000 tons of 2¼ % ore. J. A. Norton, of New York, recently elected president. H. E. Bierce managing director.

ARIZONA COMMERCIAL (Globe)—Produced 2652 tons of ore averaging 7% Cu in first half of January, shipments having been suspended two days owing to trouble at Old Dominion mill. New shaft down 300 ft., with 500 ft. more to go. Sinking will be pushed. Curtailment in large way not imminent, as company has been operating on reduced scale for several months, owing to labor shortage.

Pima County

EL TIRO (Silverbell)—New 5-year lease taken by Percy Williams, trustee for bondholders; $95,000 worth of copper ore shipped from mine in 1918.

DAILY-ARIZONA (Tucson)—Negotiating purchase of Stratton claims, adjoining company's 33 claims in Old Hat district, Catalina Mountains.

MAGNATE (Tucson)—Twenty employees developing property, four miles south of Twin Buttes. Greatest depth reached to date 185 feet.

TWIN BUTTES EXTENSION (Tucson)—Arranging for drilling. Company formed exclusively of Tombstone residents, headed by A. V. Saunders. B. F. Holland in charge.

Pinal County

COPPER BELL (Casa Grande)—Development begun under William Kemp, of Tucson.

SILVER REEF (Casa Grande)—This and Lake Shore properties consolidated under management of Frank M. Leonard, of New York.

VEKOL (Casa Grande)—New strike of silver ore made in this old producer. E. B. Holt, formerly of Mexico, in charge.

Yavapai County

BRADSHAW REDUCTION (Crown King)—Handling 150 tons per day of gold ore from Wildflower mine, brought by two-mile aërial tramway.

GRAND ISLAND (Jerome)—Preparing to ship to Extension smeltery at Verde. Main development at 500 feet.

JEROME-VERDE (Jerome)—Exploration being pushed northward on 1300 level of Maintop.

BIG BUG (Mayer)—High-grade black oxide struck at bottom of 80-ft. shaft.

LITTLE EGYPT (Mayer)—Started shipments of 5% copper ore carrying gold and silver.

A. B. GROUP (Prescott)—Property in Thumb Butte section bought from William Dearing by Kyle & Bartlett, of Denver. Old tunnel being cleared out.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Milling-grade ore reported on 3500 level across 45-ft. width of veins.

OLD EUREKA (Sutter Creek)—Shaft below 2000 ft. Orebody on 2000 level and above apparently persists at greater depth.

Butte County

DENVER (Forbestown)—New Gibson stamp mill and other improvements planned by R. H. Rountree, recent purchaser. Developed by 1200-ft. tunnel through three shoots of ore.

BLOOMER HILL (Oroville)—Will probably be reopened by National Gold Mining Co., recent purchaser. Development planned on extensive scale.

Calaveras County

MORGAN (Angels Camp)—Loring interests to develop on large scale under option. Mine was large producer in early days. Situated near Carson Hill.

UTICA (Angels Camp)—Gold Cliff and other properties to resume normal operation, labor having become more plentiful.

BERNARDI (Mokelumne Hill)—Will be reopened.

MALONEY (Mokelumne Hill)—Optioned to Oakland men, who will start development after reopening old tunnel and shaft.

Kern County

KELLY-WILLIAMS (Randsburg)—Development begun on Jan. 1 of silver-bearing ground recently located.

Nevada County

ALLISON RANCH (Grass Valley)—Management resumed by Charles K. Brocington. Mine completely unwatered. Development in progress, disclosing good ore.

IDAHO-MARYLAND (Grass Valley)—Metals Exploration Co., of New York, will not at present reopen or actively develop these recently acquired properties, it is officially stated, owing to high cost of labor and supplies. Instead of reopening Idaho-Maryland shaft, company may possibly sink new vertical shaft at some point situated centrally with respect to Idaho-Maryland properties and other adjacent holdings in Grass Valley district, which comprise Union Hill, Gold Point, South Idaho, Idaho Development, Eureka and certain fractional claims. Development for present will be prosecuted only through Union Hill shaft, now down 1200 ft. and soon to be sunk 200 or 300 ft. deeper. Officers and directors of company are: H. P. Whitney, president; Bulkeley Wells, vice-president; Thomas J. Regan, secretary-treasurer; Frederic N. Watriss and Roy H. Elliott.

MIDDLE YUBA POWER (Grass Valley)—Authorized by Railroad Commission to increase power rates. Lighting rates undisturbed. Serves 11 mining companies and 74 light consumers in Alleghany and Forest Hill, Sierra County.

ROUND MOUNTAIN GRAVEL (Nevada City)—Leased to Nevada City men, who will drive tunnel to tap channel.

San Bernardino County

DEL MAR (Barstow)—Reported sold to Eichelberger and Ichus, latter superintendent of Long Beach Canning Company.

GERTRUDE-INEZ (Daggett)—Strike of high-grade silver ore reported. Prospect shaft to be sunk. Situated in famous Calico district. W. B. Werner and F. W. Ford owners.

Santa Clara County

NEW ALMADEN (Almaden)—Strike of new body of cinnabar ore reported.

NEW GUADALUPE (San Jose)—Quarter interest purchased by H. C. Davey, in charge for many years.

Sierra County

SIXTEEN-TO-ONE (Alleghany) — New 10-stamp mill installed now in operation. Large tonnage high-grade milling ore. Underground crew increased. New development begun.

GOLD POINT (Downieville)—Plan to resume operations when snow permits.

WEHE (Downieville)—Gravel mine at St. Charles hill prepared for all-winter work by construction of snowsheds. Tunnel being advanced.

WILLOUGHBY (Downieville)—Sold to satisfy judgment for $540.

Shasta County

BALAKLALA (Coram) — Shipping 300 tons daily to Mammoth smeltery at Kennett on long-time contract.

MOUNTAIN COPPER (Keswick)—Producing 1000 tons of ore a day. Treating about 200 tons daily by flotation. Shipping remainder to smeltery at Martinez.

IDAHO

Shoshone County

NABOB CONSOLIDATED (Beeler)—W. A. Beaudry, manager, announces construction of new mill begun.

SHERMAN (Burke)—Lower tunnel has full face of lead-silver ore; struck 700 ft. east of ore in tunnel 500 ft. above and supposed to be new oreshoot. Tunnel explores vein at 1500-ft. depth. Two tunnels above, at intervals of 500 ft., in ore.

COEUR D'ALENE ANTIMONY (Kellogg) M. E. Jolley reëlected president and C. M. Powell secretary-treasurer. C. P. Blankenship, Washtucna, Wash., elected vice-president.

NATIONAL (Mullan)—Shipped 14 carloads of concentrates in January, averaging 15% copper and 40 oz. of silver, having estimated value of $3000 per car. Mill handling 300 tons per day. Ore runs about 1½% copper and from 2 to 5 oz. silver.

KANSAS

Joplin District

LUCKY O. K. AND BREWSTER MINES, situated in Kansas, near Hockerville, Okla., taken over by Federal Mining and Smelting Co. Former to be known as O. K. mine in future, now producing regularly, mill operating single shift. Brewster concentrator almost completed. P. W. George, local manager.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Continuing drainage project southwest of Calumet, involving large tract of land.

SENECA (Calumet)—Delivery of crusher expected within two weeks. Plant equipped, except rock house.

FRANKLIN (Demmon)—Men voted to eliminate 20% bonus now paid, thus returning to old wage scale.

QUINCY (Hancock) — Announced 25% reduction in operations at mine and smeltery.

LAKE (Lake Mine)—Suspended operations indefinitely Feb. 1. Produced about 900,000 lb. copper in first nine months of fiscal year ending April 30.

MASS CONSOLIDATED (Mass)—Paying miners $1 per day and trammers and unskilled laborers $3.75, a reduction of 75c. from recent scale. 318 men employed, against 450 normally. Wage cut to avoid further lay-off

VICTORIA (Victoria) — Wages reduced 15% Jan. 20, following Mass company's action.

Iron District

McKINNEY STEEL (Crystal Falls)—Has closed down Tobin mine at Crystal Falls and Tully mine at Stambaugh, throwing about 350 men out of work.

MINNESOTA

Cuyuna Range

NORTHERN MINNESOTA ORE (Deerwood) Increased capitalization from $350,000 to $700,000. C. M. Farney, of St. Paul, was elected a director and made secretary-treasurer. Charles W. Potts, of Deerwood, is president and general manager. A. K. Knickerbocker is superintendent. Company owns fee interests in various ore properties on Cuyuna and Mesabi ranges, some of which are leased to operating companies. Shaft being sunk at Northland mine, a manganiferous iron-ore property near Cuyuna. Northland will be new shipper for 1919 and be in position to produce about 50,000 tons of low phosphorus manganiferous iron ore during year. Has completed permanent power plant building and drier; also installed machinery and erected office buildings and miners' cottages. Drifting in progress. Ore hoisting will begin early in February. Foregoing statement by Charles A. Potts.

BONNIE BELLE (Ironton) — Shipping iron ore to Zenith Furnace Co., Duluth.

SAGAMORE (Riverton)—Winston-Dear Co., of Hibbing, building camps, driving piling for trestles and completing preparations to strip for John A. Savage & Co. Will be heavy producer of manganiferous ores in season of 1919.

ADBAR DEVELOPMENT (Trommald) Drifting to orebody on 76-ft. level.

JOAN No. 4 (Trommald) — Deepening shaft. High-grade manganiferous iron produced.

ONAHMAN IRON (Trommald)—Moved main office from Duluth to 1513 Conway Bldg., Chicago.

Mesabi Range

CLEVELAND-CLIFFS (Nashwauk)—To begin underground work on new property south of Buffalo & Susquehanna pit at Hibbing. Max Barber general superintendent Company now operating Crosby mine, at Nashwauk; Helmer, at Buhl; Wade, at Kinney and Fowler mine, at Aurora.

MISSOURI

St. Francois County

ST. JOSEPH LEAD (Leadwood)—Closed Leadwood mill on Jan. 11. Now running on five-day week, resulting in present production of about 60% normal.

MONTANA

Silver Bow County

ANACONDA (Butte)—Orphan Girl fissure cut on 500 level, showing 25-ft. width of no commercial value; 18 in. of low-grade ore on foot wall being drifted on.

NORTH BUTTE (Butte)—Crosscutting delayed in Sarsfield mine by water encountered at 200-ft. point, necessitating installation of pump. No curtailment in development.

NEVADA

Nye County

NEW DEVELOPMENT WORK IN NYE COUNTY includes opening deposits of siliceous material suitable for use in manufacture of paints and glass. Northwest of Beatty, plant being built under direction of M. C. Hole for treating this material; will make three grades of product. In Ash Meadow, southern Nye County, carbonate of lime deposit, suitable for manufacture of whiting and dry colors, being opened. In same region, Standard Oil Co. developing large clay deposits. Fluorspar discovery made recently near Carrava, a station on Tonopah & Tidewater R.R. south of Rhyolite.

TONOPAH SHIPMENTS for week ended Jan. 25 totaled 7158 tons, estimated gross milling value being $121,856. Shippers were: Tonopah Belmont, 2146 tons; Tonopah Mining, 1200; Tonopah Extension, 2091; West End, 701; Jim Butler, 122; Montana, 270; Tonopah Divide, 225; MacNamara, 210; Midway, 106; Halifax, 31; and Rescue, 63 tons.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—Alpha mine producing at rate of 175 tons daily of direct-smelting oxidized ores. Developments encouraging. Two new faces of ore cut on 1100 level west and south of producing stopes. Development on 1300 level being pushed as fast as water met will permit.

NEW JERSEY

Morris County

WHARTON STEEL CO. operating mines at Scrub Oak on double shift since Jan. 14 Eleven-foot vein reported discovered and effort being made to double output. Development proceeding rapidly.

UTAH

Beaver County.

SUPERIOR MINING (Milford)—Proposed to combine Beaver Copper, Beaver Lake Metals, and Utah United under this name, Beaver Copper being leader in step. Utah-United has good body of copper ore reported to be increasing in value with depth.

UTAH SULPHUR (Morrissey)—Producing sulphur from two retorts. Five retorts in all to be completed by Mar. 1. Company has large dumps from early work, to be retreated by special process

Juab County

TINTIC SHIPMENTS week ended Jan. 28 amounted to 131 cars, as compared to 150 cars week preceding.

CHIEF CONSOLIDATED (Eureka)—In 1918, produced 2,354,797 oz. silver (one-fifth production of state); 4099 oz. gold; 8,019,454 lb. lead; and 600,360 lb. zinc. Much of ore developed ran high in silver, especially from lower levels. Ore shipped during 1918 totaled 66,019 tons.

TINTIC STANDARD (Eureka) — Old shaft south of present working shaft to be re-timbered and enlarged; 150 men employed.

Salt Lake County

ALTA CONSOLIDATED (Alta)—Car of sulphide ore from new find in Brain fissure brought about $40 a ton. Two more cars of ore in transit, one carbonate and other sulphide.

WOODLAWN (Alta)—Opening ore-bearing fissure by tunnel driven at depth; now in 1285 feet.

CARDIFF (Salt Lake)—Shipping lead ore of exceptionally high grade.

Summit County

PARK CITY SHIPMENTS week ended Jan. 28 were 1623 tons, as compared with 2021 tons week preceding. Silver King Coalition tram not in operation, which caused temporary cessation of shipments from property.

WASHINGTON

Stevens County

LOON LAKE COPPER (Loon Lake)—Construction of new 100-ton mill begun. Will have flotation equipment. Timber cut, rock and concrete prepared for foundations, and site cleared and opened.

CANADA

Alberta

CONSOLIDATED OIL FIELDS (Peace River)—Good gravity oil struck in well No. 1 at Peace River village at 1132-ft. depth.

British Columbia

CORK PROVINCE (Kaslo)—Refinancing arranged. Expects to start deepening shaft 200 ft. in spring and to drive main tunnel into third vein.

GIBSON (Kaslo)—Laying 2200-ft. spiral-rivetted steel pipe line, effective head 825 ft. Will convey water to generate power for running compressor and for lighting purposes. Installation by A. C. Brintnall, formerly of Washington Water Power Company.

Ontario

MILLER INDEPENDENCE (Boston Creek)—Consulting engineers advise continued development at lower levels. Will sink to 500 level with stations at 300 and 400 levels.

McKINLEY-DARRAGH (Cobalt) — Considerable ore coming from vein on 300 level in western part of property opened for 50 ft. Much of ore high grade.

OPHIR (Cobalt)—Sale of two-thirds interest to Nipissing for $150,000 ratified by shareholders. Nipissing now in possession.

CREWS-MACFARLANE (Gowganda)—Several veins opened in which high-grade shoots occur. One carload of ore shipped and another almost ready.

TECK HUGHES (Kirkland Lake)—Mill treated 2035 tons of ore in December; average value $10.12 per ton.

DODDS CLAIMS (Kowkash) — Taken over by Kowkash Gold Mines, Ltd., capitalized at $2,000,000. John L. Orn, Baltimore, president; William W. Snow, New York, vice-president; and George W. Conklin, New York, secretary-treasurer.

PORCUPINE CROWN (Porcupine) — Charles C. Dixon, of Wilmington, Del., elected director at annual meeting to represent American shareholders.

PREMIER LANGMUIR (Porcupine) — Shipped 39 tons of barite in December.

WASAPIKA (West Shining Tree)—Main vein stripped for 2000 ft., continuing strong and well defined. Main shaft down 50 ft., ore showing well in bottom. About 3840 tons ready for milling said to average $9 per ton.

MEXICO

Baja California

CAMPAGNIE DU BOLEO (Santa Rosalia)—December production of copper was 1,785,840 pounds.

Sonora

GREENE CANANEA (La Cananea) — Has curtailed production 40 per cent.

The Market Report

SILVER AND STERLING EXCHANGE

Jan.-Feb.	Sterling Exchange	Silver		Feb.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
30	4 7580	$101\frac{1}{8}$	$48\frac{7}{16}$	3	4 7580	$101\frac{1}{8}$	$48\frac{5}{16}$
31	4 7580	$101\frac{1}{8}$	$48\frac{7}{16}$	4	4.7580	$101\frac{1}{8}$	$48\frac{7}{16}$
1	4 7580	$101\frac{1}{8}$	$48\frac{7}{16}$	5	4 7580	$101\frac{1}{8}$	$48\frac{7}{16}$

New York quotationa are as reported by Handy & Harman and are in cents per troy ounce of bar ailvcr, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Jan.-Feb.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
30	*	$67\frac{1}{8}$	4.95@5.05	4 90@4 95	6.50@6.60
31	*	$67\frac{1}{8}$	4.95@5.05	4.80@4.90	6 50@6.55
1	$18\frac{5}{8}$	67	4.95@5.05	4.80@4.85	6 45@6.50
3	$18\frac{1}{2}$@$18\frac{5}{8}$	67	4.95@5.05	4 80@4 85	6.25@6 35
4	$18\frac{1}{2}$	$66\frac{7}{8}$	4 95@5 05	4 70@4.75	$6\frac{1}{8}$@$6\frac{1}{4}$
5	18@$18\frac{1}{4}$	$66\frac{7}{8}$	4 95@5 05	4 70	6 10@6 15

The above quotations are our appraisal of the average of the major markets based generally on aalea aa made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metala for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

*Undetermined.

†For American tin of 99% grade.

LONDON

Jan.-Feb.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
30	87	80	105	$245\frac{1}{2}$	$242\frac{1}{2}$	$32\frac{1}{2}$	$29\frac{1}{2}$	56
31	87	$79\frac{1}{2}$	105	$245\frac{1}{2}$	$242\frac{1}{4}$	$32\frac{1}{2}$	$29\frac{1}{2}$	56
1								
3	88	80	(a)	$245\frac{1}{2}$	$242\frac{1}{4}$	30	$28\frac{1}{2}$	49
4	88	80	(a)	246	243	30	$28\frac{1}{2}$	49
5	85–89	79–80	105	$244\frac{3}{4}$	242	$29\frac{1}{2}$	27	48

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds aterling per ton of 2240 lb.

(a) No quotation.

Metal Markets

NEW YORK—Feb. 5, 1919

Things started coming to a head this week, but in no very favorable way. The eyes of everybody became wide open to the copper situation. The official revelations from Washington that were made public this morning were of course only what was well known in the offices of the copper-producing companies. Both lead and zinc exhibited further weakness.

Our advices from London reveal about the same situation in England as here, viz., large surplus of supplies and slowness in resuscitating industrial consumption. Furthermore, there is blindness to the danger of delay, which exhibits itself in attempts to hold up the markets in order to dispose of stocks without loss, instead of forcing the issue, i.e., stimulating consumption by ocering low prices. Good opinion favors cutting the price for copper from £105 to £90@95. One thing that seems certain is that Great Britain and France will not be buyers of American metals for a long time to come. The stocks of virgin metal are huge, and including what is in semi-manufactured forms and in scrap they are alarming.

Copper, Tin, Lead and Zinc

Copper—In our report last week we said "There has not been and is not yet any market in the broad sense, but at this writing there are signs that things are coming to a head and that there will soon be conditions approaching the natural." We referred to the impending recession by the big producers from any position of aloofness that they had previously taken. During the current week more than one of them has been willing to talk business, and the copper market acquired a broader character than previously existed. For the first time since Dec. 1 are we able to say that there is a real market, although it is still only a small one and is characterized by irregularities, as naturally would be expected.

On Feb. 1 a transaction of 4,000,000 lb. at $18\frac{5}{8}$c., f.o.b. refinery, was consummated. On Feb. 3 considerable business was done at $18\frac{1}{2}$@$18\frac{5}{8}$c. This did not reflect any rise of the market as compared with Feb. 1, but rather was an example of the sort of irregularity to which we have referred as being natural. On Feb. 4 several transactions were made at $18\frac{1}{2}$c. On Feb. 5 no business was reported to us, but there were firm bids at 18c. and firm offers at $18\frac{1}{4}$c., and there were indications that copper would be obtained in quantity at nearer the lower figure than the higher.

With the reopening of the copper market, business is being done in the main on the basis of net cash, f.o.b. refineries, but there have been some transactions on delivered terms, with a small allowance of time for payment. However, the old pre-war basis of "delivered, 30 days" no longer exists. We hope that sellers will adopt net cash, f.o.b. refineries, as the common basis and will stick to it.

Copper Sheets—The base price of copper sheets is 28c. per lb. Copper wire is quoted at $21\frac{3}{4}$@$22\frac{1}{4}$c. per lb. f.o.b. mill, carload lots.

Tin—The Government, or some of its officers, are determined to choke the allocated tin down the throats of manufacturers. As a further step in this high-handed proceeding an attempt to check the business of American smelters has been made, clearances of purchases made from them being refused. This action is being taken, we understand, in the name of the War Industries Board, although that body went out of existence Dec. 31. There is considerable doubt as to the legality of the recent actions. In the meanwhile, inasmuch as the rules relate only to lots of five tons or more, smelters are selling in lots of less than five tons and are making wholesale prices on them.

Lead—On Jan. 31 the American Smelting and Refining Co. reduced its price to $5\frac{1}{4}$c., but that was merely in the course of following the market down, the open price being already around 5c. The business reported for the week was much less than in the previous week. In some ways the lead market exhibits signs of demoralization. There are rumors of ill-advised, uncoördinated attempts of Government bureaus, acting independently, to dispose of Government stocks at sacrifices, and unfortunately there seems to be something in these rumors.

Offerings of Mexican lead in London compelled further reduction in the official price, which came down to £30.

Zinc—The little spurt of activity that we reported last week was short-lived. The demand from galvanizers ceased abruptly, and the trifling rally in prices disappeared with it. On Feb. 3 spelter was offered in tonnages at 6.35c. at the beginning of the day and at 6.25c. at the end, transactions being made at both those figures. On Feb. 4 the market opened at 6.25c. and went down to $6\frac{1}{8}$c. On Feb. 5 spelter was offered in large quantities at 6.20c. without finding buyers, and the market is quoted at 6.10 @ 6.15 cents.

Zinc Sheets—Unchanged at $13 per 100 lb.

Other Metals

Aluminum—31@32c. per lb.

Antimony—The market was quiet and unchanged at $7\frac{1}{4}$@$7\frac{1}{2}$c., for spot.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 lb.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—This market was again weaker. We quote California virgin at $95 @98. San Francisco reports, by telegraph, $99. There were considerable arrivals of Mexican quicksilver in this market.

Silver and Platinum

Silver—The latest advises from London report the demand for rupees in India as still continuing, the reserve in silver coin and bullion being 3,177 lacs on Jan. 7 as against 3,347 lacs on Dec. 22. Shipments of silver to London for week ending Feb. 1 were 1,019,000 ounces.

Mexican dollars at New York: Jan. 30, $77\frac{1}{2}$; Jan. 31, $77\frac{1}{2}$; Feb. 1, $77\frac{1}{2}$; Feb. 3, $77\frac{1}{2}$; Feb. 4, $77\frac{1}{2}$; Feb. 5, $77\frac{1}{2}$.

Platinum—Easier. We quote refined ingot at $103.

Palladium—We quote $115@125.

The general stock of money in the United States on Jan. 1, 1919, totaled $7,780,793,606; of this $3,080,510,011 was in gold coin and bullion, $400,821,930 in standard silver dollars, and $241,263,989 in subsidiary silver. The money in circulation on Jan. 1 was $5,951,368,126, or $55.76 per capita. On Jan. 1, 1918, the per-capita circulation was $48.76.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 1—(From our Special Correspondent)—Zinc Ore (Joplin District)—A heavy demand by purchasers at the week-end stiffened the zinc ore market, and a large tonnage is reported sold at an advance of $1 per ton. Silicate, on the other hand, was cut $5 to $10 per ton, and the mines producing this kind of ore are preparing to close business.

Shipments

In Tons of 2000 lb.

Week ending Feb. 1	13,433
Previous week	11,825
Same week last year	8,987
Total this year	58,172
Total last year	41,410
Increase	16,762

Zinc Ore Prices, week ending Feb. 1, 1919 and 1918

	1919	1918
High-grade sulphide ore	$47.50	$69.10
Premium, basis 60% zinc	45.00	67.50
Other grades	42@38	60@50
Silicate, basis 40% zinc	30@25	33@30

Platteville, Wis., Feb. 1—Blende, basis 60% zinc, $46 base for premium grade; $40 base for high-lead blende. No sales of lead ore were reported.

Shipments reported for the week were 2142 tons blende, 75 tons galena, and no sulphur ore. For the year to date, the totals are 8004 tons blende and 410 tons galena. During the week 2920 tons blende was shipped to separating plants. A number of mines have closed, and others will soon follow as a result of low prices.

Other Ores and Minerals

Molybdenum Ore—Charles Hardy estimates the business done during January to have been well over 40 tons. For the moment buying has ceased and quotations vary. Some say 80@85c., others, 95c.@$1.

Tungsten Ore—No sales reported, and probably the ore is unsalable except at prices so low that they would be startling if indicated. The stock of tungsten ore actually in this country is very large, and arrivals from the Orient are continuing.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Ocean freight is now 25s.

Iron Trade Review

PITTSBURGH—Feb. 4

Demand for steel products, as well as pig iron, continues extremely light, and if producers had to depend upon current purchases for their operations they could scarcely run at all. To a large extent they are working on old orders, which will not last much longer; some, notably the subsidiaries of the U. S. Steel Corporation, are making up stocks. The Steel Corporation has large warehouses, which do practically a jobbing business, and can stock large tonnages of bars, shapes, and plates and in the case of tubular goods, wire, sheets, and tin plates the mills have a warehouse capacity as part of the equipment.

The Steel Corporation as a whole is operating at between 85 and 90% of capacity. Its pipe and tin-plate mills are running substantially full, though rail and structural mills stand at the other end of the list. Independents are operating at about 60% capacity.

There is no definite prospect that, when present orders are filled, buyers will place other orders, and the present outlook is that, until there is a definite and important revival in demand, there will be a continued decline in mill operations. This awaits the development of stable conditions and a liquidation in high costs all along the line. No matter what the price of steel may be, it costs altogether too much to put it into use.

The blast furnaces and steel mills appear to be fully capable of maintaining present prices. There is not enough business going to tempt sellers to cut prices. They consider it unlikely that there would be much buying for some time to come, no matter how far prices should drop; hence they prefer to maintain prices until the demand really arrives, and by doing so they can make a little profit in the interim. With light operations the cost of production per ton is increased.

Pig Iron—Transactions are confined to small lots, generally carloads, and even such sales are infrequent. Furnaces are holding strictly to the recognized quotations, but occasional resales are made at concessions. Deliveries on contracts are decreasing somewhat. With so much scrap resulting from the sudden discontinuance of war-steel production, the tendency will be to use more scrap and less pig iron in steel making. We quote the market steady but inactive at former quotations: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50, forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—There is no interest whatever in sheet bars, and but little in billets. An occasional inquiry for a small lot of regular soft steel in billet form shows that mills are holding strictly to prices, and we continue to quote: Billets, $43.50; sheet bars and small billets, $47; slabs, $46, rods, $57. Discard steel and shell steel in various forms are available at low prices.

Ferromanganese—Producers of ferromanganese have reduced their nominal asking price to $200, delivered, for 70%, but there is no demand at that figure or at anything approaching it. Imported 80% is understood to be available at about $165, either direct or resale. Spiegeleisen is nominal at $65, furnace, asked by producers for 16 per cent.

Coke

Coke—A week and more ago some coke operators having contracts with furnaces calling for negotiation as to price when Government control should come off arranged with their customers that February deliveries should be at a fixed price, such prices ranging from $5.50 down to $5.25 and possibly $5. Since then there have been offerings of small spot lots far below $5 and even down to $4 though the quality was doubtless below standard. As a rule, the larger operators are not offering coke, but are restricting production to the requirements of their contracts. Contract holders who will pay $5 to $5.50 for February deliveries will probably want March deliveries at below the market price then ruling, to equalize for high prices paid this month. There seems now to be a surplus of coke at furnaces, in transit, and on track in the Connellsville region.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	......	37.742	42.792	......
Mar.	73.861	88.082	......	36.410	43.620	......
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	......
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125	......	50.920	49.500	......
Oct.	87.332	101.125	......	44.324	49.500	......
Nov.	85.891	101.125		43.584	48.969	
Dec.	85.960	101.125		43.052	48.492	
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	......	110.000	......	125.000	......
Mar.	23.500	......	110.000		125.000	......
April	23.500	......	110.000		125.000	......
May	23.500	......	110.000		125.000	......
June	23.500		110.000		125.000	......
July	25.904		119.913		134.913	......
Aug.	26.000		122.000		137.000	......
Sept.	26.000		122.000		137.000	
Oct.	26.000		122.000		137.000	
Nov.	26.000		122.000		137.000	
Dec.	(a)		118.447		133.167	
Year	24.628		115.530		130.507	

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85.500	67.702	293.227	248.557
February	92.000		311.525	......
March	(a)		318.875	......
April	(a)		329.905	......
May	(a)		361.217	......
June	(a)		331.925	......
July	(a)		360.347	......
August	(a)		380.900	......
September	(a)		343.905	......
October	(a)		335.543	......
November	(a)		323.550	......
December	(a)		267.736	......
Av. year	88.750		330.138	

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973		6.899		29.00	
March	7.201		7.091		29.00	
April	6.772		6.701		29.00	
May	6.818		6.701		29.00	
June	7.611		7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814		7.639		54.000	
March	7.461		7.286		54.000	
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37.25	$33.60	$33.95	$31.40	33.95	$32.40
February	37.25		33.95		33.95	
March	37.25		33.95		33.95	
April	36.15		32.95		33.95	
May	36.20		33.00		34.00	
June	36.30		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		33.40		35.40	
November	36.60		33.40		35.40	
December	36.60		33.40		35.40	
Year	$36.67		$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Feb. 4
Alaska Gold M.	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	70
Am.Sm.&Ref., pf.	107
Am.Sm.Sec., pf., A.	91
Am. Zinc	11
Am. Zinc, pf.	39
Anaconda	58
Batopilas Min.	1
Bethlehem Steel	59
Butte & Superior	18
Butte Cop. & Zinc	6
Cerro de Pasco	31
Chile Cop.	18
Chino	33
Colo. Fuel & Iron	35
Crucible Steel	53
Crucible Steel, pf.	90
Dome Mines	10
Federal M. & S.	9
Federal M. & S., pf.	34
Great Nor., ore ctf.	38
Greene Cananea	43
Gulf States Steel	52
Homestake	97
Inspiration Con.	43
International Nickel	26
Kennecott	32
Lackawanna Steel	66
Mexican Petrol.	167
Miami Copper	22
Nat'l Lead, com.	68
National Lead, pf.	108
Nev. Consol.	17
Ontario Min.	7
Ray Con.	20
Republic I.&S.,com.	73
Republic I.&S., pf.	101
Sloss-Sheffield	49
Tennessee C. & C.	12
U. S. Steel, com.	90
U. S. Steel, pf.	114
Utah Copper	69
Va. Iron C. & C.	55

BOSTON CURB*	Feb. 4
Alaska Mines Corp.	‡ .12
Boston Ely	.92
Boston & Mont.	.47
Butte & Lon'n Dev.	.11
Calaveras	1
Chief Con.	3
Contact	.05
Corbin	‡ .25
Cortez	.13
Crown Reserve	.42
Crystal Cop.	.20
Eagle & Blue Bell	2
First Nat. Cop.	1
Houghton Copper	.30
Intermountain	‡ .05
Iron Blossom	.45
Iron Cap	14
Majestic	.19
Mexican Metals	.21
Mines of America	.25
Mojave Tungsten	.04
Nat. Zinc & Lead	.09
Nevada-Douglas	.17
New Baltic	.75
New Cornelia	‡16
Oneco	.20
Pacific Mines	‡ .35
Rex Cons.	.05
Yukon Gold	.70

SAN FRAN.*	Feb. 4
Alta	.02
Andes	.03
Best & Belcher	.02
Caledonia	.03
Challenge Con.	‡ .03
Confidence	.04
Con. Virginia	‡ .05
Gould & Curry	.02
Hale & Norcross	.11
Jacket-Cr. Pt.	.03
Mexican	.08
Occidental	.40
Ophir	.09
Overman	.01
Savage	.07
Sierra Nevada	.03
Union Con.	.08
Utah Con.	‡ .01
Belmont	3.50
Jim Butler	.39
MacNamara	.25
Midway	.27
Mont.-Tonopah	.15
North Star	.08
Rescue Eula	.09
West End Con.	1.20
Atlanta	.04
Booth	.13
Comb. Frac.	‡ .02
Florence	.12
Jumbo Extension	.12
Kewanas	.04
Nevada Hills	.03
Nevada Packard	.25
Round Mountain	.32
Silver Pick	.04
White Caps	.16

COLO. SPRINGS*	Feb. 4
Cresson Con.	4.87
Doctor Jack Pot	.04
Elkton Con.	.01
El Paso	.14
Gold Sovereign	‡ .02
Golden Cycle	‡ .74
Granite	.11
Isabella	.05
Mary McKinney	.07
Portland	1.00
United Gold M.	.14
Vindicator	.44

BOSTON EXCH.†	Feb. 4
Adventure	‡ .60
Ahmeek	70
Algomah	‡ .30
Allouez	‡43
Ariz. Com.	11
Arnold	‡ .20
Bingham Mines	‡9
Bonanza	‡ .10
Butte-Balaklava	.21
Calumet & Ariz.	59
Calumet & Hecla	426
Centennial	‡12
Copper Range	42
Daly West	‡2
Davis-Daly	5
East Butte	‡9
Franklin	‡3
Granby	‡79
Hancock	‡5
Hedley	‡12
Helvetia	‡ .20
Indiana	‡ .80
Isle Royale	25
Keweenaw	‡1
Lake	3
La Salle	2
Mason Valley	‡2
Mass	‡4
Mayflower	2
Michigan	3
Mohawk	51
New Arcadian	‡1
New Idria	8
North Butte	10
North Lake	.40
Ojibway	‡1
Old Dominion	34
Osceola	‡52
Quincy	57
St. Mary's M. L.	43
Santa Fe	‡ .25
Seneca	‡13
Shannon	2
Shattuck-Ariz.	‡14
So. Lake	‡1
So. Utah	‡ .10
Superior	‡5
Superior & Bost.	2
Trinity	2
Tuolumne	‡ .82
U. S. Smelting	‡45
U. S. Smelting, pf.	45
Utah Apex	2
Utah Con.	‡8
Utah Metal	1
Victoria	‡2
Winona	‡ .90
Wolverine	18
Wyandot	‡ .50

N. Y. CURB†	Feb. 4
Big Ledge	.75
Butte & N. Y.	‡
Butte Detroit	‡ .01
Caledonia	.28
Calumet & Jerome	
Can. Cop. Corpn.	2
Carlisle	‡2
Cashboy	.08
Con. Ariz. Sm.	1
Con. Coppermines	5
Goldfield Con.	.19
Goldfield Merger	.05
Greenmonster	
Hecla Min.	4
Howe Sound	‡3
Jerome Verde	‡ .50
Louisiana	‡
Magma	25
Marsh	.03
McKinley-Dar-Sa.	‡ .47
Milford	‡ .75
Mother Lode	.30
Nixon Nevada	‡ .41
Ohio Cop.	‡
Rawley	‡2
Ray Hercules	2
Richmond	‡ .56
Rochester Mines	.26
St. Joseph Lead	‡12
Standard S. L.	.25
Stewart	.16
Success	‡ .11
Tonopah	‡3
Tonopah Ex.	2
Tribullion	‡
Troy Arizona	‡ .10
United Eastern	‡4
United Verde Ext.	‡35
United Zinc	‡
Utica Mines	‡ .08

TORONTO*	Feb. 4
Adanac	.20
Bailey	.03
Beaver Con.	.40
Chambers Ferland	.09
Coniagas	2.00
Hargraves	.03
Kerr Lake	‡5.37
La Rose	.31
Lake Shore	.90
Min. Corp. of Can.	2.00
Nipissing	‡8.75
Peterson Lake	.08
Temiskaming	.35
Wettlaufer-Lor.	.03
Davidson	‡ .60
Dome Exten.	.20
Dome Lake	.19
Hollinger	6.12
McIntyre	1.62
Newray	.12
Porcu. Crown	.28
Teck-Hughes	.25
Vipond	.20
West Dome	.13

* Bid prices. † Closing prices. ‡ Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10 ...	3 90	5 04	5.17	6 55	5 17	5 44½
No. 12 ...	3 95	5 09	5 22	6 60	5 22	5 49½
No. 14	4 00	5 14	5 27	6 70	5 27	5 54½
Black						
Nos. 18 and 20.	4 50	5 84	6 02	7 30	6 02	6 24½
Nos. 22 and 24	4 55	5 89	6 07	7 35	6 07	6 29½
No. 26 ...	4 60	5 94	6.12	7 40	6 12	6 43½
No. 28. .	4 70	6 64	6 22	7 50	6 22	6 53½
Galvanized:						
No. 10 ...	5 05	6 39	6 57		6 57	6 69½
No. 12 ...	5 15	6.39	6 62	7 85	6 62	6.79½
No. 14 ...	5 15	6 39	6.67	8 00	6 67	6 79½
Nos. 18 and 20..	5 45	6 59	6 97	8 15	6 97	7 09½
Nos. 22 and 24....	5 60	6 44	7 02	8 30	7 02	7 24½
No. 26	5 75	6.74	7 17	8 45	7 17	7 39½
No. 28 ...	6 05	6 19	7.57	8 75	7 57	7 69½

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails..	$55.00	$38 00	$65.00	$38 00
Standard openhearth rails...	57.00	40 00	67 00	40 00
Light rails, 8 to 10 lb..	3 13½	83 00	3.13½	68 00
Light rails, 12 to 14 lb...	3.09	82 00	3.09	67 00
Light rails, 25 to 45 lb...	3.00	75 00	3.00	65 00

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger.	$3 70	$5 00	$4 50	$5.04	$6.15
Track bolts	4.90	6 25	5 50	Premium	7 50
Standard section angle bars....	....	3.65	4 45	Premium	5 15

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$2 80	$4 07	$4.19½	$4 14	$4.07	$5 25	$7 00
Channels, 3 to 15 in.	2 80	4 07	4 19½	4 14	4.07	5 25	7 00
Angles, 3 to 6 in. ¼ in. thick........	2 80	4 07	4 19½	4 14	4 07	5 25	7 00
Tees, 3 in. and larger..	2 80	4 12	4.19½	4 14	4 07	5 25	7.00
Plates	3.00	4 27	4.44½	4 14	4 27	5 50	7 10

STEEL SHEET PILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4-5	$4-5	$4 50

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
¾-in. and larger	$4 40	$6.50	$7 00	$5 57	$4 74	$6 70	$7 00
CONE HEAD BOILER							
¾ in. and larger.	4 50	6 60	7 10	5 67	4 84	8 80	7 10
⅝ and 11/16..............	4 65	6 75	7 25	5 82	4 99	6 95	7 25
½ and 9/16......	5 00	7 10	7 60	6 17	5 24	7.30	7 60

Lengths shorter than 1 in. take an extra of 50c.. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows

	New York and St. Louis
Galvanized iron rigging	+17½%
Galvanized cast steel rigging.........	2½%
Bright plow steel	30%
Bright cast steel..	17½%
Bright iron and iron tiller	List

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight.....	$6 25	$7 25	$6 50	$6 25	$8 00	$7 25
Assorted ..	6 40	7 75	6 50	6 40	8 25	7 50

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh

Iron bars	3.5c.	Steel bars	2.90c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0 16½	$0 18	$0 19	$0 18½	0 16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	16c.	14c.	15c.	16c.
Hollow......	24c.	25c.	. .	28c.

STEEL AND IRON PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Jan. 1 for steel pipe and iron pipe:

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
BUTT WELD					
¾ to 3........	54	40½	¾ to 1½......	36	20
LAP WELD					
2...........	47	34½	1¼.	21	6
2½ to 6.......	50	37½	1½..........	28	14
7 to 12.......	47	33½	2	29	15
13 and 14.....	37½	..	2½ to 6.......	31	18
15...........	35	..	7 to 12.......	28	15
BUTT WELD, EXTRA STRONG PLAIN ENDS					
¾ to 1½.......	52	39½	¾ to 1½.......	36	21
2 to 3........	53	40½			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45	33½	1¼.	22	7
2½ to 4.......	48	36½	1½.	28	14
4½ to 6.......	47	35½	2.. ...	30	17
7 to 8........	43	29½	2½ to 4	32	20
9 to 12	38	24½	4½ to 6.......	31	19
			7 to 8. . .	23	11
			9 to 12.......	18	6

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	43%	43%	44 9%
3½ to 6 in. lap welded	38%	39%	40 9%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	27%	26%	29 9%
3½ to 6 in. lap welded........	23%	23%	26 9%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 5%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square ...	$0 80	$1 00	$1.25	$1 40	$0 98	$1 05
Hot pressed hexagon...	80	1.00	1.05	1.20	.78	85
Cold punched square...	2 50*	1.00	.75	.75	1 00	1 50
Cold punched hexagon.	2.50*	1.00	.75	.75	1.00	1.50

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50-10%	40%
Chicago	50%	60%
Cleveland	50-10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	40-10%	40-10%	40%
Larger and longer up to 1 in. by 30 in...	20-5%	20-5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York...... $2 00 Cleveland....... $1.50 Chicago ... $1 75

For cast-iron washers the base price per 100 lb. is as follows:

New York........ $6.00 Cleveland....... $4 25 Chicago $4.50

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.).	$64 00	$57.00	$65.00	$58 00
Tar pitch (in 400-lb. bbl.).............	21 00	18 00	22 00	19 00
Asphalt pitch (in barrels)..............	36 00	36.00	41 50	41 50
Asphalt felt........................	67.50	67.50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade............	$1.35	$1.60	$1.70	$1 95	$2 05	$2 30
No. 2 grade..........	1 20	1 45	1.50	1.75	1 80	2 05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.10 per roll in carload lots and $2.35 for smaller quantities.

Shingles, red and green slate finish, cost $5.50 per square in carloads, $5.75 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$ 056	$0 11	$0 162
Cincinnati	.086	.165	.218
Seattle	09	.175	30
Los Angeles*	.079	144	.181
New Orleans	14	20	29

* F.o.b. factory, 4, 8 and 10 inch.

LUMBER—Price per M in carload lots:

	8 x 8-In x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Y. P.	Fir	Hemlock	Spruce	Y.P	Fir
Cincinnati	$42 00	.....	$38 00	$41 00	$37.00	$39 00
Kansas City	39 00	40 50	$40.50	38.50	45 50	42 50
Seattle	19 50	19 50	29.50	19.50	19 50	19.50
New Orleans	45.00	...	.....	.....	50.00	.....
St. Paul		52 00	48 00	48.00	.	48 50
Denver	43 00	33.50	.	...	48.00	39.00
Los Angeles	*	*	*	*	*	*

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and G. 10 In. x 16 Ft.	
	Y.P.	Fir	Hemlock	Y P.	Fir
Cincinnati	.	$35 00	....	$40 00	$39 00
Kansas City	$46 00	54 75	$54 75	53 50	60 00
Seattle	19 50	19 50	19 50	19 50	19 50
New Orleans	52 00	...	....	60.00	...
St. Paul	62 50	48 00	43 00	......	48.50
Denver	43 25	32 50	32 50	35.00	31.00
Los Angeles	39 00	33.00	34.00	*	*

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 50	$4 37	$4.75	$4 32	$5 35
Cut	4 00	6 50	....	6.50	6.75

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Current	One Month Ago	One Year Ago
New York	$3 45	$4 00	$2 22
Jersey City	3 62	3 62	2 16
Boston	3 67	3 67	2 37
Chicago	3 05	3 05	2 21
Pittsburgh	3 15	3 15	2.31
Cleveland	3.32	3 32	2.44
Denver	3.67	3 67	3.20

Note—Bag refund is generally 25c. each; exceptions being, Cincinnati, 9c Dallas, 10c.; San Francisco, 15c.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17 50	$14 50	$2.90	$2 65
Chicago	18 00	17.50	1.80*	1 10*
St. Louis	22 00	16.00	. .	1 75*
Boston	22 20	18 20	3 65	3 35
Dallas	16.50	...	.....	2.50
San Francisco	20 00	.	...	2.40
St. Paul	25 00	19 00	1.97*	1 93*
New Orleans	19.74	16.45	19.47‡	19.27‡
Cincinnati	14 20	11.95	.....	..
Denver	.....	26.25‡	.....	2.50*
Los Angeles	...	......	3.00	2.30†

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton.

Note—Refund of 10c. per barrel.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1 49	$1 28	$1 90	$1 30	$1.66	$1 26
5-gal. cans	1 74	1 38	2 00	1.40	1.86	1.35

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13 00	14 50	12 25	12 50	13 00	12 50
25- and 50-lb. kegs	13 25	14 75	12 50	12 75	13.25	12 75
12½-lb. keg	13 50	15 00	12 75	13 00	13 50	13 00
5-lb. cans		....	14 25	14 00	15 00	14 50
1-lb. cans	..	....	14 25	14 50	16 00	14.50

MINING AND MILLING SUPPLIES

HOSE—

Fire

	50-Ft. Lengths
Underwriters' 2½-in	80c. per ft.
Common, 2½-in	30%

Air

	First Grade	Second Grade	Third Grade
¾-in per ft	$0 55	$0 40	$0 30

Steam—Discounts from List

First grade 25% Second grade......35% Third grade. . 40%

LEATHER BELTING—Present discounts from list in the following cities are as follows

	Medium Grade	Heavy Grade
New York	40-5%	35%
St. Louis	45%	50%
Chicago	45%	40+5%
Birmingham	30%	35%
Denver	35-5%	30%
Cincinnati	40—10%	40%

RAWHIDE LACING—50c. for cut; 45c. per sq.ft. for ordinary.

MANILA ROPE—For rope smaller than ¾-in the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft there is an extra charge of 1c The number of feet per pound for the various sizes is as follows ¾-in., 8 ft, ⅜-in, 6, ½-in, 4½ 1-in, 3½ 1½-in, 2 ft 10 in 1½-in, 2 ft 4 in Following is price per pound for ¾ in and larger, in 1200-ft coils

Boston	$0 24	Denver	$0 22
New York	23	Kansas City	23½
Cincinnati	24	New Orleans	22½
Chicago	21½	Los Angeles	25
St Paul	23	Seattle	24
San Francisco	22	St Louis	21½

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1 60
Duck and rubber for piston packing	1 00
Flax, regular	1 20
Flax, waterproofed	1.60
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.20
Rubber sheet	.60
Rubber sheet, wire insertion	.80
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.20
Asbestos wick, ½- and 1-lb. balls	.85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120.00	at Chester, Penn.
Chrome cement	net ton	65 00	at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30	at Clearfield, Penn.
Clay brick, 2nd quality	net ton	38–48	at Clearfield, Penn.
Magnesite, dead burned	net ton	37 50	at Chewalah, Penn.
Magnesite brick, 9 x 4½ x 2½ in	net ton	90 00	at Chester, Penn.
Silica brick	net ton	45–55	at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.

Birmingham—Fire clay, $40–$45; silica, $40–$50; magnesite, $90; chrome, $120.

Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1.48	1 33
San Francisco	Douglas Fir—Green	1.35	96
San Francisco	Douglas Fir—Creosoted	2 70	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.70	No. 1	$0 55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	.75
No. 4	.98		
7x9x8 white oak			1 05
7x9x8 red oak, No. 4	.80	No. 5	87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago In Bbl.	Chicago Carloads	Denver In Bbl. Lots
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0.58	$0.72	$0.67 [illegible]	$0.81
Pure destructively distilled pine oil	.58	.64	.61½	.55–.65
Pine tar oil, sp. gr. 1.02 = 1.035	.35	.56	.51½	.60
Crude turpentine	.45	.70	.65	.60–.65
*Hardwood creosote, sp. gr. 0.96-0.99	.23	.62	.59	.42–.45

* F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11.00 to 13.00	13 00	16 50	12 00 to 16 50
Colored mixed	8.50 to 12 00	10 00	13 00	11 50 to 14 00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58 00
Chicago	48 00	50 00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing	Gelatin			Black
	20%	40%	60%	80%	Powder
New York		$0 29½	$0 34½		$2 40
Boston	$0 23½	.26½	.31½	$0 35½	2 65
Cincinnati	.18½	22½	26½		2 35
Kansas City	.20½	25½	.30½	.38½	2 45
New Orleans	.20½	.24½	.28½		2 60
Seattle		25½	32½		
Chicago	18½	.22½	.30	.36	2 35
St. Paul	.19	.24½	.30½		2 45
St. Louis	19	.25½	.30½	.36½	...
Denver	12½	.24	.29	.35	2 45
Dallas	21	.25	.29	.39	
Los Angeles	23	.29	.37	....	2 95

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb.; Denver, 42c; Chicago, 31½c.; St. Louis, 31c

SODIUM SULPHIDE—In New York the price per pound is 8½c. for concentrated, 4½c. for crystals The St Louis price is 10c. for concentrated, 20c. for fused; the Chicago price is 6c. for concentrated, 4½c. for crystals. Concentrated comes in 500-lb. drums, the crystals in 440-lb bbls

ZINC DUST—For 350 mesh the New York price is 14c. per lb, Chicago, 15½c, Denver, 13½c f o b Pueblo; St Louis, 13c

ALUMINUM DUST—Chicago price is $1.30 per lb

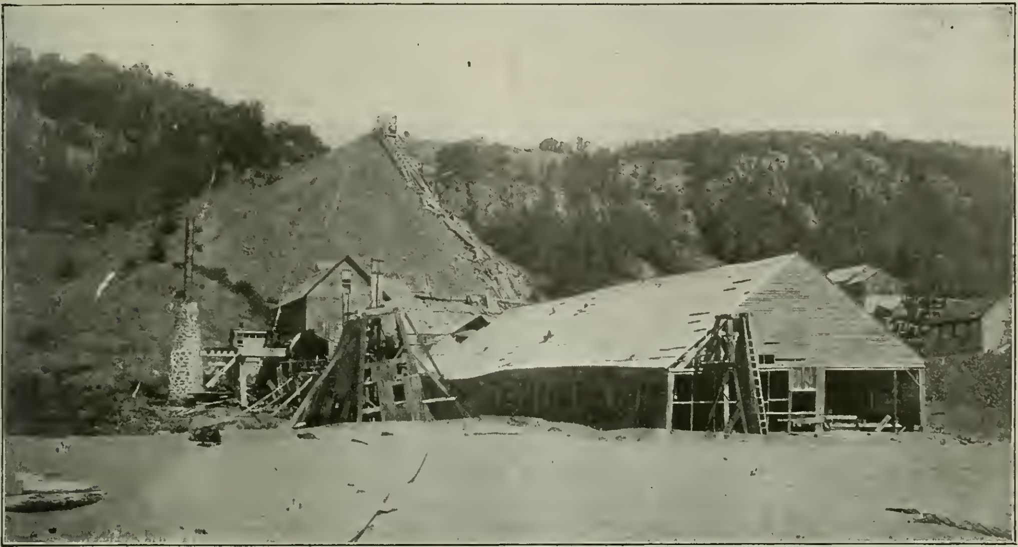
MINERS' LAMP CARBIDE—Prices net f o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drum Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101.00	$1 52
Southeastern portion U. S. A	115 50	110 50	1 63
Texas (except El Paso)	124 00	119 00	1 74
El Paso, Texas	126 00	121 00	1 27
Denver, Colo	124 00	119 00	1 74
West Coast	129 00	124 00	1 81

Engineering and Mining Journal

February 15, 1919

Volume 107 *No* 7



THE CLIFF MINE IN 1905, THE GREENSTONE IN THE BACKGROUND SHOWING THE CROSS-BREAK

The Porphyry Intrusions of the Michigan Copper District

BY THOMAS S. WOODS*

The genetic relationship of the porphyries of the Southwest has been fairly well established, and in the following generalized account of the relation of the fine-grained volcanics to the mineralization of the Michigan copper-bearing formations the author presents arguments to prove that the porphyry intrusions have considerable influence on the Lake Superior copper deposits. Undoubtedly more importance ought to be attached to the presence of porphyry areas in the Michigan copper district, and though it is possible that many geologists may challenge the opinions expressed, it is desirable that an inspiration to further enlightening discussion of the subject be created.

NO ONE with even a limited knowledge of geology and mining practice can study A. C. Spencer's "Professional Paper 96"[1] on porphyry in general, and the Ely district of Nevada in particular, and then make visits underground and on surface with well-known engineers in the Jerome, Globe, Ely, Tintic, and Bingham camps of the Southwest, without being convinced that too little attention has been given to the felsite-porphyry intrusions of the Michigan copper range as possible sources of enrichment.

The terraced porphyry mountain of low-grade ore developed on an enormous scale by the Utah Copper Co. is especially an object lesson. In the Jerome district a similar mountain of richer ore, now mined through shafts by the United Verde Co., is soon to be stripped of overburden and worked by steam shovels after the manner of the Utah mine. In all the Southwestern mining camps mentioned, the richest deposits are found, as a rule, at considerable depths in highly altered limestones and schists, near porphyry contacts. The general opinion of Western mining men is that enriched areas were altered and mineralized by hot solutions and vapors, under pressure, that rose with or after the uprushes of porphyry, circulated through fissures and later leached downward. It is generally agreed that the porphyry masses which are present below the surface are more extensive than those that appear in the scattered outcrops.

---

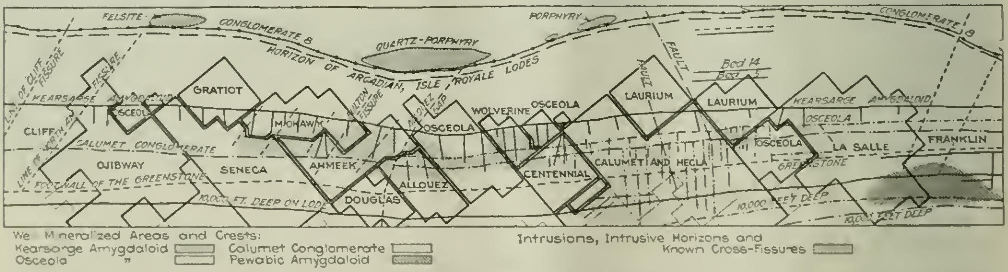
*President, Winona Copper Co., 60 Congress St., Boston, Mass.

[1] U. S. Geological Survey, 1917.

It is interesting to note that, in Michigan, diamond drilling at the Mayflower mine showed a rich deposit of copper at an average depth of more than 1000 ft., in a thick belt near an unexplored outcrop of quartz-porphyry, now much eroded and leached, east of the Kearsarge lode in Sections 4, 8, and 9.

RELATION OF PORPHYRY AND OTHER INTRUSIONS TO ORE-BEARING LODES

In the Lake Superior copper district there are at least two, and probably three, horizons of porphyry or other intrusions, many of which are dikes and sills showing slight mineralization. One of these horizons follows Conglomerate 8 for a hundred miles from the region of Lake Gogebic northeastward to Keweenaw Point, with infrequent outcrops of felsite-porphyry, mostly on the eastern side of the conglomerate. Foster and Whitney in 1850 observed that the fissile chlorite rock occurring at the base of Mount Bohemia continued almost uninterruptedly to Portage Lake, always preserving the same relation to the trap and sandstone. A second horizon, approximately two miles further west, running parallel to the first, includes the Chippewa felsite (between the Porcupine Mountains and Winona) and straddles the greenstone north of Portage Lake. A third porphyry horizon, within the outer conglomerate, is indicated by disseminated native copper with sulphides occurring under the Nonesuch shales in the region of the White Pine mine. About 1850 some development work was done on this zone a few miles west of the Ontonagon River. The same belt has recently been explored by drills north of Portage Lake.



MAP SHOWING THE GREENSTONE FOOT WALL, KEARSARGE LODE, CONGLOMERATE 8, INTRUSIONS, FISSURES AND THE PRINCIPAL MINERAL CRESTS

KEARSARGE LODE CROSSED BY MINERALIZED FISSURES

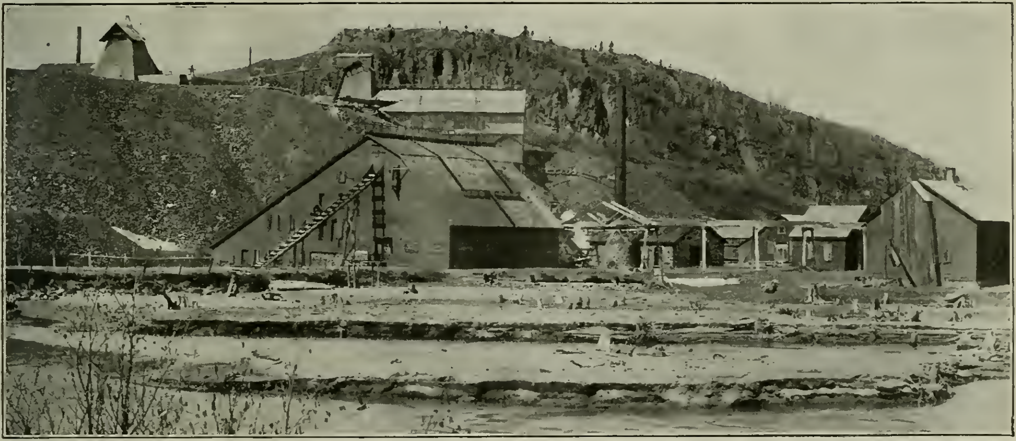
Ahmeek, with copper at the grass-roots, mines the richest mineral crest on the Kearsarge lode, which is here crossed by a series of mineralized fissures, one of them known to extend south-southeast from the greenstone almost to the above-mentioned outcrop of quartz-porphyry in Sections 4, 8, and 9. These cross-veins, in the lower levels of the mine, show a tendency to narrow and to cause less disturbance. Allouez Gap and Hill Creek mark other probable channels for the passage of copper-bearing solutions and vapors that had their sources in common with the intrusions on either hand, although excessive shattering tended to produce leached conditions, especially along the Gap, at least to considerable depths. All the important cross-fissures from Cliff to Allouez are marked by streams, and several of them have been found to be rich in copper near the point of contact with the greenstone foot wall. Foster and Whitney asserted that no permanently productive cross-vein had been discovered on Keweenaw Point which varied 15° from a north-northwest course.

MINERALIZATION INDICATED BY CROSS-FISSURES

The upper valley of Hill Creek indicates a diagonal break in the formation intersecting several of the mineralized cross-fissures, one of which cuts Mohawk No. 1 shaft, where a rich pocket of ore was found in a lean section of the lode near the point of intersection. The same combination of fractures, in better ground, occurs near the new Seneca shaft, again north of Ahmeek No. 2, and should be found at greater depth under Ahmeek No. 3 and No. 4. The parallel cross-fissures mark the direction of the so-called "north shoots" of copper; diagonal fissures, the less common "south shoots." United Verde Extension and Gadsden, in the Jerome camp, show a like system of faulting, which, in mineralized areas, offers favorable opportunities for enrichment. The Wolverine-South Kearsarge mineral crest implies an uncharted porphyry in Sections 17, 19, and 20. On Section 17, in the Old Colony tunnel, "a much decomposed poikilitic rock with decomposed feldspar in abundance, breaking into angular fragments," and "a much brecciated . . reddish felsitic-looking rock" indicate such an intrusion so altered as to make identification difficult. In the southeast quarter of Section 19, near the junction of the trap and sandstone, the old New York & Michigan Co. explored a red and green chlorite rock, fissile but not stratified, enveloping masses of amygdaloid, with native copper occurring in the small veins and also in the adjoining fissures.

The course of Conglomerate 8 does not run parallel to that of the Kearsarge. Apparently the quartz-porphyry in Section 4 pushed this bed to the west, though further south other important intrusions (that make the geology of the Torch Lake property so puzzling) crowded it to the eastward. Here there are possibilities of a double fold like that at South Lake in the neighborhood of other extensive intrusions. In Section 16 (New Baltic) the conglomerate is again bent to the west, as in Section 4.

The augite-porphyrite sills and unexplored quartz-porphyries of Torch Lake lie southeast of the great Calumet & Hecla mine on the Calumet conglomerate lode, which has not yet been found to be well mineralized at any other point. The copper ground on the conglomerate near the surface consists of two irregular crests, uniting 2500 ft. below the outcrop, and lengthening northward and southward at greater depths. A diagonal fault striking nearly west intersects each crest. The Douglas Creek valley, through which passes the electric railroad and the highway, extends from the northern crest southeastward across the intrusions, in a direction parallel to that of the cross-fissure system occurring further north in Ahmeek and Mohawk ground. It is likely that this valley marks an important cross-fissure, through which the northern crest of the conglomerate mine was enriched. The lengthening of the deposit at depth may have been due partly to contributions from the greenstone horizon of intrusions and partly to leaching. Between the southern crest of the conglomerate mine and the porphyry outcrops are Osceola shafts Nos. 1, 2, 3, and 4 on the Osceola lode (where rich ground was opened), and three unidentified amygdaloids, further to the southeast, which were shown by shallow drills to carry good copper ore in Torch Lake territory, but none in La Salle ground. Although surface indications are lacking, it is possible that there is another parallel fissure here. The absence of mineralization in the Laurium shaft on the Kearsarge lode at this point, for which various explanations may be offered, is admittedly a flaw in the argument.



PHOENIX MINE, SHOWING THE PHOENIX FISSURE AND EAGLE RIVER FOLLOWING A BREAK IN THE GREENSTONE FROM SOUTHEAST TO NORTHWEST

Previous to 1850, the old Trap Rock Co., exploring in Section 8, just west of the Mayflower intrusion, found disseminated copper in a fine-grained porphyrite similar to Bed 59 of the Torch Lake section, which is near the quartz-porphyry outcrop and has many characteristics of a sill. The beds are in the same horizon, ranging and dipping with the formation. In 1914 a like bed was cut by a drill on Tamarack ground east of the Seneca in Section 20, just southeast of a much-disturbed and altered area. The line of the famous Cliff Fissure, extended south-southeast, intersects both of these points.

In Section 16, southeast of the rich discovery drill holes of the New Arcadian and of Franklin Junior on the Isle Royale-Arcadian lodes in the adjoining Section 9, explorations conducted about eight years ago by the New Baltic company proved a much-faulted and broken formation, with scattered bunches of rich copper ore. Conglomerate 8 is itself mineralized at this point. The maps of the Michigan Geological Survey show a fault running north-northwest (in a direction parallel to that of the known cross-fissure system at Ahmeek and Mohawk) from the northeastern corner of Section 16 through eastern Franklin into southwestern La Salle; also a shorter parallel cross-fault further to the southwest.

The evidence of mineralization in Sections 9 and 16, and the recent discovery of fair copper rock on the Pewabic lode in the Rhode Island section of Franklin, strongly indicate a porphyry intrusion in Sections 15 and 16 which has mineralized a belt of ground following the above-mentioned fault-fissure. The occurrence of a narrow seam of Mohawkite 110 ft. above the first branch of the Kearsarge in Rhode Island drill-hole No. 4, in Section 4, on the line of the fissure, also points to conditions similar to those found at Ahmeek and Mohawk opposite the intrusion. Further development on the Pewabic, Calumet conglomerate, Osceola and Kearsarge lodes north of the 32d-level crosscut at Franklin will prove or disprove the theory as to the existence of commercially profitable deposits at this point in one or more of these well-known beds.

In the Ontonagon district, North Lake, situated between important intrusions of felsite-porphyry on either side of the mineral belt, with the deep valleys of the two Fire Steels cutting across the formation, geologically considered, is a promising property. Near the porphyry contact in the eighth-level crosscut to the southeast, entirely in accordance with a geologist's forecast, disseminated copper has been found in rock assaying up to 3½%, or 70 lb. per ton.

Two known cross-faults and Penn Creek indicate that the Cherokee property may be worth exploring. At the King Philip mine, now a part of Winona, the sand-filled valleys of the Sleeping River and its tributaries give such evidence of cross-fissuring as to warrant further development work at depth. The cross-valley of the Misery River holds some prospect of success for Wyandot.

At Contact the streams follow the formation and offer little encouragement. Between Contact and Champion much of the copper belt is covered with a heavy overburden that makes surface indications of little significance. The unusual richness of the rock, together with the occurrence of sulphides and magnetite at the Champion mine, indicates important porphyry intrusions near at hand, perhaps in the much-shattered Globe tract, further south.

It is reasonable to conclude that in early geological ages, before continental ice-sheets moved from Keweenaw Bay westward across the Portage Lake region, the porphyry intrusions along Conglomerate 8' formed a broken range of irregular hills, three of which, Mount Bohemia, Mount Houghton, and Bare Hill, have escaped erosion.

The hard, crystalline greenstone still towers above the other beds along the upper range, giving evidence of a violent volcanic uplift. When the few mineral crests that rise to the outcrops of the master lodes (and coincidently a small number of cross-fissures) were enriched, it is likely that contributing intrusions on the eastern side of the belt stood also above the intervening beds into which the copper-bearing solutions penetrated from two higher sources.

Various theories have been offered to explain the occurrence of native copper with rare sulphides in the Michigan district, in place of the oxides and rich sulphides of the southwest. The difference seems to be one of chemistry; for the fundamental laws of nature, regulating the deposition of minerals, unlike those established by man for the benefit of lawyers, covering questions of apex, are the same in all states.

Future of Cloncurry Field Uncertain

Melbourne Correspondence

The three principal companies operating on the Cloncurry field, in North Queensland, during 1918 produced approximately £1,250,000 worth of copper, but, notwithstanding this, the future of the district appears to be somewhat uncertain, owing to several causes. First, the distance from the coast, necessitating heavy transport charges; second, the gradual depletion of the richer orebodies; and third, the attitude of the labor unions.

In the course of a serial article in *Chemical Engineering and Mining Review*, S. Harris, of the Mount Cuthbert company, states that there are millions of tons of ore averaging 3 to 5% copper and only awaiting evolution of a scheme for treatment on a large scale. Under present conditions these ores cannot be treated profitably, but he believes that a scheme for handling them must be evolved, if the industry is to be established on permanent lines. To bring this scheme to full fruition, a metallurgical plant would be necessary, according to Mr. Harris. Preferably, but not necessarily, this should be erected in a central situation and be capable of dealing with the classes of ore existing on the field either as separate entities or in combination, to obtain the most profitable results. On the Cloncurry field, Mr. Harris says, every class of ore, from the highly basic to the highly acidic, is found, the latter predominating. Both the oxidized and the primary or sulphide zones are represented. Some of these ores are amenable to direct smelting; others, it is claimed, would require preliminary concentration by wet gravity methods and flotation; and yet another class would be best treated by a leaching process.

Foreign Trade in Lead and Zinc

Imports and exports of lead and zinc, as reported by the Department of Commerce for November, 1918, and the figures for November, 1917, as finally revised, are as follows:

IMPORTS	November, 1917 Pounds	November, 19 Pounds
Lead		
Ore, metal contents	2,616,067	1,596,136
Bullion, metal contents	15,870,741	10,602,379
Imported from (in part)		
Canada	610,969	210,527
Mexico	15,986,204	10,939,890
Pigs, bars and old	3,150,251	1,200
Zinc.		
Ore, metal contents	5,272,904	2,199,426
Imported from		
Canada	496,000	381,591
Mexico	4,776,904	1,817,835
Blocks or pigs, and old	34,878	306
EXPORTS		
Lead:		
Pigs, bars, etc., produced from domestic ore	14,688,767	8,806,100
Pigs, bars, etc., produced from foreign ore	2,128,313	7,567,081
Exported to (in part):		
Denmark		111,997
Canada	182,012	39
United Kingdom	8,800,952	15,521,243
Argentina	111,922	224,000
Japan	560,027	66,000
Brazil	134,651	184,532
Italy	1,624,773	224,000
Zinc		
Dross	3,243,606	2,402,987
Spelter:		
Produced from domestic ore	13,560,834	12,601,780
Produced from foreign ore	2,495,615	2,560,953
Exported to (in part):		
France	2,082,765	1,568,000
Italy	862,084	1,899,612
United Kingdom	12,616,236	7,586,519
Canada	489,195	1,670,377
Mexico	121	300
Japan		1,910,082
In sheets, strips, etc	2,492,353	2,354,823

Paper Driving Belts

Some particulars of the paper driving belts which are now being introduced into German workshops are given in the *Bulletin des Usines de Guerre*, a translation of which appears in the *Compressed Air Magazine*. The paper is cut into narrow bands, which are then spun. The belts are made by weaving or braiding. Woven paper belts are of two kinds—paper fabric and paper thread belts, the former being the more frequently used. The fabric is first cut into bands 40 m. long, which are subsequently made up according to the desired width and thickness. A core of strengthening material is interposed, either cotton or sheet metal, though more recently these cores have consisted of paper thread and metal wires interwoven. The core is surrounded with the paper strips and the whole sewn with strong thread. Belts so prepared are said to be very flexible and to wear satisfactorily. Woven paper belts have a tensile strength of from 100 to 125 kg. per centimeter of width.

The Source of Placer Platinum in the Tulameen District of British Columbia

By R. M. MACAULAY*

Sufficient information has not yet been gathered to prove that the platinum deposits of the Tulameen district of British Columbia can be economically worked. The deposits are large as to extent, but considerable capital would be required to exploit them. The origin of the platinum-bearing rock is found in peridotite and pyroxenite dikes, intruded through the so-called Tulameen group and subjected to some replacement.

FOR several years the demand for platinum has increased more rapidly than production of that metal, with the result that the price has risen steadily. In 1917 the world's production of new platinum was only 83,000 oz., whereas in June, 1918, the United States Government estimated its requirements alone at 69,000 oz. Except for the smaller amounts of platinum obtained as a secondary product from the reduction of other ores, the world's output comes from placers, those of Russia being the large producers.

Exploitation of Platinum-Bearing Ore Has Not Followed Its Discovery

For years the source of the placers has been a subject of study and investigation, and the mother rock has been identified and traced, but no attempt has been made to mine or to work out a system of treatment for the ore, or even to test the rock to ascertain its actual value per ton. The high price of platinum and its recent shortage before the armistice encouraged attempts to mine the platinum-bearing strata which are the sources of the platinum in the placers. Canadian engineers drilled the upper benches of the Tulameen placer beds with the hope of locating pay sands that would give increased production. The district at one time was the chief producer of platinum in America, and it is estimated that 20,000 oz. has been recovered from its gravels since 1885.

Situation of the Tulameen District

The Tulameen district is situated in the southwestern part of British Columbia, forms a part of the Similkameen mining division and consists of about nine square miles, extending from Tulameen Station, on the Kettle Valley R.R., nine miles to the west and two miles north of the Tulameen River and seven miles south of it. Physiographically, it is situated at the eastern flank of the Hope Mountains, and to the north and east lies the interior plateau region of southern and central British Columbia. The platinum placers of the Tulameen River and its tributaries, also Olivine, Lodestone and Grasshopper mountains, on which the platinum-bearing rocks, peridotite and pyroxenite, outcrop, are included in this area.

The first explorers were undoubtedly the fur traders and voyageurs of the Hudson's Bay Company, who entered the country by the Okanogan and Columbia River route, which was then the main outlet for the southern interior. Soon after the 49th parallel was fixed as the international boundary, the Hudson's Bay Company opened several trails through the Hope Mountains, and one of these led through Lodestone Mountain and Tulameen Village; but little was known of the district before 1885. Placer gold is supposed to have been discovered about 1852 in the interior of British Columbia, and in 1858 some of the miners coming in from California went to the discoveries on the Fraser River, and a few proceeded up the Similkameen River and worked bars on the lower part of that stream. In 1860 placer gold was found near the mouth of the Tulameen River. The following year the British government built the Dewdney trail across the Hope Mountains into the Similkameen district.

The Tulameen district and the surrounding region were found to be good ranching country, and it was a cowboy who, while ranging horses in the Tulameen Valley in the autumn of 1885, discovered a nugget of gold in the bed of Granite Creek near the Tulameen River. This discovery was followed by a rush of miners and prospectors to Granite Creek and Tulameen, six miles up the river, the following spring, and the river bed was staked from below Granite Creek to several miles above Tulameen. The platinum which was panned with the gold had little value at that time, and was usually dumped back into the stream.

About the year 1898 some prospectors, searching for the original source of the metals found in the placers, discovered high-grade gold-quartz veins, but these were not workable. In 1900 Dr. J. F. Kemp made an examination of the belt of peridotite and pyroxenite which stretches across Lodestone, Olivine and Grasshopper mountains, and reported the rocks to be the source of the platinum. The outcrops have been prospected several times, but the claims were soon dropped.

The best part of the gold placers on Granite Creek and Tulameen River was worked out in the three years following the discovery, but the upper benches were worked by rockers and sluice boxes in a small way for the next 10 or 15 years. The platinum placers produced from 2000 to 2500 oz. a year until 1892, after which it became hard to make wages, and little work was done until the high price of the metal brought a few miners back.

District Is a Part of the Interior Plateau Region

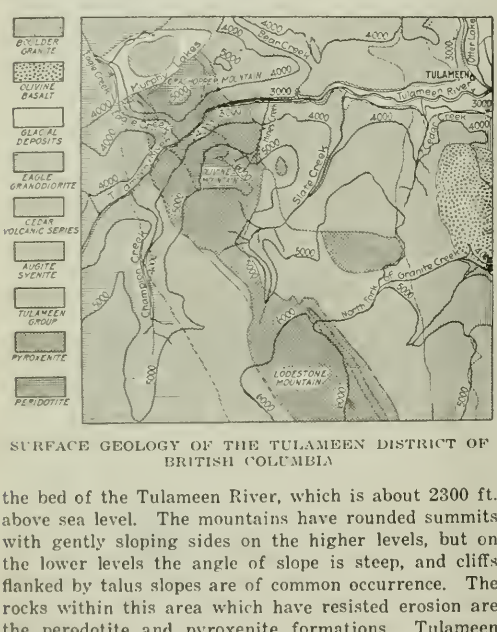
One of the main topographical features of central British Columbia is the interior plateau region, which has its southern limit at about the 49th parallel of latitude at a point southeast of the Tulameen district. From here it extends northward, gradually widening through central British Columbia. At the 50th parallel, which is the latitude of Tulameen, it has a width of about 100 miles and borders on the Hope Mountains in the west. At this latitude the highest points of the plateau are from 5000 to 6000 ft. above sea level. The streams which traverse this belt have formed valleys, some of which are 4000 ft. deep.

---

*Mining engineer, Rossland, British Columbia.

The Tulameen district may properly be described as being a part of the great interior plateau region, but it is situated so near the border that the more typical plateau features are not everywhere highly developed in it, and there is a tendency to the formation of a more rugged type of topography.

The highest point in the district is Lodestone Mountain, with an elevation of 6150 ft.; the lowest point is the bed of the Tulameen River, which is about 2300 ft. above sea level. The mountains have rounded summits with gently sloping sides on the higher levels, but on the lower levels the angle of slope is steep, and cliffs flanked by talus slopes are of common occurrence. The rocks within this area which have resisted erosion are the perodotite and pyroxenite formations. Tulameen district is drained by the Tulameen River, which rises on the eastern side of the Hope Range and empties into the Similkameen River at Princeton.



SURFACE GEOLOGY OF THE TULAMEEN DISTRICT OF BRITISH COLUMBIA

OLDEST ROCKS REGARDED AS OF TRIASSIC PERIOD

Underlying rocks are of igneous and sedimentary origin and range from the Triassic to Recent. The oldest formations have been classified as the Tulameen group, and are tentatively referred to as being of the Triassic age. These rocks are mostly of volcanic origin, and, being interstratified with some argillites and thin beds of limestone, are thought to have been laid down under water. The volcanic portion makes up perhaps 90% of the entire group and is prevailingly andesitic in composition. The sedimentaries contain some indistinguishable fossil plants, and have been greatly altered both by regional and contact metamorphism, so that a schistose structure is frequently evident. They dip at angles from 25° to vertical, and cover the largest area of rock formation in the district.

During the period between the deposition of the Tulameen and the Cretaceous groups, mountain building, accompanied by a number of igneous intrusions, took place. These intrusions are referred to the Jurassic period, and have been thrust through the rocks of the Tulameen group in the following sequence: Boulder granite; peridotite and pyroxenite; augite syenite, and granodiorite, all of which are found in various parts of the district in large and small bodies and have a general north and south trend.

GEOLOGICAL SEQUENCE OF THE FORMATIONS

Two conformable Oligocene groups rest unconformably on top of the above-mentioned rock. The lower or Cedar volcanic series, is prevailing andesitic, whereas the upper, or Coldwater group, includes sandstones, shales and conglomerates that lie at angles rarely steeper than 45° and have not been greatly disturbed since their deposition. Intrusive into the Cedar and Coldwater series, and supposed to be of Miocene age, is a body of pink alkaline granite, known as the Otter formation; and lying unconformably on top of these series is a volcanic flow of olivine basalt, which, although of a later period than the Otter granite, is probably of the same age. The basalt is the youngest formation in the district, and still preserves its horizontal position. Stream and glacial deposits cover the floors of all the valleys and much of the higher country.

The Canadian Geological Survey has correlated the rocks of the Tulameen area as follows:

FORMATION OF ROCKS OF TULAMEEN DISTRICT

Period	Special Name of Formation of Group	Character of Rocks
Quarternary		Stream deposits Glacial material
Post-Oligocene probably Miocene		Olivine basalt
	Otter formation	Granite
Oligocene	Coldwater series	Sandstones, shale, and conglomerates
	Cedar volcanic series	Andesites, breccias
Jurassic	Eagle formation	Granodiorite Augite syenite Pyroxenite
	Boulder formation	Perodotite Granite
Triassic	Tulameen group	Volcanic rocks, limestones and argillites

Dikes, which range in character from acid granite porphyries to basic diabases, are numerous throughout the region, but have been intruded in a sequence too intricate to be worked out.

TULAMEEN GROUP SUBJECTED TO IGNEOUS INTRUSIONS

The oldest of the rocks found on Olivine and Lodestone mountains is undoubtedly the Tulameen group, which has the igneous formations, syenite, peridotite, and pyroxenite, intruded through it. The origin of these three intrusive rocks was probably the same, that is to say, they were thrust up as columns of molten rock to the surface, where they solidified. The peridotite and pyroxenite are closely associated in origin and age, and can be treated as one, and were probably first intruded through the Tulameen group. The syenite contact with the Tulameen group is fairly clean cut, but, with the pyroxenite, it is not always clear; on the contrary, it shows evidences in some places of being intrusive. The close magmatic relation of the syenite to the pyroxenite and the peridotite, as well as the nature of the contacts, gives the impression that the syenite closely followed the pyroxenite and peridotite in time of intrusion. The augite syenite ranges in composition from a true syenite to a gabbro.

There is no sharp contact between the peridotite and pyroxenite. From a pure peridotite, on one side, there is a gradual replacement of olivine by augite, until the olivine is eliminated altogether and the rock becomes pure pyroxenite. This transition covers about 100 ft. in width, although sometimes more than that. Both the pyroxenite and peridotite are cut by small dikes, which fill the cracks formed in cooling and contain both olivine and pyroxene. The area of the pyroxenite outcrop is large, extends across Olivine and Lodestone mountains in a general northwest and southeast direction, and completely encloses the two bodies of peridotite. The formation shows considerable variation in composition and texture, the normal color varying from black to a dark green and the formation containing only augite and magnetite. The latter is usually in small crystals, but it sometimes occurs in large bunches.

The peridotite outcrops in two distinct bodies, the larger one on Olivine Mountain being about two and a half miles in length and varying from one-half to over a mile in width. The rocks are generally well exposed, and the boundary line is fairly closely defined. The peridotite rock contains, besides olivine, some chromite, which occurs either in distinct individual grains or in irregular veins or bunches, and these are found only in restricted areas, whereas the individual grains are disseminated through the entire mass. In the peridotite there is frequently evidence of alteration of the olivine to serpentine, and in some instances veinlets of asbestos have been formed. However, generally speaking and excepting along the contact zone, the mineralogical characteristics throughout the peridotite showing are uniform. The peridotite rock of the Tulameen district is similar to the so-called Russia rock, which is the source of the platinum placers of Russia.

PLATINUM OCCURRENCES ARE IN SMALL AMOUNTS

It has not been definitely determined whether the platinum comes altogether from the peridotite or also from the pyroxenite. Geologists who have studied the occurrences in Russia, at Tulameen, and elsewhere generally conclude that it comes somewhat from both rocks. Platinum never occurs in large nuggets in the Tulameen placers. The largest nugget of platinum of which there is record came from the Ural Mountains and weighed 252 oz., and the largest recovered from Tulameen was probably not over half an ounce in weight. The ordinary nuggets from the Tulameen placers are from one to four millimeters in diameter, and examination is hard to make. Their surface is usually pitted with round cavities, which are often filled with chromite and sometimes contain a little magnetite. Dr. Kemp, in a bulletin of the U. S. Geological Survey, states that he found olivine and pyroxene associated with the platinum in some nuggets, and this probably led to his conclusion that the original source of the platinum was in both the peridotite and the pyroxenite.

ORIGIN OF TULAMEEN PLATINUM DUE TO MAGMATIC DIFFERENTIATION IN PERIDOTITE

Though the pyroxenite contains concentrations of magnetic iron ore in bunches, particularly on Lodestone Mountain, and some copper associated with the magnetite on Olivine Mountain, there is also local concentration of chrome iron ore in the peridotite, but the mineral of economic interest is of course the platinum. The peridotite is undoubtedly the mother rock of the platinum which is now found in the placer of Tulameen River, and those who have been engaged in seeking the source agree that veins and masses of chromite generally contain higher percentages of the platinum than the massive peridotite, which only has fine grains of chromite disseminated through it. This shows that, although it may migrate in solution as do other metals, the platinum is also a product of magmatic differentiation, like the chromite, and has become associated with it.

CHROMITE SEGREGATIONS OCCUR IN OUTCROPS

In chromite-bearing districts, a body of peridotite may show the chromite segregations larger and more abundant toward the outer edge or contact of the peridotite with other rocks, but so far this has not been proved on Olivine Mountain. Segregations of chromite have been found in all parts of the peridotite outcrop, but it cannot be said that these are not the result of apotheses or small dikes from the pyroxenite in the interior of the mass.

I have observed that samples of apparently the purest chromite, when ground fine and placed on a plate, were attracted by the magnet, showing the presence of finely divided magnetite, which could not be distinguished in the sample. Samples from bunches of chromite in the peridotite where no pyroxenite was visible appeared to be as much attracted when treated this way as those from the contact. This might warrant the supposition that pyroxenite is always present where there are concentrations of chromite, even though it does not show on the surface. If it could be proved that some slight concentration of the chromite and platinum has occurred in the zone of contact between the peridotite and the pyroxenite, mining might be attempted, as the body is large.

Sampling of these rocks has been unsatisfactory. Some of the samples which were expected to give the best results showed no platinum whatever, though others ran higher than was expected. The analysis of platinum is difficult to make, and unless the assayer is especially experienced it is hard to obtain accurate results. Samples of the chromite concentrations taken from different places on Olivine Mountain have assayed from a trace to two ounces of platinum, but usually the results vary from 0.01 oz. to 0.05 oz. Platinum assays have been obtained from the peridotite rock from all parts of the deposit, but the best results were from pyroxenite dikes and serpentine veins in the peridotite, and from the peridotite-pyroxenite rock of the contact zone, the assays always being highest where the chromite was the most massive. I have never heard of platinum being obtained in assays of pure pyroxenite.

COMMERCIAL EXTRACTION OF PLATINUM DOUBTFUL

A few prospectors in the Tulameen district have devoted their energies to the search for the original source in the solid rock of the platinum of the placers. Although the original source has been known for some time, it still remains to be demonstrated whether or not the platinum occurs in such quantity in the rock as to make its extraction commercially possible. There are few instances in which platinum is obtained in commercial quantity from the solid rock, and these are usually cases in which it is not the primary mineral sought. The most notable occurrence of this metal in the solid rock in America is probably that at the Rambler mines in Wyoming, where it occurs as the arsenide—sperrylite—in association with a variety of copper compounds, notably covellite. Some lode mining of platinum has been tried at the Key West mine, in Clark County, Nev., where it occurs in 10- to 50-ft. dikes which cut gneisses.

The conclusion of geologists who have studied the platinum-bearing rocks at Tulameen has been that the chances of finding workable concentrations are slight, and that on account of the deep section of these rocks which can be examined on the surface, and because of the fresh condition of the formation, the conditions which would be encountered below the surface would likely be the same as those found on the surface. Then, too, the expense of thoroughly testing the rock, either on the surface or by drilling into it, and the fact that there is practically no precedent in platinum lode mining, and therefore no capital directly interested in it, have discouraged attempting to prove the possibility of mining the formation for platinum.

This will be sufficient to supply the data necessary for guidance in connection with the larger plant, the erection of which is dependent on a satisfactory settlement of the power question.

In view of the fact that it will be considerable time before hydro-electric power will be available for electrolytic treatment on a profitable scale, it has been decided to proceed with the immediate erection of an oil-flotation plant of an initial capacity of about 200 tons per day. The value of this installation will be realized in connection with the working out of the special concentration problems encountered.

Graphite Industry in Alabama

The following is a list of the graphite companies which operated plants in Alabama during 1918, as compiled by W. F. Prouty, of the Geological Survey of Alabama. The list is arranged alphabetically, the post-office address and the situation of the plant being given in each case. It was the intention to publish the table with Dr. Prouty's article "Alabama Graphite in 1918," which appeared in the Jan. 25 issue of the *Journal*, but for unavoidable reasons it was impossible to do so.

GRAPHITE COMPANIES IN ALABAMA

Name of Company	Address	Situation of Plant
Acme Graphite Co	Ashland	3 miles N W of Ashland
Alabama Graphite Co., No. 1 plant	Ashland	5¼ miles W of Ashland
Alabama Graphite Co., No. 2	Ashland	6¾ miles N W of Ashland
C B Allen Graphite Co	Ashland	6½ miles S W of Ashland
American Graphite Co	Gadsden	2 miles N W of Ashland
Ashland Graphite Co	Ashland	4½ miles N of W of Ashland
Atlas Graphite Co.	Ashland	8 miles S W of Ashland
Axton-Noe Graphite Co	Ashland	6 miles N W of Ashland
Carbon Mountain Graphite Co	Lineville	Graphite, 2 miles S E of Pyriton, 5 miles N E of Ashland
Ceylon Graphite Co.	Birmingham	2 miles S W of Hollins
Clay County Graphite Co	Ashland	Hassell Gap, 2 miles N of Ashland
Crucible Flake Graphite Co	50 Broadway, New York	7 miles S W of Ashland
Crystalline Flake Graphite Co	Ashland	3 miles N E of Ashland
Diamond Graphite Co	Alexander City	
Duro Flake Graphite Co	Sylacauga	6½ miles N W of Rockford
Eagle Graphite Co. (a)	Ashland	7¼ miles S W of Ashland
Empire Graphite Co. (a)	Ashland	7½ miles S W of Ashland
Flaketown Graphite Co	Mountain Creek	3¾ miles N E of Mountain Creek
Goodwater Graphite Co	Goodwater	1 mile N W of Goodwater
Graphite Company of America	Goodwater	1 mile N W of Goodwater
Griesemer Graphite Co	Ashland	4½ miles W of Ashland
Graphite Mills, Inc	Ashland	2½ miles W of Ashland
Hood-Graves Graphite Co	Alexander City	7½ miles S W of Ashland
Jefferson Graphite Co	Birmingham	6 miles S W of Ashland
Jennings Graphite Co. No. 1 plant	Lineville	2¼ miles N E of Ashland
Jennings Graphite Co. No. 2 plant	Lineville	2¼ miles N E of Ashland
King Graphite Co	Lineville	2½ miles N W of Ashland
Liberty Graphite Co	Birmingham	5 miles N W of Lineville
Lineville Graphite Co	Lineville	4½ miles N W of Lineville
May Brothers Graphite Co	Ashland	5½ miles N W of Ashland
Monitor Graphite Co	Ashland	3½ miles N of Ashland
National Flake Graphite Co	Ashland	2½ miles N W of Ashland
Norway Graphite Co	Clairmont Springs	3½ miles S of Chandler and 9½ miles W of Ashland
Parkdale Graphite Co	Talladega	½ miles N E of Parkdale
Peerless Flake Graphite Co	Lineville	4½ miles N E of Ashland
Pocahontas Graphite Co	Ashland	4½ miles S W of Ashland
Quenelda Graphite Co	Ashland	7 miles S W of Ashland
Republic Graphite Co	Ashland	2 miles N of Ashland
Southern Graphite Co	Ashland	2½ miles N W of Ashland
Southern Star Graphite Co	Ashland	5 miles N W of Ashland

(a) Plant Burned in 1918

Mount Read & Roseberry Mines

The directors' report and statement of accounts for the year ended Sept. 30, 1918, for the Mount Read & Roseberry Mines, Ltd., of Tasmania, says that a parcel of 110 tons of ore was purchased during the year by the Anaconda Copper Mining Co., and treated at its Great Falls electrolytic zinc plant, payment being made for the zinc, lead, silver, and gold contents. The opinion was then expressed that the ore was exceptionally suitable for that method of treatment. E. R. Crutcher, formerly of the staff of the Anaconda company, is now engaged on preliminary laboratory research work at Queenstown, Tasmania; and it is purposed to install an experimental plant, with a daily capacity of about one ton of metallic zinc, as soon as possible.

Canadian Mining Law

Speaking at the annual general meeting of the Canadian Mining Institute, A. W. G. Wilson said:

"The codification of existing mining laws, and their amendment where necessary, will have to be considered. It may appear desirable to so amend existing laws that the country may be assured that in the future the control of important mineral resources shall be vested only in the hands of residents of Canada or subjects of the British Empire. This action has been taken with respect to natural gas and petroleum resources, and it may be desirable to extend it to other similar resources that are essential for military purposes or to enable Canada to secure and maintain commercial independence. Such legislation is in force in other countries."

Utilizing Volcano Steam

The utilization of volcanic power is a new industrial exploitation which is being made in Italy. According to *Italian News Service*, the present enormous price of coal has led to the development of this manner of securing heat.

The first experiments were made some years before the war by Prince Ginori-Conti, in Tuscany, at Larderello, near the salt mines of Volterra, a region extensively covered with volcanic formations, the most wonderful being the so-called "soffioni," which are certain volcanic vents omitting powerful jets of hot steam containing boric salts and various gases used in the extraction of boracic acid.

In 1905, Prince Ginori-Conti applied this natural steam to a 40-hp. engine, using only a small section of the Nenella fissure, which is the most powerful "soffione," the steam ejected having a pressure of five atmospheres. The results obtained during several years of experimentation were satisfactory, so that he continued to make larger and deeper borings, measuring the force of the steam ejected. Combined, this force could operate engines of many thousand horsepower. In 1912 an experiment was made, wisely on a more modest scale but sufficient in scope to obtain conclusive results, for which a 300-hp. turbine-alternator was used. Later, because of the enormous increase in the price of coal, the prince decided to exploit the thermic energy of these "soffioni" on a much larger scale, but as other substances are emitted with the steam, among them sulphuric acid, which corrodes metals, particularly iron, and therefore the pipes in which the steam was to be collected, he attempted to use this steam only for heating. Three turbine-alternators of 3000 kw. each were installed, fed by boilers at low pressure not heated by coal or other combustible fuel, but by the natural steam, superheated to 165° C., issuing from the "soffioni" and piped and carried to the boilers.

Today the works at Larderello have a central plant of 16,000 hp. operating without interruption and distributing current to Florence, Livorno, and Grosseto, and its capacity is soon to be increased.

The Ruck Zinc-Distilling Furnace

The accompanying engravings are interesting as illustrations of a recent type of distilling furnace introduced at the works of the English Crown Spelter Co. by E. Ruck, general manager of that company. The specially interesting feature of this furnace is the provision of gas and air conduits in the front wall of the furnace, which is intended to improve the heating of the front ends of the retorts. It will be noticed, furthermore, that while the general lines of this furnace are of the Rhenish type, the front ends of the retorts are broad pretty nearly to the face of the furnace, as in the ordinary Belgian type.

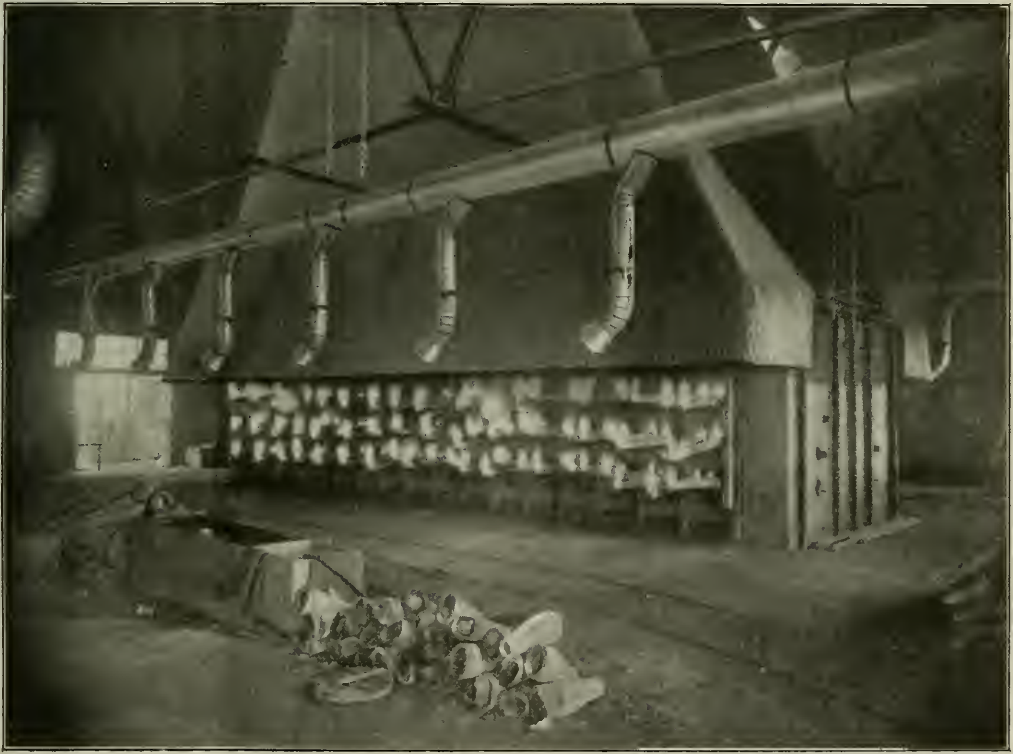


FIG 1. GENERAL VIEW OF RUCK REGENERATIVE ZINC DISTILLING FURNACE

Referring to the drawing, *A* shows the air regenerators, and *B* the gas regenerators. Part of the hot gases from the regenerators pass upward over the retorts *C*, *D*, *E*, through passages at *G*, while the front ends of the retorts in the second tier are heated by the gases passing through the flues *H*, *J*, in the direction of the arrows. These passages, it will be noted, have outlets in the neighborhood of the front ends of the retorts. Suitable provision is made for cleaning the flues, the openings being normally closed with bricks in the usual manner.

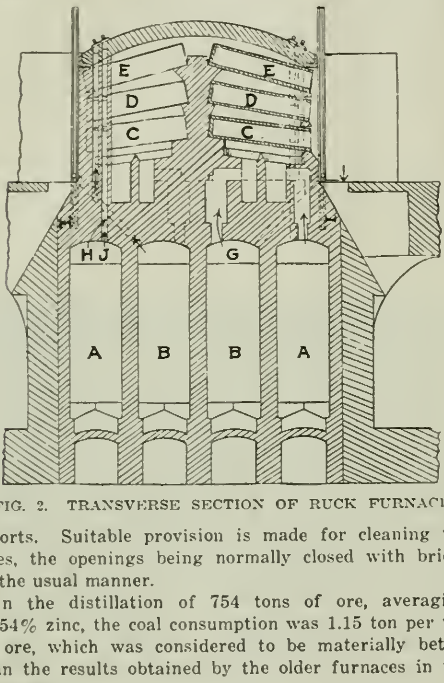


FIG. 2. TRANSVERSE SECTION OF RUCK FURNACE

In the distillation of 754 tons of ore, averaging 46.54% zinc, the coal consumption was 1.15 ton per ton of ore, which was considered to be materially better than the results obtained by the older furnaces in the same works.

Canada's International Relations*

Canada is economically dependent on other territories. We lack many commodities essential to commercial independence, such as supplies of raw sulphur, iron, coal, and other materials. We are dependent on outside sources, in part foreign, for much of the iron ores which are converted into pig iron and steel in our blast furnaces. We produce no anthracite coal. Central Canada, in which is nearly one-half of our population, and about one-half of our manufacturing industries, is, at present, directly dependent on the United States for winter fuel, and for steam power. The coal fields of eastern and western Canada could not be developed sufficiently to enable them to replace this foreign fuel supply in less than three years' time, were that supply suddenly withdrawn. Fuel supplied from these fields would not be so satisfactory to the consumer and would cost much more. Our present house-heating appliances are not adapted to using this type of fuel, and the people would experience difficulty in learning how to use it properly. Our present transportation systems are not capable of handling the additional traffic that would develop, and would have to be expanded. This expansion would be costly and would require considerable time for effective development.

On the other hand, the United States is practically dependent upon Canada for nickel, asbestos, and for certain other materials. An extensive trade has been developed between the two countries in both raw and manufactured mineral products. The most important electro-chemical industries of the continent are situated at Niagara Falls, on both sides of the international boundary, and are dependent on the electrical power generated there. We are reported to possess material reserves of potential power, a portion of which we will be able to exchange for essential commodities that we do not possess, or which are not at present convenient of access. Eventually we will probably control the supplies of coking coals and the byproduct coke industry of the continent. International relations arising from these conditions will need consideration, preceded by accurate investigation, some of which is now in progress.

At present about 80% of the nickel industry, approximately 90% of the copper industry, a percentage of the iron and steel industry, and nearly the whole of the heavy chemical and fertilizer industry, and portions, or the whole, of many other industries, are controlled by citizens of the United States, and many of the head offices of the companies concerned are situated outside of Canada. The same is true of many minor industries. In a number of cases the control of the greater portion of the raw materials now produced, and which would be required by industries not now established in Canada, is in foreign hands. At the present time a copper refinery owned by citizens of the British Empire would be almost wholly dependent for its supply of raw material in the form of blister copper (90-98% pure) on the product of mines and smelteries owned by foreigners. The same is true of nickel, sulphuric acid, nitric acid, hydrochloric acid, and many other products.

This condition of affairs gives rise to several problems, the most important of which involve the consideration of ways and means to persuade or compel the foreign owners of basic industries to produce finished products in Canada.

Copper Economy in Telephone Work*

The reduction, which has been found practicable, of the size of the wire and the weight of copper required in the transmission circuits of telephone companies not only greatly reduced the cost of material, but made it possible to use, in the underground conduits, cables with as high as 30 times the number of circuits for which they were originally intended. When it is considered that there are over 20,000,000 miles of copper wire in use, and that the reduction in weight is from one-half to even one-quarter of what was formerly needed, the saving can be appreciated. And when it is realized that the underground conduits for the telephone cables have cost over $100,000,000, some idea of the saving in construction through increased capacity can be formed.

---

*Abstract from A. W. G. Wilson's address at the Annual General Meeting of the Canadian Mining Institute, March, 1918.

*Abstract from a letter from Theo. N. Vail to the Hon. John A. Moon, chairman, Committee on the Post Office and Post Roads, Washington, D. C.

Concreting Prospect Drill Holes

By ROY H. POSTON*

In the Southeast Missouri lead district the formations are such that exploratory drill penetrations through the strata often form channels for underground water, and this condition imposes a serious handicap in mine pumping operations. The practice of plugging the openings with concrete has proved successful in stopping the flow. Three examples illustrating how this was done under different conditions are given.

PROSPECT drill holes sunk from the surface frequently penetrate crevices, fissures, channels, or porous-rock areas that serve as passageways for water in its downward course to subterranean stream or reservoir, and occasionally such drill holes are directed into or through the reservoir itself. If the bore hole is cut below this water reservoir or stratum, by an underground stope or drift, the water diverted by the hole from its natural course flows directly into the mine, thereby throwing an unnecessary burden upon its pumping facilities. The flow of water may often be stopped before it enters the mine by inserting a wooden plug in the bore hole, but this is not always possible, because of varying conditions such as the height of the mine roof, and the velocity of the flow of water; and other methods must be employed.

DETERMINING THE WATER CHANNEL IN A DRILL HOLE

An effective and inexpensive method of curtailing flows from the sources mentioned is to concrete the bore hole either from top to bottom or across the offending channel or water supply. The position of the channel may be determined by lowering a small piece of wood, suspended from an ordinary cord, into the hole until the "pull" on the string indicates that the channel has been reached, the "pull" being easily perceptible if the water is still flowing from it. The measurement of the string then determines the channel with respect to the collar of the hole. A standard cement is used in the ordinary proportions required for concrete foundations and walks, but it is essential that the mixture be made thin enough to facilitate pouring into a hole of small diameter, and lumps or small rocks that would be permissible in other kinds of work must be eliminated.

MARKING THE POSITION AND PLUGGING THE DRILL HOLE

Diamond-drill holes in the Missouri districts vary from 1¼ in. to 4 in. in diameter, and occasionally are larger, and they are consequently easier and less expensive to concrete than churn drill holes, the diameters of which are commonly 6 in. or more. Before starting a bore hole, a short piece of iron pipe, slightly larger in diameter than the gage of the drill bit, is set in solid rock and firmly wedged into a vertical position by means of wooden wedges, the procedure being known to drillers as "corking." This pipe, usually known as the "sleeve," projects several inches above the ground, and serves as a guide for the drill bit when beginning the hole. When the hole is fathomed, or finished, this sleeve pipe is usually left in position, to mark the exact situation of the hole for future reference. It should immediately be plugged to keep mischievous boys, surface drainage, or other agencies from clogging or filling it with debris. The plugging requires little time and trouble, and should be insisted upon by every drill foreman, for it is usually quite a task, if not entirely impossible, to clear a hole of accumulated material if it has been left open for any length of time. A cheap and efficient method of plugging a diamond-drill hole has already been described[1].

HOLE MUST BE CLEAR THROUGHOUT ENTIRE LENGTH

After ascertaining the depth of the hole from the drillers' log or other source, the first step is to make sure that the hole is absolutely clear for its entire length. One method of doing this is by lowering an iron weight into the hole. The weight should be about 12 in. long, weigh 3 or 4 lb. and be slightly less in diameter than the bore hole. One end should be pointed, and a small hole made in the other allows the insertion of a strong steel wire. Small rocks, pieces of core, and other similar obstacles may be forced downward by pounding carefully with the weight, as the pointed end serves to break up and dislodge the pieces. If a particularly stubborn obstacle is encountered that will not yield to the hammering of the weight, a small charge of dynamite exploded thereon will usually force it down, but this practice is not to be recommended except as a last resort, as the character of the rock in the vicinity of the shot may be such as to fill the hole with loose particles of rock broken by the shot itself. Usually one-third or one-half a standard stick of dynamite will

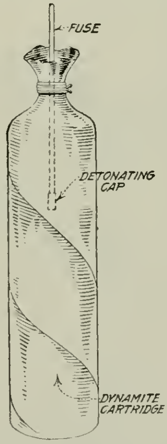


FIG. 1. DYNAMITE CARTRIDGE PREPARED FOR USE IN DRILL HOLES

serve the purpose, and it may be prepared for firing as shown in Fig. 1, this being, in my opinion, an excellent method, as it presents no projections to catch the sides of the bore hole in its descent.

---

*St. Francois, Missouri.

[1] *Eng. and Min. Journ.*, June 9, 1917, p. 1026.

Care must be taken in lowering the weight into a hole, as water flowing from side channels or crevices may sometimes dam up on top of the weight and cause enough extra strain to be thrown on the wire to seriously inconvenience the operator. For this and other reasons the wire should never be allowed to play out over the sharp edge of the sleeve pipe, but should be placed over some round object, such as a pick or shovel handle, to prevent unnecessary kinks or the shearing of any of the metal in the wire on its passage into the borehole.

When the hole has been cleaned throughout its entire length, the lower end, if open, is plugged to retain the concrete when it is poured. This may be done in various ways and depends on existing conditions. If the hole is cut underground by a drift or stope, and the back is accessible, a wooden plug may be driven into the hole, but if the roof is too high to reach, or the mine is filled with water, other means must be employed.

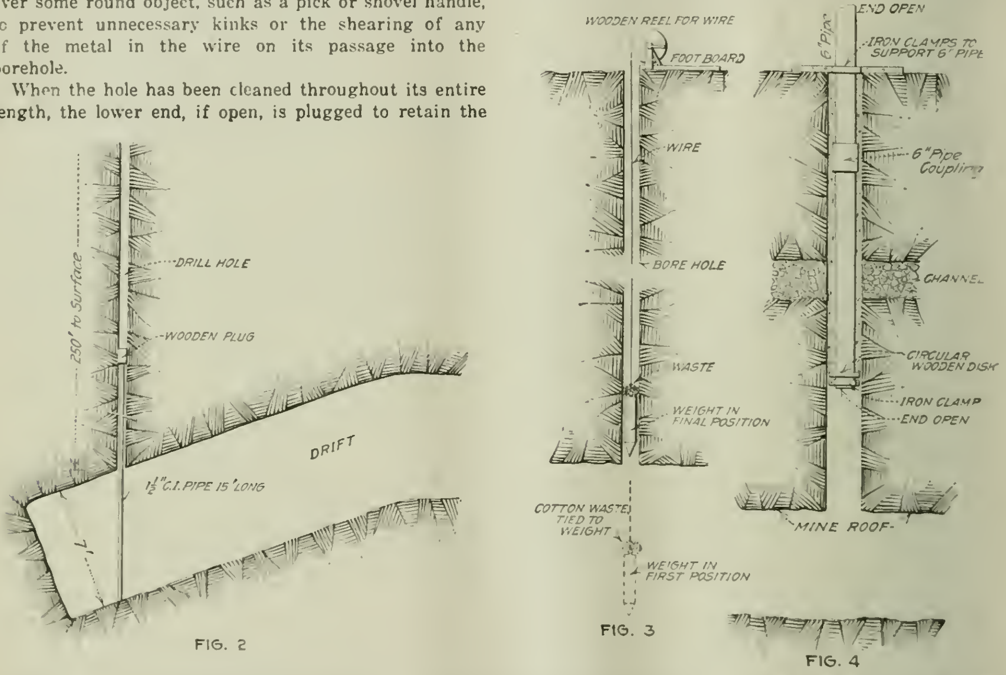


FIG. 2

FIG. 3

FIG. 4

FIGS. 2, 3, AND 4 SHOW METHODS USED IN THE SOUTHEAST MISSOURI DISTRICT IN CONCRETING DRILL HOLES

METHODS OF PLUGGING DRILL HOLES

Fig. 2 illustrates a method employed when a drift was filled with water and the hole was therefore inaccessible. Fig. 3 shows a method used to plug a drill hole cut by underground workings where the roof was inaccessible, but could be seen by means of a strong light. In this instance, the weight was first lowered through the hole into the mine-working to an assistant, who tied a piece of ordinary cotton waste securely to the top of the weight. The waste forms a tight sleeve or "pack" around the weight, so that when it is drawn into the hole from above, the opening is completely filled and ready for concreting. The wire should be securely fastened to some solid object near the collar of the hole, and must be of sufficient strength to sustain the weight of the concrete in the hole until the mixture has set. In this method, the weight employed should be different from that used to clear the hole of obstacles and should have a square top or shoulder to provide better support for the concrete to rest upon. The wire should be of steel and of sufficient tensile strength to hold the load, which will depend on the diameter and depth of the hole. It should be free from all bends and kinks, and preferably should be in one piece, but if it becomes necessary to splice, the work should be carefully done. After cementing, the wire must not be untied from the support on surface for at least 48 hours.

Fig. 4 illustrates a method of concreting a churn-drill hole, in which it was necessary to shut off the flow of water from nearby channels and at the same time to leave the hole open to provide ventilation for a stope. A piece of pipe of a diameter 4 in. less than that of the hole was fitted at one end with a pair of iron clamps that could pass freely into the hole. A wooden disk was placed above the clamps and served as a base for the concrete. When in place the pipe was supported on the surface by means of clamps.

I know of one instance where it was impossible to find the collar of a certain hole on surface and it became necessary to plug the hole from the underground workings. This was done by filling standard 1½ in. x 6 in. tamping bags with wet concrete and pushing them up into the hole, one at a time, using a short section of pipe. When no more concrete could be forced into position, the hole was plugged by means of a soft pine stopper that had previously been soaked in water. This plug soon expanded and held the concrete in position until it had set. Other conditions may be encountered in the work of concreting drill holes, and these must be met by the experience and ingenuity of the man in charge of the work. As only a small batch of concrete is necessary for each hole, it is usually mixed by hand by the side of the hole to be sealed. All the necessary material and paraphernalia for the work may be easily loaded into a one-horse wagon and transported from hole to hole with little loss of time or inconvenience.

Discharging Water From Mining Plants

By Chesla C. Sherlock*

The pollution of streams by mining operations has already been discussed[1]. In the present paper those cases will be considered where the mine operator or owner has discharged water or other substances from his mining property so that it will flow over the land or property of another in obedience to the law of gravitation.

In the former discussion those principles of law regarding the rights and obligations of riparian owners in respect to such matter as might be brought from the mine and discharged into the stream were pertinent. But the courts are agreed that the principles governing riparian owners do not apply in instances where water is taken from a subterranean course, brought to the surface, and discharged so that it will flow, according to the lay of the land, upon the property of another.

Riparian rights are something which are acquired with notice by the man who buys land adjoining a stream; and the existence of the stream is notice to him that he must accept the rights of a mere riparian owner. He cannot exercise any other right in such an instance, because if he did so he would be in a position to cut off the rights of the owners of other land facing the stream who might be below him. But when the owner of land is not located upon the course of a stream, even though his land is below that of a mine owner, entirely different principles of law apply in case water is discharged from the mine so that it will enter his land and do damage to it.

When a man buys land which is lower than adjoining land, he takes it with notice that he cannot hold the owners of the higher land liable for such water as may flow on his property by natural drainage, but the mere fact that he is bound to accept the water flowing by natural drainage from the land of another does not give the owner of the higher land the right to alter this flow or to increase it so as to add to the reasonable natural flow of water upon the land of the lower owner.

In other words, so long as the water flowing onto the land of the lower owner is the result of natural drainage, the said lower owner cannot complain; but if the water flowing onto his land is the result of artificial means or methods adopted by the higher owner, then he has some rights which he may assert.

Even though there is a natural drainage of considerable water onto the land of the lower owner, no principles of riparian ownership apply; and, even if water is flowing with more or less regularity upon the land of the lower owner, the mine owner has no right to change its character by adding to its content any other substance taken from the mine, nor has he any right to add to its volume by adding pure water to it, without incurring liability.

This does not mean that the mine owner whose mine is located at a higher point has no right to discharge water or other substances upon his own land. He has that right beyond the shadow of a doubt, and the lower owner cannot prevent his so doing, but the liability of the mine owner begins when such substances or water pass from his own land onto that of another.

The mine owner may not be held liable, either, in case the discharge of water upon his own land subsequently flows upon the land of another, but does no damage. This decision was reached by the South Dakota court, holding that the lower owner had no right to enjoin the work of the higher owner when such flowing of water across the former's land did him no damage.

If the mine owner can, by "slight expense," prevent the water which he discharges from his mine or other operation from doing the lower land owner any damage, he is legally bound to exert such means and spend the money necessary to prevent such damage being done. But, said the Pennsylvania court, if this expense would consume all the profits of the mining operation, then it is clearly unreasonable to hold the mine owner to such a duty.

The court said: "If the expense of preventing the damage from his act is such as to practically counterbalance the expected profit or benefit, then it is clearly unreasonable and beyond what he could justly be called upon to assume. If, on the other hand, however large in actual amount, it is small in proportion to the gain to himself, it is reasonable in regard to his neighbor's rights, and he should pay it to prevent the damage, or should make compensation for the injury done. Between these two extremes lies a debatable region where the cases must stand upon their own facts under the only general rule that can be laid down in advance—that the expense required would so detract from the purpose and benefit of the contemplated act as to be a substantial deprivation of the right to the use of one's own property. If damage could have been prevented short of this, it is injuria which will sustain an action."

The mine owner's liability might be expressed in another way, as it was explained by the Louisiana court. If a man buys lower land he is bound in statutory servitude to receive the natural drainage of the higher land, provided that no agency of man has been used to make that servitude more burdensome to him. But if the mine operator takes water and other substances out of his mine and discharges it upon his own land, then he is bound to confine it there; or to so care for it that it will do no injury to the land or property of another. It was held that the burden to perform this duty is assumed by the mine owner or operator as soon as he brings water or other substance to the surface and discharges it upon his land, having notice in advance that it will naturally seek the lower level and reach the land of another.

In Maine it was said that the mere fact that one has conveyed land to another with knowledge that it is to be used for a slate quarry will not estop him from demanding damages due to the discharge of water and rocks upon his own land. There the mere fact that the plaintiff had granted the quarry to another cannot be taken to confer the right upon the owner of the quarry to make an illegal use of it so as to injure the grantor. Nor was the conveyance to be regarded as a waiver of damages in working the quarry, even though the grantor knew that it was to be so used by the purchaser.

---

*Box 84, University Place Station, Des Moines, Iowa.

[1] *Eng. and Min. Journ.*, Nov. 16, 1918, p. 861.

A California case was based upon slightly different facts. The mine owner caused water to flow over the land of another, when it was shown that it would not naturally have flowed over his land, in obedience to the law of gravitation. The court held that the owner of the lower land was entitled to an injunction to prevent further damage, and to damages for the injury already done, if it was shown that the circumstances did not authorize or justify the mine owner to cause the water to so reach the land of the lower owner.

In another California case the court said that the rule is general that when one brings a foreign substance on his land he must take care of it, and not permit it to injure his neighbor, even at expense to himself. The facts in this case showed that only slight expense was necessary to prevent injury to the neighboring land.

In a Pennsylvania case, it was held that if an upper land owner, by pumping, increased the amount of water which would naturally flow upon the land of another, and, by artificial means, concentrated it at one point, that he was *prima facie* liable for damages.

In an Indiana case, the mine operator admitted that he had pumped water from his mine so that it would increase the natural flow upon the lower land owner, but attempted to justify such action upon the ground that it was only the reasonable consequence of his right to the use and enjoyment of his own premises. The court held that the question of whether he had been guilty of negligence in so acting was one for the jury to determine.

In another Indiana case, it was contended that the increased flow of water was only the consequence of a reasonable use of the land in carrying out the mining operations, and therefore justifiable. The court said that while lower land is servient to the natural drainage flow of higher land, and such reasonable contamination as might occur in a reasonable use of said land, yet the lower land is not servient to unreasonable artificial flowage, and if the injuries could have been prevented by the mine owner at inconsiderable cost to himself, as the evidence seemed to indicate, then he was liable therefor.

The Licensing of Engineers.

The question of the licensing of engineers has been taken up by the Engineering Council, and a License Committee has been appointed with the following members: Chairman, T. L. Condron, Chicago, Ill.; F. C. Shenehon, Minneapolis, Minn.; Farley Gannett, Harrisburg, Penn.; John H. Dunlap, Iowa City, Iowa; Arthur M. Greene, Jr., Troy, N. Y.; Caleb M. Saville, Hartford, Conn.; James H. Herron, Cleveland, Ohio; A. M. Schoen, Atlanta, Ga.; John Klorer, New Orleans, La.; Philip N. Moore, St. Louis, Mo.; A. Lincoln Fellows, Denver, Colo.; C. H. Snyder, San Francisco, Calif.; and Amos Slater, Seattle, Washington.

The country is being divided into districts by the chairman, to be assigned to the various members of the committee for the gathering of information from state officers, and others, relative to existing and proposed legislation on the subject of licensing engineers and architects. The committee is already receiving inquiries for information and assistance on this subject.

Safe Cyanide Fumigation*

By T. O. Smith

Hydrocyanic acid gas is one of the most important fumigants, but its application is attended with considerable danger in the hands of one not thoroughly familiar with its properties. A simple device for using it with safety is here described.

The lines shown in the accompanying cut represent the walls of a room or the sides of a box in which the articles to be fumigated are placed. *O* is a hole through which a cord connects the apparatus with the operator on the outside. A large beaker is placed in the proper position with regard to the articles to be fumigated and the required amount of dilute sulphuric acid poured into it. The exact amount of potassium or sodium cyanide is then weighed into a test tube and a cork inserted. The cord which extends through *O* is tied around the bottom of the test tube. The tube is then placed across the beaker with the bottom resting on the lip as shown. The lip of the beaker prevents it from rolling off. When everything is in readiness the operator removes the cork and, stepping away from danger, pulls the cord. This causes the test tube to fall into the position shown in Fig. 2, dropping the cyanide into the acid. In this manner hydrocyanic acid gas may be generated in any desired concentration, without danger to the operator.

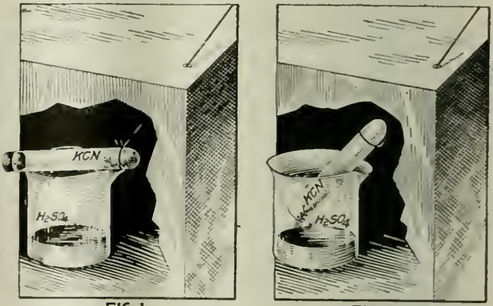


FIG. 1 FIG. 2

A SAFE METHOD OF MIXING CYANIDE AND ACID

American Zinc Products Company's Rolling Mill—Erratum

In our issue of Nov. 2, 1918, in describing the zinc-rolling mill of the American Zinc Products Co., at Greencastle, Ind., it was stated that it had a daily capacity of from 1000 to 1500 tons of zinc plate and sheets. This was an error; the figure given represented the *monthly* capacity.

---

*Abstracted from the *Chemist Analyst*, Dec., 1918, p. 18.

Linking Up Isolated Mineral Districts by the Loco.-Tractor Transport System*

BY FRANK DUTTON

The problem of the opening up of isolated mineral districts in non-mountainous regions, where a heavy initial outlay would be unjustifiable, is usually complicated by the inefficiency and slowness of animal transport over rough roads, the comparatively high cost of ordinary tractors, and the limitations in the matter of locomotive size and weight in connection with light railways. The new system to be described uses trucks running wholly on light rails. The loco.-tractor, which takes the place of a locomotive, is shod with solid rubber tires, which run on prepared strips of road metal on each side of the railway track, but a guiding portion runs on the rails. The practical advantage of the system will be obvious, particularly with reference to the large increase in haulage power obtainable.

IT HAS been said that transport is the essence of civilization, and it is everywhere realized that the prosperity of a country is largely determined by the extent of its transport facilities.

Science has provided and developed, to a high degree of perfection, the wonderful system of steamships and railways. These, however, are in the nature of arterial lines of communication. There is, nevertheless, a serious "missing link" in the railway system as at present evolved. This missing link is the transport service required to open up and develop agricultural and mineral districts, and so connect them to the arterial railways and the markets of the world. This problem is not a new one; indeed, it is one of the oldest, and yet no solution has as up to now been evolved that has found general acceptance or wide application.

DEVELOPMENT NEEDED IN PIONEER RAILWAY SERVICE

Railway development during the last 20 years has all been in the direction of higher speeds, heavier trains and locomotives, and heavy track. The development in the reverse direction for pioneer railway services has been practically at a standstill. In the system to be described the problem of the light railway for development services has been approached from an entirely fresh standpoint, and the solution adopted will be found not only a means of overcoming all the technical difficulties in cheap railway construction at less than one-third the cost of the cheapest branch railway, but practically as cheap as a hard road.

If it is possible to apply suitable motive power to a train running on a railway built with rail sections of 16 lb. per yard, gradients 1 in 20, and curvature of 50-ft. radius, then the question of cheap railway construction would appear to be in a fair way to being solved.

The results obtained and tests made with a rubber-tired road tractor put me in possession of facts that I had not previously seen recorded, and which apparently have escaped the attention of those interested in mechanical traction. This experience led to the design of a loco.-tractor—a special form of machine that is intended to take the place of the locomotive on pioneer light railways. The loco.-tractor will operate satisfactorily on a railway line built to the specification already noted. A railway to this standard could be built at one-third the cost of the cheapest branch railway, and even for much less than the cost of a first-class road.

THE LOCO.-TRACTOR LIGHT RAILWAY

The loco.-tractor system is based on the two following fundamental principles:

1. The low tractive resistance of vehicles running on rails, as compared with the high tractive resistance of vehicles running on roads.

Tractive resistance per ton:

Vehicles on rails, 6 to 20 lb.
Vehicles on roads, 56 to 200 lb.

2. The high tractive effort obtained by using solid rubber-tired driving wheels running on roads, as compared with the low tractive effort of locomotives running on rails.

Tractive effort per ton of axle load:

Solid-rubber tires on roads, 1330 lb.
Locomotives on rails, 344 lb.

TRUCKS RUN ON RAILS; THE TRACTOR RUNS ON THE ROAD

To take advantage of these valuable properties, the loco.-tractor system uses trucks running wholly on rails, thus securing the greatest possible efficiency in utilizing power for hauling purposes. The guiding portion of the loco.-tractor also runs on the rails, but the driving wheels, shod with solid-rubber tires, run on prepared strips of road metal on each side of the railway track. Thus, for a given horsepower and weight, the hauling power is four times as great as with ordinary locomotives. The three principal reasons why railways can be constructed cheaply on the loco.-tractor system lie in the facts that sharp curves, light track, and steep gradients can be used.

---

*Abstracted from the *South African Journal of Industries*, Aug., 1918, p. 1089.

First, as regards sharp curves: As there are no coupled driving wheels on the loco.-tractor, and as the driving axle is fitted with a differential, very sharp curves can be negotiated without risk of derailment or loss of power, or fear of damaging the track. Curves of 50-ft. radius offer no difficulties whatever, thus facilitating cheap construction in difficult country and enabling the railway to pass through villages or pass cultivated areas without demolishing buildings or expropriating valuable land.

Second, as regards light rails and sleepers: As already stated, only the guiding portion of the loco.-tractor is carried on the rails, and, as this weight is small, a rail heavier than 16 lb. per yd. is unnecessary. No matter how heavy or powerful the loco.-tractor used may be, a heavier track than 16 lb. will never be required, as the heavy driving portion of the loco.-tractor runs on the special wheelway and not on the rails.

Third, as regards gradients: The high tractive effort obtained by means of the solid rubber-tired driving wheels can be turned to full account by introducing gearing between the engine and the driving wheels. This combination gives a powerful draw-bar pull for starting and when running at low speeds. The gradient used, therefore, is almost a matter of indifference, but it is recommended that, wherever possible, the ruling grade should not be steeper than 1 in 20. The high starting tractive effort of the loco.-tractor enables it to start with a full load on a 1-in-14 grade, with all trucks hanging on the couplings without jerk or strain. This is impossible with the ordinary type of locomotive. A further advantage of the system is that the trouble experienced with wet or greasy rails is entirely obviated.

TRIAL OF SYSTEM GIVES GOOD RESULTS

A trial of this system was authorized by Sir William Hoy, and a test section has been laid down on the veld at Canada Junction, near Johannesburg, South Africa. As the general manager's instructions were that the test should be a severe one, grades and curves were accordingly incorporated in the test track that would never be encountered in actual practice. The rails and sleepers were not ballasted, but just laid on the gravel and dirt found on the site. The wheelways for the driving wheels were comprised of the same material, and received no preparation whatever, beyond the pressure of the wheels of the loco.-tractor running over them a few times. Other difficulties were introduced, such as putting the super-elevation on the wrong side on curves, using crippled second-hand track, omitting check rails on curves, and similar modifications. The curves are of various radii, the sharpest being 37-ft. radius, and a balloon curve of 50-ft. radius forms part of the line.

As regards gradients, fairly long grades of 1 in 17 and 1 in 18 are used on the straight, though there is a grade of 1 in 18 on a 100-ft. curve. This is equivalent to a grade of 1 in 14 on the straight.

The rails used were the ordinary mine-track type, weighing 16 lb. per yd., with the usual light-steel sleeper weighing about 6 lb. The loco.-tractor, as will be seen in the illustration, is a rubber-tired road tractor which was converted for use on the trial railway. The only alternation that was made was in fitting the front axle with a ball socket, so that a four-wheeled rail bogie may support the front portion of the loco.-tractor, instead of the usual steering wheels. The latter are raised up clear of the ground when the loco.-tractor is running on the railway. The weight of the loco.-tractor is so distributed that 3000 lb. rests on the rails and 5655 lb. on the driving wheels.

THE LOCO.-TRACTOR IS QUICKLY CONVERTIBLE

The loco.-tractor can, in a few seconds, be converted from road to rail, or vice versa, so that the utility of the machine is exceptional. It is as serviceable on the road as on the rail, without any alteration whatever. The tractor is fitted with a 35-hp. engine using kerosene as fuel. The rear axle is driven by a worm drive, and it is believed that this is the first instance where the worm drive has been used as the final drive for traction purposes. The driving wheels are particularly large, being 4 ft. in diameter, and the twin rubber tires are 5 in. wide. One of the most remarkable features of the test was the accuracy with which the driving wheels aligned themselves to the setting of the steering bogie on the rail track. No matter how many times or in which direction the loco.-tractor ran over the course, the driving wheels followed the same "spoor" exactly. The trucks used on the trial were high-sided bogies with a floor space 16 ft. long by 5 ft. 6 in. wide. The test load of 16 tons was made up with railway sleepers.

SPEED ATTAINED EXCEEDS EXPECTATIONS

In view of the adverse conditions of the test, and also of the fact that the track was composed of crippled and bent rails, it was thought that only low speed would be possible, but it was found that the loco.-tractor rode easily at 18 miles an hour and took the 50-ft. curves at 12 miles an hour with perfect steadiness. Attempts were made to derail the loco.-tractor on the sharp curves, and excessive speeds were run, but it was found impossible to cause a derailment.

The loco.-tractor could stop and start with a full load on any grade or curve on the trial track, without any jerking or slipping, and this with the full weight of the train hanging on the tractor. During the heavy rains last summer a cloudburst occurred at Canada Junction, which washed away a considerable portion of the trial track, leaving holes over a foot deep, and in other places piling gravel and earth on the track to a depth of several inches. Except for having to reduce speed very considerably, the tractor successfully passed over these obstructions, which had not been removed.

The trial at Canada Junction sufficiently demonstrated that the principle is entirely practicable; indeed, the small tractor available did much better in every respect than was expected.

Consolidated M. & S. Co., of Canada

The annual report of the Consolidated Mining and Smelting Co., of Canada, for the year ended Sept. 30, 1918, indicates that the fiscal year began under unfavorable conditions. The cost of producing zinc was still very high, and the Imperial Munitions Board had canceled its lead contracts. The costs of producing and smelting Rossland ore were steadily increasing, and the margin of profit had disappeared, and the coke supply was very uncertain, both as to quantity and price. All materials were almost prohibitive in cost.

Labor was extremely restless, owing to the ever-increasing cost of necessaries and to the continued agitation of a number of men with strong I. W. W. tendencies, who endeavored to promote sabotage, misunderstanding, and discontent. Every means possible was adopted to avoid a breach with the men, but, finally, demands were made in such a manner and in such direct repudiation of a definite agreement recently negotiated, that they could not be conceded. The men walked out on Nov. 15, 1917. The staff closed down the plant, unloaded the incoming freight, shipped out the metals on hand and kept the plant in repair. After six weeks' cessation from work, the views of the majority of the men (who never really favored the strike) prevailed, and the men returned to work under the terms of the agreement.

The year's operations were expensive, owing to intermittent operation, shortage of tonnage caused by the reduced purchasing power of gold, making mining operations impossible, and heavy overhead expenditure. The work was conducted with a view to holding the loss down as low as possible. The metallurgical results showed improved gold recoveries.

Operations at the lead-smelting plant continued to be unprofitable during the first part of the year. This was owing mainly to the fact that the metal recoveries were not as high as the quantities paid for. The metal losses were smaller than they had been for many years, but the prices paid for the metal lost were extremely high. In former years, each unit of lead lost cost the company from 40 to 50c., whereas in 1917-1918 the same amount of metal cost as much as $2.20.

In the latter part of the year much improvement was made in extracting the lead from the smoke. The percentage of extraction has already shown a substantial increase, although the installation to take full advantage of the recent discoveries is not yet completed. For many years the rates charged for smelting customs lead ores were too low to cover the metallurgical losses and operating expenses. On Feb. 1, 1918, these rates were advanced to cover expenses and insure a small profit.

Both of the lead and copper refineries worked on small tonnages most of the year, and they were handicapped on that account. The lead refinery showed a reduction in costs, especially in the latter months of the year, and proved that for small tonnage plants the Betts process can compare favorably with the Parkes process. The acquisition of a fluorspar mine will insure a further reduction in cost, the fluorspar needed having formerly been purchased in the East.

In the copper refinery the costs have been about as low as could be expected, with the exception of the melting and casting of refined copper. The great variety of shapes required by munitions orders for the small tonnage handled, and the difficulty in securing competent labor to do this work, made it advisable to have the copper cast in transit at Great Falls, Mont. In the meantime the melting plant is being enlarged and equipped to handle commercial orders.

The sulphuric and hydrofluosilicic acid plants were successfully operated throughout the year. Several improvements were made in the hydrofluosilicic acid plant, and there is now no difficulty in making sufficient acid to operate the entire plant.

Many important changes have been made in the zinc plant and concentrator. At the beginning of the year and prior to that date the cost of producing zinc was so high that it would have been impossible to keep the plant running when zinc dropped to its normal price. The plant was thoroughly reorganized, and large reductions were made in costs. Large-scale experimental work proved that further improvements could be made, more particularly in concentration. These are now being installed in the plant, and, when completed, will reduce the cost of producing zinc much further, and will also enable the lead and silver of the Sullivan ore to be reclaimed. The whole process has been worked out and designed for the complex ores of the Sullivan mine. It is possible, though, that other ores may be treated in the same way, but sufficient work has not yet been done to indicate which ores may and which may not be so treated. The year's developments and improvements have demonstrated that at last the problem of handling the complex Sullivan zinc ore has been solved.

With a plant operating on from 1000 to 2000 tons of this ore per day there should be no trouble in producing zinc and lead at a profit on any market that has existed in recent years, provided that the cost of labor and supplies falls with the price of these metals. This successful solution of the problem makes available many millions of tons of mixed ore in the Sullivan mine which formerly could not be considered commercial ore, although high in metal content.

Although all the present plant will be used, substantial expenditures on capital account must be made for the necessary extensions to treat the large tonnage mentioned; besides, it will take a considerable time to do this work.

The research department, which has become an important part of the organization, worked on the concentration of the ores in Consolidated and other mines; the metallurgical smoke problem; the manufacture of different chemicals from byproducts, and the solution of the various difficulties in the company's different processes. Some headway has also been made on the concentration of the low sulphide ores from Rossland. These results are especially encouraging, as the portion of the Rossland ores most amenable to concentration is that which is the most difficult and expensive to smelt. Great strides have also been made in reducing the costs and increasing the efficiency in the mines, though the full force of these will not be felt till working conditions become normal again.

In concluding the statement from which the foregoing abstract is taken, S. G. Blaylock, the assistant general manager, calls attention to the whole-hearted loyalty and energy of the staff who have been working out the various problems, and mentions W. M. Archibald, manager of mines, and his efficient staff; T. W. Bingay, controller; James Buchanan, smeltery superintendent; B. A. Stimmel, assistant manager of the zinc plant; J. K. Batchelder, superintendent of refineries; R. W. Diamond, superintendent of concentration and testing; G. F. Chapman, construction engineer; W. E. Jones, mechanical engineer; G. E. Murray, assistant superintendent of smeltery; A. L. MacCallum, superintendent of acid plants; F. E. Lee, W. H. Hannay, and R. K. Blois, research engineers; R. Vaughan, F. S. Willis, H. Woodburn, and R. G. S. Anthony, department superintendents in the zinc plant; R. H. Hatchett, chief chemist; and F. E. Beasley, assistant superintendent of refineries. E. H. Hamilton resigned from the staff early in the year, and F. N. Flynn resigned on Aug. 31.

Additional statements are appended signed by James J. Warren, managing director; W. M. Archibald, manager of mines; T. W. Bingay, controller; and L. A. Campbell, vice-president and general manager of the West Kootenay Power and Light Co., Limited.

Portland Cement in 1918

Estimated shipments of portland cement in 1918 amounted to 71,645,000 bbl., valued at $113,910,000 compared with 90,703,474 bbl., valued at $122,775,088, in 1917, according to the U. S. Geological Survey. The figures show a decrease in quantity of 21% and in value of 7.2%, and, in fact, the output was the lowest recorded since 1909.

Exports of hydraulic cement from the United States for the first 11 months of 1918 amounted to 2,025,178 bbl., valued at $5,257,285, or $2.59 per bbl. The exports for all of 1917 were 2,586,215 bbl., valued at $5,328,536, or $2.06 per bbl. The decrease in output was the effect of the war restrictions imposed by the Government upon fuel supplies, transportation facilities, labor, and private construction work in general.

Two new plants produced portland cement in 1918—the Old Mission, at San Juan de Bautista, Calif., and the Three Forks, at Hanover, Mont.; and six plants were idle during the year, one each in California, Kansas, Michigan, Nebraska, New Jersey, and New York. The total number of producing plants in 1918 was 114, and the total number of plants that shipped cement was 115. The average factory price per bbl. for portland cement in bulk in 1918 ranged from $1.34 in the Tennessee-Alabama-Georgia district to $1.91 in California. The average price for the whole country was $1.59 per bbl. in 1918, compared with $1.354 in 1917. The wholesale market price of portland cement per bbl. at New York during 1918 ranged from $2.14 in January to $2.90 in September, compared with a range of from $1.92 to $2.12 per barrel in 1917.

Mine Motor Starters

Because of the injurious effects of moisture in mines, and the consequent severe operating conditions, special care must be exercised in the selection of motor starters and controllers, particularly those used for the ventilating fan and pump motors, as in most mines these two pieces of apparatus must be kept in continuous operation. Another condition which affects the operation of motor starters is the wide fluctuation in generator or line voltage caused by mine hoists and locomotives. For these reasons the standard design of hand or automatic starter will not operate satisfactorily, and one should be selected which is especially adapted for the conditions to be met.

A mine motor self-starter manufactured by the Cutler-Hammer Manufacturing Co., of Milwaukee, has recently been redesigned and now embodies several operating and protective features essential to the continuous operation of a ventilating fan or pump motor. Plain hand starters and starters without self-resetting features will drop to the "off" position every time a large decrease in voltage occurs. This, of course, stops the motors controlled by them, and serious results may follow. When a motor receives current at a voltage considerably lower than its rated potential, it will slow down; and it will stop when this voltage drops to a certain point or when the current is off. Control apparatus is required that will automatically insure the continuous running of the pumps and fans, even if at reduced speed, and that will also restart them.

To meet these conditions the starter mentioned, which is of the pilot-switch accelerator type and adapted for motors up to 100 hp., is equipped with a rugged relay which is sensitive and positive in its action. This relay guards against injury to the motor, and it causes all of the armature resistance to be inserted in case of a considerable drop in voltage, thus checking the heavy current resulting from the decreasing counter electromotive force. If the line pressure falls to about 80% of normal, the relay drops out, opening the control circuits to the accelerating switches, which drop, in turn, and cut into circuit the heavy-duty starting resistance, which has capacity for continuous service at low voltage. The motor then runs at slow speed until the voltage increases. At about 90% of normal, the relay pulls in again, cutting out the resistance and permitting the motor to accelerate to normal full speed.

A single coil overload, where shunt-wound motors are used, can be added to insert the armature resistance, in case of an overload, and thus keep the fan or pump going at a reduced speed. This single-coil overload and the voltage relay prevent the shunt motor from "flashing over" under severe voltage fluctuations. When the voltage drops to a low amount, the motor tends to run as a generator and is likely to "flash over" across the brushes, thus injuring the motor and commutator. With a compound motor the overload is not so necessary, because, when the motor tends to run as a generator, the compound winding opposes the shunt winding, neutralizing the field and preventing those conditions which result in "flashing over."

French Iron Mines and Steel Works in the invaded regions are to be reconstructed and reorganized by the "Société Corporative des Mines de fer et de la Sidérurgie des régions sinistres" which has recently been formed for the purpose of conducting commercial or industrial operations in this connection, according to the *Ironmonger*. The company is affiliated with the "Comptoir Central d'achats industriels pour les régions envahies," and has its offices with that organization at 40 Rue du Colisée, Paris. The new company is practically a technical commission of the Comptoir Central. For convenience, however, a separate share company has been organized. Its capital stock of 1,000,000 fr., divided into 2000 shares of 500 fr. each, is held by iron-mining and steel companies owning properties in the invaded regions of France. The society is administered by a "Conseil d'administration" (corresponding to a board of directors), composed of not fewer than 10 and not more than 25 members, elected by the shareholders. The new company is making estimates of the raw material and equipment that will be needed to restore the damaged iron mines and steel works in the northern and eastern part of France. Its method is to gather the best information available regarding the extent to which iron mines, blast furnaces, and steel works have been destroyed, and on the basis of these data prepare purchase programs covering the materials needed for replacement.

Defining "Tailings" and "Residues"*

By A. W. Allen

Precise interpretations of the word "tailing" elude search among the more important technical treatises—with one exception. A comparatively recent textbook on ore dressing states that it may be defined as "material containing a metallic content in insufficient amount to warrant the expense of further treatment." This interpretation seems to conflict with recognized opinion on the subject. If a tailing is valueless, then what word can be used to designate the third product from a concentrating table, that subsequently undergoes further reduction and additional treatment; or the material from an amalgamation plant, that still contains a considerable proportion of gold, recoverable by cyanide; or the dump of sand awaiting treatment?

Failing to discover any acceptable definition, I turned to the Standard Dictionary, to find the word "tailing" defined by the Funk & Wagnalls authorities as "those portions of washed ore that are regarded as too poor to be treated further; used especially of the débris from stamp mills and other ore-dressing machinery, as distinguishable from material that is to be smelted." An archaic conception, possibly of reasonable acceptance about the middle of the last century, but somewhat out of date at present. "The débris from stamp mills"! And this definition was revised many years after a new process had multiplied the world's output of gold by making the treatment of this "débris" practicable. For further enlightenment I then turned to Webster's New International Dictionary, to read: "The lighter or refuse ore accumulated at the lower end of the buddle or washing apparatus, or carried away by the water."

The extended usage of a word in a particular and generally accepted sense is sufficient justification for its continuance. In the present instance, however, it is obvious that new methods in metallurgical work have resulted in an altogether different conception of finality in treatment. What was too poor to mine 50 years ago would now appear a bonanza. The alteration in conditions and the startling results of intensive research have revolutionized methods of handling. The material may remain substantially the same; its appellation is unaltered; the dictionary definition alone demands modification, because progress was unforeseen when it was formulated and passed unnoticed when it was revised.

The alteration in the meaning of the word "tailing" has been almost imperceptible. For a considerable time it was used to designate a material too poor to treat any further. Then came new processes. Tailings were still tailings, but they were valuable. The last word had not been spoken; the air of finality in the definition indicated a mistaken and pessimistic outlook on progress. So the use of the word has been continued in English-speaking countries to refer, in the great majority of instances, to something that would or might repay additional attention, although one product, at least, had been removed. The secondary treatment of what was previously considered valueless developed the necessity for an additional designation for the waste material finally discharged from the plant. The word "residue" was adopted, and has been extensively used in this connection.

In these days of complication in metallurgical treatment, the use of apt terms to designate the various products is a help to the operator and a necessity to the author. In bygone times, in the atmosphere of which our modern dictionaries are prone to linger, when stamp mills produced amalgam and débris, and when the summit of concentration achievement was reached with the single buddle, the need of an extensive vocabulary was less in evidence. Today agreement is a help in the coödination of impressions and experiences; and this cannot be achieved when technicians disagree as to the precise meaning of the words they use.

In hydrometallurgical literature the gold metallurgist was perhaps the first to differentiate between "tailing" and "residue." This was due, probably, to the absolute necessity of distinguishing between the two products. The same development has occurred in concentration practice with reference to the re-treatment of material which was previously considered unprofitable; but concentration specialists are inclined to overwork the term "tailing," by making it refer to all material from which concentrate has been removed, whether in the preliminary, intermediate, or final stages of treatment; or to go to the other extreme and consider it only as a waste and valueless product. If there was any indication of agreement, it would be another matter, and custom could be pleaded as a sound reason for the continued use of a term in the sense of an accepted interpretation. In the present instance there is no unanimity of authoritative opinion, although the need for harmony of expression, to facilitate reference and classification, is an obvious one.

In conclusion, the following definitions are submitted to summarize the points raised, and for the purpose, if possible, of opening a discussion on the subject:

Tailing.—The material from which one or more concentrated or partly concentrated products have been removed, and which is available for further treatment.

Residue.—The waste or final product from a hydrometallurgical plant which, at the time of operation, is valueless as far as metal content is concerned.

---

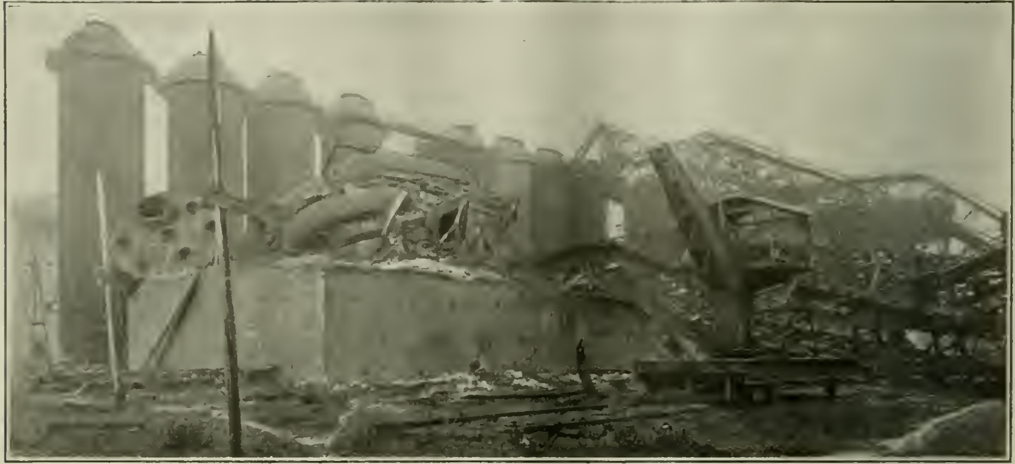
*The third of a series of articles on the standardization of terms used in hydrometallurgical operations. The previous papers, "The Difference Between Extraction and Recovery," and "Leaching and Filtration Nomenclature" were published in the Oct. 26 and Nov. 7, 1918, issues, respectively.

Concentration Table Covering

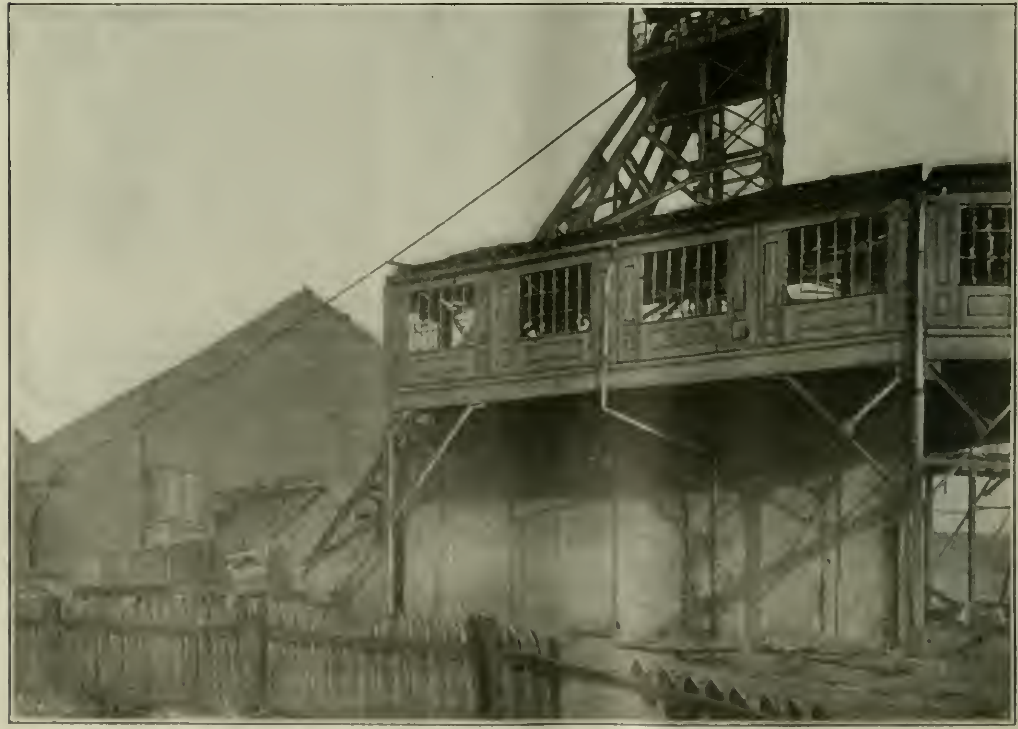
It has always been difficult to obtain a satisfactory covering for concentration tables used in the treatment of mineral ores. In lieu of a better material, linoleum has been largely used for the purpose, but the abrasive action of the ores, and, in the case of mine waters containing sulphuric acid, the corrosive action of the acid, soon destroys the linseed-oil content of linoleum.

Minefab is the name of a new material which has been specially developed to meet the requirements demanded, and a recent service-testing program, carried on simultaneously in a number of different mining districts, has proved its value. It is made with a heavy fabric base, coated on both sides with an extremely tough, flexible, protective film of pyroxylin, which ruggedly resists abrasion and is immune to sulphuric-acid corrosion. The coldest weather does not affect its flexibility, and it is absolutely waterproof. Being white in color, the contrast between it and the ore facilitates closer adjustment.

Havoc Wrought by Germans at French Mines

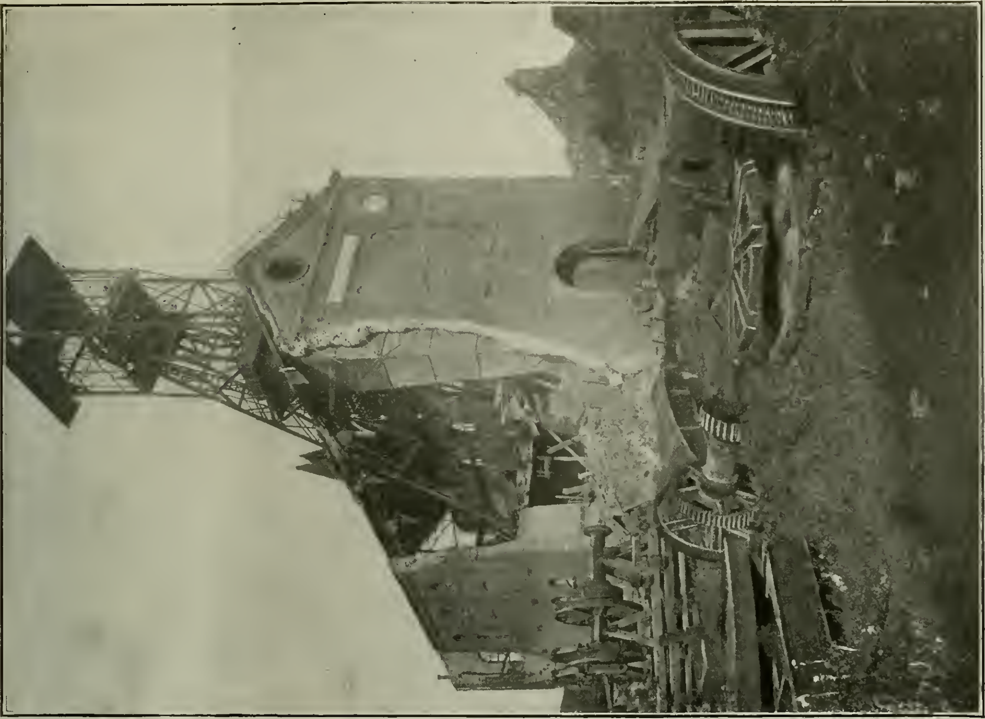


DESTRUCTION OF BLAST-FURNACE PLANT AT WINGHE, PAS DE CALAIS, FRANCE



HEADFRAME AT ONE OF THE ROEUF COAL PITS AT LOURCHES, FRANCE

HOISTING DRUM AT SCHNEIDER COAL MINES, LOURCHES, NORTHERN FRANCE



HEADFRAME AT L'ECLAIREUR MINE, AT LOURCHES

Mineral Production of British Columbia for 1918

THIS British Columbian official statement was prepared before the receipt of the official reports for the year 1918 of the gold commissioners and resident engineers of the province of British Columbia, and the customary returns of mineral production annually made by managers of mines and reduction works; consequently, it must necessarily be regarded as being a preliminary review of the progress of 1918, together with an estimate of the quantities and value of the several mineral products, which it is believed will prove to be approximately correct.

The accompanying table shows an estimated mineral production during 1918 of a total value of $41,083,093. It will be seen that the total value of the production of 1918, as estimated, is $4,072,701 greater than that of 1917, equivalent to an increase of about 11%. As compared with earlier years, the production of 1918 appears even more favorably, for it exceeds the next highest recorded production—$32,440,800, made in 1912—by $8,642,293, or about 26.6%. The value of the products of the metalliferous mines in 1918 was about equal to the preceding year, exceeding it by only about $3687. The great increase made is therefore almost entirely attributable to the products of the collieries, which show outputs, both of coal and coke, exceeding those of the preceding year, the increased output of coal being 142,093 tons, and that of coke 30,751 tons. In addition to this, the selling price of the coal was greatly raised by the exigencies of the war, and these two factors combined caused the value of the colliery products in 1918 to amount to about $12,794,932, an apparent increase over the preceding year of $4,310,589.

MINERAL PRODUCTION FOR 1917-18

The accompanying table shows the quantities and value of the several minerals produced in 1917, and the estimated production in 1918. It may here be explained that the prices used in calculating the estimated value for 1918 of silver, lead, copper, and zinc are the average prices for the year, as published in the *Engineering and Mining Journal*, less a deduction of 5% off silver, 10% off lead, and 15% off zinc.

NOTES ON GOLD PRODUCTION FOR THE YEAR

Practically all the placer gold was obtained in the Cariboo and Cassiar districts, only about one-tenth of the total coming from the other regions.

During the last four years the production of placer gold in the province has steadily decreased. The chief reason is to be found in the economic conditions of high prices for labor and supplies, which made placer mining less profitable than in former years. Also, shortage of labor handicapped operations. So many men left for active service in the war that the number of individuals mining in a small way was materially less than in former years.

There are undoubtedly many deposits of gold-bearing gravels in the Atlin, Cariboo, and other districts, which, under normal conditions, will yet be worked either by hydraulicking or dredging. The increased demand for gold and probable lowering of costs now that the war is over should cause renewed interest in placer mining.

With regard to the increased production in lode gold, it must be considered that the 1917 gold production was abnormally low, the output for the years preceding the war varying from $4,000,000 to $5,000,000. The increase in 1918 over the preceding year is due largely to the entry into the producers' list of a new mine—the Surf Inlet property of the Canadian Belmont Mines—which made an output of about 43,000 oz. But for this added production, the gold output for 1918 would have been practically the same as in 1917.

The following table shows the estimated production of lode gold in British Columbia for 1918.

ESTIMATED BRITISH COLUMBIAN LODE-GOLD PRODUCTION, 1918, BY DISTRICTS

	Ounces
Boundary-Yale	56,734
Rossland	38,096
Skeena	48,621
Coast (Southern)	5,800
Lillooet	2,140
Nelson	4,300
All others	1,585
Total	157,276

The approximate silver production of the various districts for the year is estimated to have been as follows:

ESTIMATED SILVER PRODUCTION IN BRITISH COLUMBIA IN 1918 BY DISTRICTS

	Ounces
Slocan and Slocan City	1,353,265
Skeena	306,422
Fort Steele	288,540
Boundary-Yale	248,085
Ainsworth	225,020
Windermere-Golden	139,250
Coast	115,120
Omineca	96,758
Trail Creek	58,484
All others	55,917
Total	2,886,861

About 75% of the total output of silver comes from the treatment of silver-lead-zinc ores, and the remainder mainly from the smelting of gold-copper ores carrying silver.

LEAD SHOWS INCREASE IN QUANTITY AND DECREASE IN VALUE

The total amount of lead produced in 1918 as compared with the previous year shows an increase in quantity of 6,642,196 lb., but, owing to the lower market price of lead, a decrease in value of $6393.

ESTIMATED PRODUCTION OF LEAD IN BRITISH COLUMBIA, IN 1918, BY DISTRICTS

	Pounds
Fort Steele	19,340,800
Slocan	11,665,700
Ainsworth	7,157,400
Windermere-Golden	3,031,000
Nelson	2,146,581
All others	608,180
Total	43,949,661

The above figures show, as compared with the previous year, that the lead production in 1918 was increased in Fort Steele, Ainsworth, and Windermere-Golden districts and that there was a slight decrease in the Slocan and Nelson outputs.

COPPER PRODUCTION INCREASED

The amount of copper estimated to have been produced in 1918 shows, as compared with the previous year, an increase in quantity, but, owing to the lower market selling price, a decrease in value.

The Hidden Creek mines and the smeltery at Anyox of the Granby Consolidated Mining and Smelting Co. were operated practically continuously throughout 1918, although closed for a short time by a strike, which was soon settled.

ESTIMATED PRODUCTION OF COPPER ACCORDING TO DISTRICTS IN BRITISH COLUMBIA, IN 1918

	Pounds
Skeene division	30,925,928
Southern Coast district	19,470,760
Boundary-Yale district	10,324,992
Trail Creek division	2,043,560
Omineca division	562,000
All others	59,770
Total	63,387,010

The Granby Co.'s mines at Phœnix were unable to supply the smeltery at Grand Forks with sufficient ore to run the smeltery at capacity. The ore reserves of these mines are approaching exhaustion, and the large-scale production of former years cannot be maintained. Also, the high operating costs during 1918 left little margin of profit in working the low-grade ores at Phœnix. To quote the Granby Co.'s annual report: "The old Phœnix mine has been run more from patriotism than hope of profits."

MINERAL PRODUCTION FOR 1917-18

Material	Production, 1917		Estimated Production, 1918			
	Quantity	Value	Quantity	Value	Increase	Decrease
Gold, placer, oz	24,800	$496,000	15,400	$308,000		$188,000
Gold, lode, oz	114,523	2,367,190	157,276	3,250,895	$883,705	
Total gold		$2,863,190		$3,558,895	695,705	
Silver, oz	2,929,216	2,265,749	2,886,861	2,601,120	335,371	
Lead, lb	37,307,465	2,951,020	43,949,661	2,944,627		6,393
Copper, lb	59,007,565	16,038,256	63,387,010	15,681,946		356,310
Zinc, lb	41,848,543	3,166,259	36,149,894	2,501,573		664,686
Total metalliferous		$27,284,474		$27,288,161	3,687	
Coal, tons	2,149,975	$7,524,913	2,292,068	$11,460,340	$3,935,427	
Coke, tons	159,905	959,430	190,656	1,334,592	375,162	
Total collieries		$8,484,343		$12,794,932	$4,310,589	
Miscellaneous and building materials		$1,241,575		$1,000,000		241,575
Total production		$37,010,392		$41,083,093	$4,072,701	

The Canada Copper Corporation, operating the Mother Lode mine and smeltery at Greenwood, treated a slightly smaller tonnage in 1918 than in 1917, from which approximately 2,200,000 lb. of copper was recovered, together with low gold and silver contents. Toward the end of 1918 the smeltery was closed, the ore reserves at the Mother Lode mine being exhausted.

Copper mining is now firmly established as the most important form of mining in the province, and from all indications it should maintain this place for years to come. In 1918 it formed 38% of the total value of the mineral production for the year.

Zinc Output Shows Decrease

The estimate of zinc output may be low, as it has been difficult to get information regarding shipments to the United States. The 1918 production is valued at $2,501,573, as compared with the 1917 value of $3,166,259, due to the decreased market price of the metal.

ESTIMATED PRODUCTION OF ZINC IN BRITISH COLUMBIA IN 1918, ACCORDING TO DISTRICTS

	Pounds
Fort Steele	22,000,000
Slocan	13,601,954
Omineca	327,940
Ainsworth	220,000
Total	36,149,894

The estimate for Ainsworth is only about one-quarter of last year's production, but final figures may increase the output for this division considerably.

Iron—The year 1918 produced a great demand for iron and steel on the Pacific Coast, the normal demand having been greatly increased by the need for steel in shipbuilding and munitions work, whereas the usual outside sources were monopolized by war needs in other parts of the world and the high freight rates made the lack of local production more pronounced. Consequently, it was suggested that the conditions are favorable for the establishment of an iron-smelting plant somewhere on the British Columbia coast. So far nothing definite has materialized, although there is apparently a prospect of such a plant being established. As is well known, there is on the coast an adequate supply of magnetite ore, sufficiently free from impurities to be within the "bessemer limit," to supply ore for such a plant.

During the summer months of 1918 the provincial government engaged Dr. Alfred Stansfield, of Montreal, to make a report on the commercial feasibility of smelting British Columbia magnetites in an electric furnace; the abnormal price of iron due to war conditions offering a possible field for that class of smelting. Dr. Stansfield's report will soon be made public.

Platinum—The very insistent demand for platinum for war purposes caused a most exhaustive search to be made for it in commercial quantities by the Dominion government officials. A number of drill holes were sunk in the Similkameen district, the final results of which are not yet available. A small amount of crude platinum was saved as a byproduct from placer-gold workings, the exact quantities not being known.

Molybdenite—The urgent demand for molybdenite for war purposes continued throughout the first half of 1918, but gradually the market fell away. During the year a carload of molybdenite ore, carrying also gold, cobalt, and arsenic, was shipped from the Hazelton View mine, Hazelton, to the Mines Department at Ottawa for treatment. Returns on it have not been received. A small shipment of molybdenite was made from the Golconda claim, Osoyoos mining division. No other molybdenite shipments were reported.

Chromite—About 800 tons of chromite ore, carrying from 30 to 45% chromic oxide, was shipped from the Mastodon claim, Grand Forks division, in 1918, and a deposit on Scotty Creek, near Clinton, was opened up, but no shipments were made. With the end of the war the market for chromite temporarily collapsed, as large stocks are available, with no purchasers in sight.

Manganese—Fifteen carloads of ore, containing from 35 to 50% manganese, was shipped from the Curle Manganese group, near Kaslo. A large deposit of good-grade manganese was discovered during the summer of

1918 near Cowichian Lake. No shipments were made.

Non-Metallic Minerals—One hundred tons of fluorspar was shipped from the Rock Candy group, in the Grand Forks division. This property is owned by the Consolidated Mining and Smelting Co. and is being equipped to make steady shipments in the future. The mineral is shipped to the Trail smeltery and is used for making hydrofluoric acid, which is used in the lead refinery.

Shipments of magnesium sulphate (Epsom salt) were made from Spotted Lake, Osoyoos division; and 170 tons of magnesium sulphate was shipped from deposits near Clinton. Deposits of hydromagnesite in the Clinton division attracted considerable attention, but no shipments have been recorded.

A production of arsenic valued at $20,000 was made by the Nickel Plate mine in 1917, and although no figures have been received, a similar production is thought to have been made in 1918.

Zinc Used in Construction of New Jersey Zinc Co.'s New Building

A new building was recently completed for the exclusive use of the New Jersey Zinc Co. This concern, which has stood sponsor for many new uses of zinc in various forms, realized that for building purposes rolled zinc possessed many desirable features. Accordingly, plans were made, when the building was projected, to utilize sheet zinc in the structure and to use as much zinc in other ways as possible. This was at a time well in advance of the ruling of the War Industries Board which called upon manufacturers, as a patriotic duty, to substitute zinc for other metals in the nonferrous field for a great variety of uses.

Flashings, gutters, and all other outside work upon the building are made of rolled zinc, this material having been substituted for copper, thereby effecting a material saving in cost. The substitution of zinc for copper offers a new field whereby building costs can be decreased, and the future should bring increased use of this metal for the foregoing purposes. Sheet zinc is easily worked and is non-corrosive, and its durability has been thoroughly demonstrated in Europe, where it has been employed for more than a century.

Over each door of the new building is carved a horse's head, the company trademark. The entrance and vestibule doors are constructed of sheet zinc rolled on wood. The knobs and locks are made of zinc plate, a detail that is embodied throughout. Zinc composition is the material used for the hinges. Side walls of the elevators immediately inside are of zinc construction. Likewise, the elevator doors and bell plates are zinc coated, giving a rich satin finish. All of the window hardware is manufactured from zinc plate. This includes sash, locks, and handles. A complete ventilating system is installed throughout the building. The grilles for the registers were first stamped and then zinc plated.

In the interior fixtures, zinc materials are consistently employed. This metal is used in the hardware, including trimmings and fittings, of the mail chute. Some of the panel doors inclosing cutout boxes, enunciator boxes and all low-tension work in the electrical equipment are made of zinc plate. The lighting fixtures are also zinc plate, and frames for the illuminating lamps are spun from rolled zinc sheets. Ornaments that are to be found throughout the building have been cast from zinc.

Paint, enamels and tints that compose the interior decorations include zinc oxide and "Lithopone" (zinc sulphide-barium sulphate) as ingredients. These are ordinarily used by paint manufacturers in the higher-grade paints and enamels, however, and their use is, therefore, not considered unusual in this structure. Many of the furnishings to be used are designed to be in keeping with the structural features of the edifice. These include desk fittings and office supplies, all of the materials for which are products of the company. This applies even to the window shades, which contain "Lithopone."

NEW JERSEY ZINC CO. BUILDING, NO. 160 FRONT ST., NEW YORK

The amount of zinc used in the construction of the building is shown in the following items: The front doors contain 150 lb.; roofs and gutters, 700 lb.; lighting fixtures and equipment, 350 lb.; electric switch plates, 175 lb.; outlets, 45 lb.; hardware, 700 lb., and sherardizing consumed 100 pounds.

The utilization of zinc in buildings as described in this instance is an economic feature which is believed to be susceptible of greater development, especially for household purposes.

Deep Mining on the Rand

The lowest workings on the main incline from the Turf Mines shaft of the Village Deep have now reached sea level, i.e. 5,633.69 ft. vertical, which is the greatest depth at which mining is now done on the Rand, states the *South African Mining Journal*. All the natural obstacles to working at this depth have been successfully overcome. The rock pressure has proved the chief obstacle, but this has been countered by the special methods of support adopted. The increased heat has likewise been offset by adequate ventilation.

Melting Silver, Nickel, and Bronze Alloys By Electricity

THE operation at the Philadelphia mint of a 1000-lb. Rennerfelt electric melting furnace throughout 1918 demonstrated the fact that melting silver, nickel, and bronze alloys by electricity is economical and saves both time and labor. Tests have been thoroughly satisfactory, and have indicated savings of approximately 40% in costs of melting. It is purposed to install similar furnaces at both the San Francisco and Denver mints. For the Philadelphia mint two additional furnaces of the same type have been ordered, one of 1000-lb. and the other of 1-ton capacity. The new furnaces will be equipped with improved power-tilting and power-pouring devices, by which each furnace will rotate about the pouring lip as a fulcrum. This will permit of molten metal being poured directly into molds mounted on trucks running on a track that will pass under the pouring lip, the trucks being propelled by electric motors with automatic stop. Direct pouring of molten metal will obviate the necessity of pouring into ladles and then into molds. The new furnaces will also be equipped with automatically controlled electrode feeds, by which the temperature will be regulated.

The electric current was first turned on in the operation of the 1000-lb. Rennerfelt furnace, on July 9, 1917, being supplied from an outside source. It is of 3-phase, 60-cycle, and 2200 volts, transformed at the furnace to 110 volts. The total weight of the complete furnace ready for current is 12 tons.

It was several weeks, however, before conclusive evidence from numerous tests indicated that the furnace fully met requirements. There seems to be no absorption by the nickel of the carbon in the incandescent electrodes, which would result in inferior metal. It has been stated that the atmosphere in the furnace under heat is non-oxidizing. Results, however, have shown that every precaution must be taken to keep the surface of the molten metal covered if good non-oxidized ingots are to result. Should the furnace attendant neglect to keep the door closed and the metal covered, oxygen from the outside air will, of course, cause trouble. In any open furnace where the crucible is dispensed with, there will always be more or less trouble attributable to refractories fusing and being carried into the ladle or mold. It has been found, however, that practically all this difficulty is obviated if a spout is built upon the ladle, so as to secure the good results of a bottom pourer. The question of loss of heat between the furnace and the molds is a point worth consideration, and although a bull ladle is now being used at the Philadelphia mint, on account of the present furnace not fulcruming at the spout, it is hoped, as before stated, ultimately to pour directly from the furnace into molds. The chilling effect of a thin stream across 18 in. or more of spout results in the molten metal taking a sinuous course, which is indeed not only difficult to direct properly, but, by reason of its small cross-section, is soon too cool to make good bars. At the Philadelphia mint it is the practice to hang a 200-lb. ladle in the shank on the bearings attached to the front of the furnace. This ladle can be rapidly filled without spilling the metal, and the melters are relieved of the weight during the pouring period. As the turntables carrying the molds are within 10 ft. of the furnace mouth, the operation of taking off a heat with two ladles, pouring simultaneously into two sets of vertical molds, consumes 15 min. and is done with no confusion. The mint operatives prefer the shank with one swivel end. The weight of the ladle, shank, and metal is about 200 lb. This weight is borne by the two men only a fraction of a minute, after which the shank is placed on a bail on the chain hoist in position for pouring. As the ladle is emptied, the man on the swivel end of the shank operates the chain to maintain a proper pouring distance between the lip of the ladle and the mouth of the mold.

To avoid oxidation during the period of filling and emptying the ladle, as the pouring from the furnace starts, some granulated pine charcoal is immediately placed on top of the molten metal in the ladle. Owing to the provision of a specially constructed skimming spout, the charcoal is held back, the surface remains well covered, and only clear metal free from carbon flows into the molds. Though ordinarily no metal shows the results of oxidization within the furnace itself, this is possible, particularly on scrap metal, where chips presenting a comparatively large surface are used, and the necessary precautions not exercised. Where the melts consist mostly of bar metal, operatives are seldom annoyed by this bugaboo, which is so well known by all melters of non-ferrous alloys.

This electric furnace is rated at 125 kw. and 750 lb. of metal. It has been found, however, that 1000 lb. per charge is correct, and the men endeavor each time to hold the heat at that weight. This provides for 33 bars before shearing, which will measure 24 in. in length, 4½ in. wide, and 1 in. thick. The furnace is never allowed to cool off entirely, except when repairs may be necessary. After a run of 8 to 12 hours, if a shut-down period follows, coke or lump charcoal is thrown in the hot furnace, and added from time to time until the current is again thrown on. There is no difficulty incident to stirring the metal in this furnace, and analyses on cupro-nickel and bronze alloys show a good mixture. The cupro-nickel melts are not stirred, the temperature at pouring being sufficiently high to bring about a thorough mixing. The volatilization loss in the furnace would seem to be somewhat higher on zinc in the bronze alloy than in crucible furnaces, the assayer reporting losses averaging about one-half to three-fourths of 1%. Figures, however, on this volatilization loss are not yet conclusive.

The furnace has proved its worth on cupro-nickel, bronze, and on silver-coin melting. In the latter case samples taken from top and bottom of a 1000-lb. melt showed homogeneity. In an alloyed melt, and when reducing fineness from 902 to 900 with the comparatively

---

*Abstracted from the 1918 report of the Director of the Mint, Treasury Department, Document No. 2822, p. 11.

small amount of copper required, assay returns were most encouraging, and there is a good prospect of being able to use the furnace for silver-ingot making. The first roof on the furnace lasted for 799 heats, and the cylinder was not renewed until 1277 heats had been made, the heats being of cupro-nickel and bronze, the former predominating. In the second run the roof lasted over 1000 heats. The table following shows quantity and variety of metals melted in the electric melting furnace during the fiscal year, and the current consumption per ton of metal melted, and time per 1000-lb. melt:

Variety of Metal	Gross Ounces Melted	Time to Melt 1,000 Lb in Min., Preheated Furnace	Kilowatt-Hour Consumption per Net Ton, Average
Cupro-nickel	15,980,341 80	100	500
Bronze	11,988,277 23	70	300
Silver	10,031,101 00	60	198
Tin	57,147 00	10	46

The cost to melt the most refractory alloy handled at the mint—cupro-nickel—in the electric furnace is $9.45 per net ton, which is less, by 50%, than the amount incurred when gas and crucible melting is practiced.

The Aftermath in Paris and London

By Mark R. Lamb

France has begun to beat her arms into plows and other useful things. Shell steel is being diverted to other uses. A few score of German field guns are grouped around the Arc de Triomphe, and may stay there, but the exhibition shows how quickly such instruments become worthless except as scrap steel. They are rusty, parts are gone, and there is an impulse to call the oxy-acetylene man to cut them up for the electric or openhearth furnace. An interesting (and perfectly safe) stunt is to stand behind the guns and peep out through the bullet holes in the steel shields, trying to imagine how it would be to see and hear how such holes are made. An insignificant, unpretentious ruling was made today by the postoffice. Hereafter mail to and from Luxemburg will be paid on the same basis as the other parts of France and her colonies. I wonder if Mr. Wilson saw that?

Register with the police on arrival in England, as you are advised. It is better than to forget. Then get your meat tickets; otherwise you will live on fish and fowl. Curious that there is no shortage of bread in England, and no shortage of meat in France.

Do not come to Europe expecting to buy as cheaply as before the war. It will be a long time before clothes will be reasonable in price. Sugar is not served. You are permitted to import 1 lb. of sugar in your baggage, but more than that will be confiscated. One gentle lady was terribly mortified to see her trunk leaking a trail of sugar, but the inspector (who says the law is foolish) failed to see the leakage. To those of us in the States, who at great personal sacrifice (?) limited ourselves to 3 lb. of sugar monthly, it is a joke to see the entire British nation gravely carrying its sugar ration in its pocket. At breakfast, out comes a paper bag, a soap box or a jewel casket, and its owner carefully selects a suitable lump for the tea and another (to be ground under heel) for the porridge. The ceremony of wrapping this in a paper napkin and grinding on the floor is alone worth the trip to see.

Your most fashionable friend on Piccadilly invites you to tea. The house is gorgeously decorated and furnished with rare things. The owner is wealthy, and his wife a dream of fashion, but—you sit closely around a fireplace. Snow fell last night in London. Yet you look at the fireplace twice to discover the fire. I think the coal allowance is 200 lb. annually for all purposes of the household. The master says: "We realize now that we have not studied heating as you Americans have. We sleep cold, eat cold, bathe cold, and in general live cold."

About the time tea is served the mistress touches the bell, and to the maid languidly says: "Maria, the bones." Maria dutifully goes for the bones—for the soup! The bones are carefully suspended over the fireplace in this magnificent drawing-room, simply for lack of coals in the kitchen. They simmer along, most of the odor coming into the room with the coal smoke, which the wintry wind outside puffs down the chimney. Your insatiable curiosity persuades you to accept the invitation to stay to informal dinner. As the time approaches, the excitement becomes intense. With much trouble the maids and men succeed in scorching the fish and drying out the chops. (You have not yet obtained your meat tickets, so the chops are few.) How you long to show them how cooking on an open fire is done in the mountains!

In all seriousness and perfect gravity, and with no excuses, the dinner is prepared and eaten. And to think that all England is living like that! England with coal for all the world and miners to mine it! Patience! They will soon be back from France. It shows, at least, what Englishmen will stand for in a good cause, and what we in America would have come to, except for the English fleet, and France, and Belgium, and poor little Serbia, and Italy, and those who helped in Russia, and, last but not least, Germany's bad management.

Bring all your money. It is easier than cabling for it. And don't bring travelers' cheques. Everyone except the issuing company itself discounts them heavily. These are a few prices: One little sour orange, 10c.; one little sour apple, 15c.; one nice big apple, $1.20; one large *luscious* pear, 7fr., i.e., $1.40. These are honest-to-goodness prices. Grapes (hothouse variety) are as large (nearly) as golf balls and cost 2c. each. Yes, each—not per pound. A lunch of fish, meat, and potatoes, without wine, $2.

So in considering your branch office, figure expenses multiplied by three as compared with New York. I am not sure your office will pay, but some offices will, and I hope mine is among the number. If expenses are high, prices of American goods are also high. The demand is good. Stores are crowded. Wages are high. Those who have escaped the war must go on living, and they now know better how to live.

The autos are all gone. The wrecks that now infest the streets are of the vintage of 1913, and they look it. They are, many of them, returned from the front line. And how the city needs paint and varnish and is crying for it! Never mind choosing a representative who knows French. Everyone here, even the policeman, has a few words of English. Choose him for his ability to see where your products are needed.

Typewriters are sold at double the American prices. Sixty per cent. of the shoes used in England are made in America and are now double in price. I had planned to take home a nice, heavy English overcoat at a reasonable price, so came over with an old one. It was a mistake. Of course I bought one, because it is necessary to have one on, at least during dinner (it makes me sneeze to think of it); but I'm stung. The wool that once was in English coats has gone to supply blankets for English and American soldiers; so this is not a complaint.

London and Paris are both dark, and it is dangerous for an unsophisticated American to be alone on the streets at night. The Seine is over the walls, and this means that the coal barges cannot navigate. We are cold, but will be colder. The coal is of poor quality, anyway. Many slack heaps in Pennsylvania are coarser than the best grades delivered here. From this it will be seen why any kind of briquet is acceptable. It is a fact that large rectangular briquets are still made. They are stacked carefully each time they are moved. Then when used they must be broken by hand. The small oval briquet is in evidence, and when properly made is in great demand.

The heat is turned on in the hotel morning and evening for an hour, but now that the Peace Conference is on, we keep warm (with rage) wondering if the Germans are to be paid their war expenses. In Paris the men are happy enough, but one sees too many sad-eyed women in mourning. Who will pay *them?*

Yesterday the *Excelsior* published a map of Paris showing the location of every bomb dropped by the Germans—a total of 270, causing 266 deaths and 603 wounded. Today the map is of the shells from the long-range gun—182 shells, with 256 killed and 620 wounded. Will the Kaiser be content when he reads the list and sees the map?

After seeing just one battlefield and devastated city, I am ready to accept a position as Peace Commissioner; and I defy any Frenchman to ask for conditions against Germany that I would not grant.

It seems good to hear American autos and flivvers hooting about the city. There are plenty of American soldiers and officers here, but the first impression is that there are far more Y's and K's than regulars. Perhaps they still have their uses. It is to be hoped that those many shiploads of food for France and England will be sent promptly. It is badly needed, and, besides, if it does not arrive promptly, it will do me no good.

Mount Lyell Mining and Railway Co.

The reports and statements of accounts of the Mount Lyell Mining and Railway Co., Ltd., at Mount Lyell, Tasmania, for the year ended Sept. 30, 1918, show that a profit of £455,898 18s. 7d. was made. After deducting £18,022 13s. 4d. for prospecting and development, £50,397 for depreciation of mine and other plant, £64,403 6s. 4d. for taxes, and £60,000 for appropriation for new plant expenditures during the present year, the net profit from all sources amounted to £247,288 10s. 6d., as compared with £268,611 4s. 4d. for the year ending Sept. 30, 1917.

The total quantity of ore mined was 264,542 tons; and 240,947 tons of mixed material—ore and concentrate—was smelted. The blister copper produced amounted to 5773 tons. The flotation plant treated 29,703 tons of ore, averaging 2.95% copper, and the extractions for the year were 88.06% of the copper, 74.25% of the silver, and 68.24% of the gold.

The new converter plant was put in operation early in August, and is working satisfactorily. The recovery of sulphur from the pyrite is under consideration. Coal-dust firing was applied to a rotary distillation furnace, but the locally obtained refractory materials proved unsatisfactory. Tests are being made with gas-fired furnaces.

The ore reserves show a small increase. The estimates as of Sept. 30, 1918, are: Mount Lyell mine (including South Lyell mine), 2,028,747 tons, containing 0.49% copper, 1.48 oz. silver, and 0.04 oz. gold per ton; North Mount Lyell mine, 1,036,300 tons, containing 6.0% copper, 1.33 oz. silver, and 0.005 oz. gold per ton.

Tomboy Company to Adopt Flotation

The Tomboy Gold Mines Co. has decided to erect a plant for the treatment of its ores by the oil flotation process, and has advised D. A. Herron, the general manager, immediately to place the orders for the material required.

This matter had been under consideration for a considerable period. It was referred to in the annual reports for 1917 and 1918, and by the chairman in his speech at the last general meeting. At that time definite action had to be delayed owing to the war, but now Mr. Herron is confident that, if he can place the orders at once, he will be able to get delivery of the material required in good time to enable the plant to be erected this summer.

The directors have been guided in this matter by a joint report of the general manager and R. M. Raymond (who is acting as the company's consulting engineer during Maj. P. L. Foster's absence on military duty), in which they strongly recommend the adoption of the oil process, and say that "it can conservatively be counted upon to effect a betterment of at least $1 per ton on the present grade of ore." The directors have had the further advantage of personal conferences with Major Foster in London, and he emphatically recommends the adoption of the process and the immediate erection of the plant.

The estimated cost of the plant is $150,000, to be met out of earnings; and on the basis of present output the additional profit derived from its installation should be $12,500 per month, sufficient in 12 months to reimburse the company for the expense that the improvement will entail.

A New Special Mine Pump, to be driven by helical gears instead of spur gears, is being built by the Midwest Engine Co., Indianapolis, Ind. The new pump will be of a duplex, double-acting, power-driven plunger type, unusually rugged in construction, and, because of its special and unique features, it is theoretically calculated to withstand the severe duty imposed by gritty and acid mine water. Experiments to overcome the rapid depreciation in pumps caused by mine conditions have been conducted by the Midwest company for some time, in order to develop a metal of such composition as will withstand deterioration due to acid water. A cast iron has been developed which shows a tensile strength as great as that of cast steel.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Copper Conference Continues

Resolutions urging the enactment of legislation which will make possible the extension of long-term credits to foreign buyers of copper were adopted by the labor delegates from the Western copper-producing areas, who were in Washington during the week ended Feb. 8 conferring with the Secretary of Labor. John D. Ryan, the president of the Copper Export Association, was a party to the conference. He declared that the producers have no secrets which they care to withhold from their men with regard to the present situation. He gave to the conference all the information in his possession which has a bearing on the solution of the problem which confronts the industry. The labor delegates appointed a permanent joint conference committee, which is empowered to confer with their managers in an effort to establish a working agreement as to wages to cover the period of readjustment.

The resolutions which were adopted by the labor delegates are as follows:

Whereas, The copper industry is now confronted with the most critical situation in its history because of an enormous surplus of copper in stock for which there is no market at present; and

Whereas, The Department of Labor, realizing that existing conditions are causing a radical reduction in working forces by the various companies that entails hardship and dissatisfaction, has offered its services in trying to find a solution for the problems; and

Whereas, Mr. Eugene Meyer, Jr., chairman of the War Finance Fund, has assisted in many ways in helping to bring about a readjustment of conditions, and in persuading the various Government departments to hold the copper now owned by them instead of "dumping" it and causing a further demoralization of the market; and

Whereas, Mr. James Lord, president of the mining department of the American Federation of Labor, has worked tirelessly to help solve the many problems that confront us,

Be it resolved, That this conference of men from the mining industry from Arizona, Montana, and Utah express our appreciation to the Secretary of Labor, Mr. Wilson, and his associates in the Department of Labor for the valuable advice and coöperation they have given in this critical time;

Be it further resolved, That we extend to Mr. Eugene Meyer Jr., and Mr. James Lord our sincere appreciation for their efforts in behalf of the men in the copper industry;

Be it further resolved, That we urge the officials of the Department of Labor to continue their efforts to bring about conferences with the employers, that all those interested may coöperate in preserving industrial peace and in solving the big problems of getting the industry on a peace basis.

Whereas, The copper industry in peace times has always depended upon export trade for over half its product, and

Whereas, We deem it to the best interest of labor and industry in this country to help to remedy this temporary breakdown of the machinery of international trade, and

Whereas, It appears upon reliable authority that foreign countries have great difficulty at the present time in financing purchases of the products of our country,

Be it resolved, That this meeting of representatives of the labor of the copper industry do urge and recommend that Congress pass such legislation authorizing Government aid as will furnish the necessary long-term credits to facilitate the resumption of our export trade in raw materials, agricultural products, and manufactured goods

The Senators and Representatives from Montana, Utah, and Arizona were visited by the labor delegates and urged to expedite the passage of a bill which would aid banks and trust companies in extending financial help to all purchasers of copper. The delegates will return to their districts to discuss the results of the conference with their fellow workmen, so as to prepare the way for a prompt readjustment of the wage scale.

The Department of Labor is represented throughout the conferences by Secretary Wilson, Felix Frankfurter, H. L. Kerwin, and Hywel Davies. Mr. Davies is Federal Labor Administrator for Arizona. Eugene Meyer, head of the War Finance Corporation, who was a party to the conferences, is expected to outline the steps necessary to secure the financial aid which will be required.

The comparison of wages paid on the war basis to copper miners, with what would have been paid on a peace basis, according to the sliding scale, which was discussed on page 286 of the *Journal* of Feb. 8, is made in the following table:

WAGES PAID COPPER MINERS ON WAR BASIS AND ON SLIDING SCALE

Comparisons	War Basis	Sliding Scale
26c. copper in Butte	$5.75	$5.00
20c. copper in Butte	5.00	4.50
18c. copper in Butte	4.75	4.25
26c. copper in Clifton	5.00	4.00
20c. copper in Clifton	4.25	3.25
18c. copper in Clifton	4.00	3.00
26c. copper in Globe, Miami and Jerome	5.90	5.15
20c. copper in Globe, Miami and Jerome	5.15	4.40
18c. copper in Globe, Miami and Jerome	4.90	4.15
26c. copper in Bisbee	6.05	5.30
20c. copper in Bisbee	5.25	4.50
18c. copper in Bisbee	5.00	4.25

Among the articles taking the new Shipping Board rate of $1 per 100 lb. from north Atlantic ports to England, Scotland, and Ireland are copper ingots, lead billets, mica, spelter, vanadium, zinc ashes, zinc dross, and zinc oxide. Ferrosilicon takes the rate of $1.50 per 100 lb.; pig iron, $20 a ton; and silver in bars, 1% ad valorem.

The potash bill, which was approved by the Secretary of the Interior and considered by the Senate Committee on Mines and Mining, has been altered and introduced by Senator Henderson. The bill has been restricted to domestic potash, and the time for licensing imports has been reduced from five to two years after the signing of the peace treaty.

The only exceptions to the order of the War Trade Board, dated Jan. 30, which permits the use of a general rather than an individual import license, are tin, tin ore, tin concentrates, metals containing more than 5% of tin, nitrates, spiegeleisen, ferromanganese, Naxos emery ore, Naxos emery, breadstuffs, feathers, furs, meat and meat products, peanuts, and rice.

After extended debate, the House of Representatives by a vote of 71 to 226 refused to instruct the conferees to accept the Henderson amendment providing relief for war-mineral producers, which became section 7 of the Dent bill for validating war contracts. This left the conferees free to insist on numerous changes in the section. The debate in the House showed that body to be about equally divided in regard to the matter of relief for the producers of war minerals.

Protecting American Rights in Mexico

Because of the conditions that have existed in Mexico during the last eight years, with such a disastrous effect upon the lives and property of foreigners in that country and upon the lives, property, and wellbeing of the Mexican people themselves, an organization, known as the National Association for the Protection of American Rights in Mexico, has been formed by a group comprising some of those who responded to Mexico's invitation to invest in enterprises in that republic, as well as others who are desirous of assisting in the protection of American rights and in the promotion of the welfare and peace of the common people of Mexico, who are among the principal sufferers from the chaotic conditions now prevailing.

It must be apparent that the effective, practical, and friendly recognition by the Mexican government of its obligation to protect American and other foreign rights will be followed by a rapid development of Mexico's resources, with increased revenue to the government, reëstablishment of its credit, employment for its people, and a supply of food products more than sufficient for the country's needs. But it is also clear that this development is largely dependent upon the continued help of American capital and enterprise, neither of which will be available for this purpose until the Mexican laws and officials recognize the rights of Americans and afford adequate protection to their lives and property.

The organizers of the association feel that gross injustices have been committed in Mexico to American citizens and to American property rights; that there has been a lack of accurate information concerning the actual conditions which have prevailed and a lack of coördinated effort to prevent their repetition; that there exists a vital necessity for the creation of a medium for the ascertainment of all of the facts bearing upon the Mexican situation, and through which an appeal may be made to public opinion and to the governments of Mexico and of the United States; and that it is only through concerted action, in which it is hoped all persons interested in Mexico may participate, that a condition of stability and responsibility in that country can be effected which will result in the full recognition and protection of American rights.

It seems clear that too much light cannot be thrown upon the facts regarding the Mexican situation, if intelligent and effective action on the part of the American people and representatives is to be secured. To that end the association will, among other things, collect all data regarding foreign industries and enterprises in Mexico, will keep in touch with all decrees, laws, regulations and other developments affecting American rights in Mexico, and will be prepared to furnish information in respect thereto to the Government of the United States and to the American public. It will also make a thorough study of the Mexican situation from historical, legal, and economic standpoints, and will request its members to keep it constantly informed as to such matters as will enable it to prepare a complete report on any violation of American rights in Mexico, upon the resultant paralysis of American enterprises, upon the effects of such acts upon the moral and economic life of the Mexican people, and upon such other matters as bear upon the relationship between this country and its citizens and the Mexican republic and its people.

The association will endeavor to keep itself constantly in touch with the Mexican government and with the government of the United States as to all matters affecting American rights and property, and will at all times be prepared to take and vigorously prosecute such legitimate steps as may be necessary for their protection.

It is the desire of the association not to embarrass the Government (which might have appeared to be the case had this organization been undertaken during the continuance of hostilities in Europe), and not to bring it into conflict with the Mexican government; its chief aim will be to work with both governments upon a friendly and helpful basis with reference to all the aforementioned matters.

If such a program can be carried out, the organization can, it is confidently believed, be of great service in assisting to remove causes of friction between the United States and the Republic of Mexico. The success will be largely dependent upon the extent and character of its membership, which should be nation-wide; and, in order that the largest possible number of members may be secured in the shortest possible time, it is urged that all those who are interested in the object and purposes of the association as above outlined immediately send their names and addresses, together with a statement of the particular nature of their connection with Mexico, to Frank J. Silsbee, Secretary, at the temporary office of the association, Room No. 2800, 120 Broadway, New York City. A blank application for membership in the association, together with such further information as may be desired, will be furnished upon request.

Association of the 27th Engineers

Report of the Secretary-Treasurer

Nov. 24, 1917, to Dec. 31, 1918.

Up to Jan. 1, 1919, this association had received subscriptions and funds from other sources as follows:

Subscriptions as reported in *Eng. and Min. Journ.*	$19,580.95
Additional receipts in 1918, but not reported to end of year	553.96
Interest on bank deposits	197.91
Exchange	.75
Annual dues	5.00
Total	$20,338.57
Uncollected	593.36
Receipts	$19,745.21

Its disbursements have been as follows:

Athletic goods	$2,054.68
Musical instruments and music	2,566.54
Cigarettes and tobacco (not including Christmas present)	2,165.97
Games	95.75
Typewriting machines	341.50
Miscellaneous (cash to company funds)	1,052.30
Wool (550 lb.), cloth, and knitting machines (2)	(a)1,224.39
Miscellaneous goods	13.65
Exchange and bank charges	14.29
Assistance to men and families	(b)133.65
Christmas present, 1918, sent through Lieut.-Col. O. B. Perry	2,500.00
Total	$12,162.72

(a) The actual amount paid for wool purchased was $1834.82, but part of it was sold, the proceeds of which amounted to $610.43, which has been deducted.

(b) $143.65 was disbursed, but $133.65 is entered, $10 having been returned.

The balance on hand Jan. 1, 1919, is $7582.49.

All expenses in administering the fund and the affairs of the association generally were assumed by the *Engineering and Mining Journal.*

I understand that Colonel Perry has made some expenditures in behalf of the men in France, to be paid for out of the Comfort Fund, as to which I have not yet received detailed advices. Consequently, I am unable to include them in the account for 1918.

Following is a report on the activities of the Woman's Auxiliary of the American Institute of Mining Engineers on knitted goods, which supplements a previous report already published.

As has been previously reported, the Association of the 27th Engineers provided the Woman's Auxiliary of the American Institute of Mining Engineers with two knitting machines, a quantity of wool, and material for 72 wool-cloth sweaters. The members of the Auxiliary, their friends, and some others who were interested in the regiment, went to work enthusiastically, and up to the end of the year had turned in the following articles: 170 sweaters; 773 pairs of socks; 89 pairs of wristlets; 85 helmets; 3 mufflers.

Included in the above are some donations obtained by the association and the Woman's Auxiliary, the wool for which was not supplied by the association. Of the above goods, the following were shipped to the regiment, part to the First Battalion and part to the Second; 121 sweaters; 500 pairs of socks; 89 pairs of wristlets; 85 helmets; 3 mufflers.

A donation of 24 comfort kits was also received.

After the regiment had gone to France, it was impossible to make shipments, owing to Government regulations. The unshipped goods were held, hoping that some way might be found to get them to the regiment, but it appeared to be impossible, and, after the armistice was signed, having learned of a great need for knitted articles by the Navy League for distribution to soldiers and sailors, I took up with the League the matter of turning over our supply. They were grateful for our offer, and accepted the following goods, the understanding being that they would supply a similar number for the men of the 27th Engineers, should the need arise: 49 sweaters; 263 pairs of socks.

It is not expected that there will be need for the above, and I feel that all who had anything to do with the donation or making of the goods should be glad that they have been applied to fill a real need, although, of course, there is regret that they could not be sent to our own regiment.

When it was considered advisable to discontinue knitting, there was a rather large supply of wool on hand, which was offered to the Navy League, from which it was purchased, and they bought it back at the same price the association paid for it. The proceeds from the sale of this wool, and some small lots which were taken by individuals, amounted to $610.43.

The matter of wool and knitted goods has not yet been finally closed, owing to delayed returns. At the present time there are about 10 pairs of socks on hand to be disposed of, and there is also a supply of wool, probably not more than 30 pounds.

Thanks are due to Mrs. H. N. Spicer, who worked untiringly as chairman of the Emergency Committee of the Woman's Auxiliary; to Mr. A. L. Gresham, assistant to the secretary of the American Institute of Mining Engineers, who very kindly assisted with the distribution of the wool, receiving the goods, shipping, etc.; to the American Institute of Mining Engineers, which gave permission for the use of its rooms for the meetings, storing and handling of material; and to all others who generously coöperated in the work.

In making disbursements from the fund we did not have it in mind that the termination of the war was coming so soon as it did, and therefore a rather large balance of cash was left on hand. However, this will not be so large as it appears, for, as noted above, Colonel Perry, who has been taking good care of his men, has made expenditures for their comfort in France whereof details have not yet been reported, besides which Colonel Perry has generously dipped into his own purse. Anyhow, it is certain that all the money on hand, and more, too, will be needed in welcoming the men home and giving a helping hand to those who need it. Therefore the subscription list is not closed. From all that we hear, the care that the mining industry has given its men has contributed to producing a fine spirit among them and has done much to make the 27th Engineers one of the distinguished regiments of the service.

W. R. INGALLS,
Secretary-Treasurer.

Employment for Engineers

For the convenience of engineers returning from military service, a list of agencies is here given which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau: Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service: A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service: George W. Kirchwey, state director, 16 East 42d St., New York City.

Tongkah Harbour Tin Dredging Co.

MELBOURNE CORRESPONDENCE

The Tongkah Harbour Tin Dredging Co. is registered in Tasmania and operates in Siam. It has been one of the most successful Australian-owned tin companies in the East. The report for the year ended Sept. 30, 1918, shows increases in yardage handled and in returns of tin oxide as compared with the previous 12 months. The value, too, was 15.7d. per ton, as against 9.4d. in 1917. The general manager, Eliot T. Lewis, states in his report that the smallness of the increase is due to the fact that shortage of material prevented the carrying out of all but absolutely essential repairs. Data of operations are given in the following table:

STATISTICS OF OPERATION OF TONGKAH HARBOUR TIN DREDGING CO., IN 1917-1918

	1918	1917
Ground dredged, cu yd	3,183,250	3,682,550
Tin oxide produced, tons	1,314	1,188
Average yield per cu yd	0.870 lb.	0.721 lb
Average value per cu yd	15.717 d.	9.419 d.
Value of tin output exclusive of royalty	£221,561	£144,845
Average price of tin ore concentrates	£168 12 5	£121 18 —
Average cost of production per cu yd., exclusive of depreciation	5.021 d.	4.403 d
Average surplus per cu yd available for profit and loss account	10.696 d.	5.036 d
Actual net profit	£118,920	£67,921

The sum of £80,302 was brought into the accounts from the previous year. The profit on working account for the current term was £150,783, of which £118,920 remained as net profit after payment of all charges and royalties, and providing for dredging boat channel and depreciation of plant, stores, and spares. Of the resultant £199,222, four dividends (equaling in all 40%, or 8s. per share) absorbed £90,000, and the dividend tax was £2475, leaving £106,747 to the credit of profit and loss account.

The company output, to Sept. 30, aggregated 11,081 tons of tin oxide, which brought £1,247,808; and it had paid in dividends £435,000, or 54s. per share. An additional dredge for the deeper outer harbor is to be built as soon as practicable. No. 6 dredge has been working on the outer harbor during a part of the current year, with much better results than the boring had led the management to expect.

Bituminous Coal and Coke Production in 1918

Estimates of bituminous coal production in the United States by months during 1918 were completed on Jan. 20 and furnished to the U. S. Fuel Administration by the U. S. Geological Survey. These figures, which include lignite and coal made into coke, compared with the corresponding months of 1917, show an increase of 34,092,437 net tons for the 12 months. The figures by months are given in the following table:

PRODUCTION, IN TONS, OF BITUMINOUS COAL IN UNITED STATES IN 1917 AND 1918

Months	1917	1918
January	47,967,354	42,607,206
February	41,352,711	44,384,937
March	47,868,652	48,631,115
April	41,854,320	46,590,570
May	47,086,452	50,927,195
June	46,824,646	51,758,214
July	46,291,572	55,587,312
August	47,372,226	55,732,092
September	45,107,956	51,757,334
October	48,337,726	52,885,513
November	47,689,801	44,386,987
December	44,037,147	40,634,525
Total	551,790,563	585,883,000

The production of byproduct and beehive coke in the United States during the same years, 1917 and 1918, is given as follows:

COKE PRODUCTION, IN TONS, IN UNITED STATES IN 1917 AND 1918

Months	Beehive		Byproduct	
	1917	1918	1917	1918
January	2,923,056	2,242,362	1,787,850	1,649,819
February	2,489,888	2,234,281	1,806,773	1,562,056
March	3,138,977	2,630,433	1,813,435	2,051,206
April	2,813,935	2,580,931	1,859,278	2,021,437
May	2,861,364	2,757,719	1,879,268	2,139,204
June	2,754,897	2,712,726	1,880,335	2,092,155
July	2,753,902	2,813,910	1,882,200	2,300,673
August	2,649,755	2,657,022	1,914,450	2,387,675
September	2,727,367	2,570,238	1,918,714	2,410,798
October	2,780,436	2,611,885	1,898,192	2,563,183
November	2,677,284	2,339,197	1,899,526	2,523,746
December	2,596,687	2,255,296	1,889,259	2,562,048
Total	33,167,548	30,406,000	22,439,280	26,264,000

Anthracite Price Restrictions Removed

WASHINGTON CORRESPONDENCE

Removal of anthracite price restrictions along with the bituminous schedule came as a surprise. It had been expected that the maximum prices on anthracite would be retained until Feb. 15 or Mar. 1. The formal order suspending prices and other restrictions was not signed until Jan. 31, although the announcement that bituminous price control would be abolished was made Jan. 17. The only restrictions which were not suspended were those requiring that contracts be made subject to maximum prices, if reinstated, subject to cancellation by the Fuel Administration, and subject to requisition or diversion of coal by the Fuel Administration; those prohibiting re-consignments of coal, and those requiring shipments of coal to tidewater to go through the Tidewater Coal Exchange. The latter restrictions were retained at the request of the Railroad Administration, to avoid the possibility of congestion at ports.

Before one of the striking lessons of the war can be forgotten, the Secretary of the Interior has taken a decided step toward the establishment of power plants at coal mines and the linking up of the industrial East with electric transmission lines. The details of the plan are set forth in a letter by Secretary Lane to the chairman of the Appropriations Committee of the Senate, in which an appropriation of $200,000 is asked for investigation purposes during the fiscal year 1920.

January Pig-Iron Production

Pig-iron production during January was 3,302,260 gross tons, or an average of 106,525 tons per day, compared with 110,762 daily, or 3,433,617 gross tons in December, according to *Iron Age*. During January, 35 furnaces were blown out and only 8 blown in, leaving 323 stacks, with 104,180 gross tons' estimated daily capacity, in blast Feb. 1, as compared with 350 furnaces, of 109,675 tons' daily capacity, active Jan. 1. Ferroalloy made in January amounted to 32,787 gross tons, of which 22,383 tons was ferromanganese.

Oil-Land Development

At a recent meeting of the California Section of the American Mining Congress, D. M. Folsom presented an interesting paper on the present oil situation, paying particular attention to the influence of existing laws upon new development.

In the course of his remarks, Mr. Folsom pointed out that petroleum and its derivatives have become just as essential to America's industrial life as wheat is to the country's material existence; and that laws which interfere with its production interfere also with industrial progress. Business of the Pacific Coast is especially dependent upon a steady production of petroleum. Practically all transportation by land and by sea is by means of this fuel, and more than half of the stationary power is derived from the same source.

Under existing laws, an oil-development company has three legitimate ways in which it may secure oil lands: First, by discovery and location on vacant Government lands; second, by leasing patented land from its owners and paying a royalty in oil or money, sometimes accompanied by a cash bonus; and third, by direct purchase of patented land.

Under the first plan the operation is purely a wildcat venture, because for many years all ground showing promise of the development of oil has either been taken up or withdrawn from location. Such ground, if it exists at all, is now far from transportation. Should a company follow this course, drill a 3000-ft. hole at the cost of, say, $100,000, and strike a good flow of oil, it would discover, according to recent experience, that all land in the vicinity except its own 160 acres would be immediately withdrawn from entry. Unless the well was a gusher, the company would find itself in trouble. With one small well and unable to secure more territory, far from transportation, the company would soon realize that its property was a liability, not an asset.

The intent of the first withdrawals of land in 1909 by President Taft was to protect the legitimate operator and to develop the various oil fields efficiently for the good of the nation, but the law has been administered in such a manner as to block development on public lands. Efficient development and operation of oil lands are possible only through the employment of a large amount of capital, the drilling of many wells, large production, ample storage capacity, cheap transportation, and refining facilities at no great distance.

Acting under the second plan, if the development company leased several tracts and succeeded in bringing in one good producer, the well would have to be extraordinarily good to be profitable. The income from such a well would be regarded mainly as profit which would be subject to the excess-profits tax of 60 to 80%, because the business was conceived and the well developed since Mar. 1, 1913. Because the risk is great in any event, and because any hoped-for profits will be more than cut in half, this second plan is not attractive.

In the third method—the acquisition of land by purchase—the purchase price may be written off over a series of years, but this does not constitute an attractive business proposition, either. No one would purchase land with the object of drilling for oil unless fairly certain that oil was present. This fact will be known to both vender and purchaser, and, the vender knowing it, the price would be high, and a large profit on the investment would be improbable.

Thus, in whatever manner prospecting work may now be undertaken, the risk is hazardous, and if fortunate strikes are made the Government gets the larger proportion of profit. The taxes on new oil industries are so large that they tend to destroy the business.

The oil industry does not object to paying its just proportion of the war debt, and, quite properly, that should be a large portion; but it should be proportional to production.

The Situation in Mexican Affairs

If President Carranza is sincere in his reported desire for a fair and amicable adjustment with the foreign owners of oil lands and mines, and if he is really in position to "make good" his promises, says the *Evening Sun* of Feb. 8, it will be an excellent thing, especially for Mexico. It is now said he means to call a special session of the Mexican Congress in April to revise the laws by exempting properties that are already being worked from the confiscatory provisions of the constitution, and by granting certain other relief measures. Doubtless the foreign investors will meet him half way, but they will need to be convinced of his sincerity.

Mexico wants capital. The opportunities are vast, and money will flow in copiously if really stable conditions can be created. Carranza proposes to refund the national debt, and expects our help toward doing it. New York capitalists have been approached, and are willing to respond—if they can feel sure of stability. It is a large "if."

There is probably some truth in the frequently made statement that the better and more intelligent classes in Mexico are more friendly in their feeling toward us than they once were. But are they in real control of their country? The situation is by no means hopeless, but it is well for our Government to make haste slowly and be sure of its facts before any adjustment of difficulties—on paper—is accepted as final.

Haig Praises R. E. Tunneling Companies

The special order by Sir Douglas Haig in the London *Times* of Dec. 5, and printed in a recent bulletin of the Institution of Mining and Metallurgy, is of great interest, in view of the number of men, mostly mining engineers, who have served in the tunneling companies. It follows:

> A large number of men are now being withdrawn from tunneling companies for urgent work at home. Before they leave the country I wish to convey to the controllers of mines and to all ranks of tunneling companies, both Imperial and overseas, my keen appreciation of the fine work that has been done by them throughout the last four years.
>
> At their own special work, mine warfare, they have demonstrated their complete superiority over the Germans, and whether in the patient defensive mining, in the magnificent success at Messines, or in the preparation for the offensives of the Somme, Arras, and Ypres, they have shown the highest qualities both as military engineers and as fighting troops.
>
> Their work in the dangerous task of removing enemy traps and delay-action charges, on subways, dug-outs, bridging roads, and the variety of other services on which they have been engaged, has been on a level with their work in the mines.
>
> They have earned the thanks of the whole army for their contribution to the defeat of the enemy. Their fighting spirit and technical efficiency have enhanced the reputation of the whole corps of Royal Engineers and of the engineers of the overseas forces.
>
> I should like to include in the appreciation the work done by the army mine schools and by the Australian Electrical and Mechanical Mining and Boring Company.

Ole Hanson*

Ole Hanson is the melting pot's vindication. A native-born son of immigrant parents, there is no hyphen attached to this Seattle Mayor's title of American. An advocate of such legislation as the minimum wage law for women and the eight-hour day for both men and women workers, there was doubt in some Seattle minds about the course he would take if the labor troubles which were threatening the Washington city came to a head. They were not kept in doubt.

"This is not a strike; it is attempted revolution engineered by anarchists, Bolsheviki, and the I. W. W.," he said; and he laid a heavy hand upon the situation, with the result that the crisis there was safely passed. In a statement discussing the situation Mayor Hanson declared:

> The labor unions must now cleanse themselves of their anarchistic element or the labor unions must fall. They are on trial before the people of this country. I take the position that our duty as citizens stands ahead of the demand of any organization on the face of the earth. The union men, the business men, the churchmen, must first of all be citizens. Any man who owes a higher allegiance to any organization than he does to the Government should be sent to a Federal prison or be deported

Throughout his political career Ole Hanson has been a disciple of Theodore Roosevelt, and his words, published by coincidence on Roosevelt Memorial Day, are such as would have delighted that great American.

---

*Editorial in the New York "Tribune" of Feb. 10, 1919

Editorials

Developments in Copper

THE official statement about copper that was published in Washington last week was received by the public as the revelation of a bad situation, but there was nothing in it that the readers of the *Journal* had not already had, and there was one slight misstatement, viz. with respect to the fixed price for copper. We may appropriately review the main events of the last three months.

In the first place, let it be clearly established in the mind that the Government never fixed the price for copper in the sense that it named a price at which all business should be done. What it did was to fix a *maximum*, first 23½c. and later 26c., *above which* producers might not go. Producers being unwilling on any day up to Dec. 1, 1918, to sell for any less, the prices of 23½c., and later 26c., prevailed as the market prices. But if at any time producers had had more copper than they could sell at the stipulated maxima, and had desired to sell, the market price would no longer have been at the maxima, but would have been at something less. We repeatedly drew attention to this during 1918, arguing that the maintenance of the market at the restrictive maximum indicated that there was not copper enough.

A precisely parallel situation as to high-grade zinc illuminates this. There was a fixed maximum price of 12c., which prevailed as the market price so long as the supply was short, but upon a liberalizing of the specifications, letting in a new supply of high-grade zinc, the market fell below 12c. overnight, and subsequently the maximum price ceased to be a factor in the market; at any rate, not a direct factor, though it was always a threat.

Manifestly the condition as to copper and zinc was quite different from that of silver, in which case the Government *agreed to buy* the metal at a certain price, and subsequently established conditions equivalent to a maximum of $1.01⅛ and a minimum of 99⅝c. To have had real *fixing* of the price for copper, something similar would have had to be done.

On Nov. 1, 1918, a previous agreement between the War Industries Board and the copper producers was renewed for two months, without any change of terms. On Nov. 15, 1918, a new agreement was arranged, cancelling the previous one. The agreement of Nov. 15 merely meant that if the Government needed to buy any more copper (which nobody anticipated it would) it would pay 26c. for it up to Dec. 31, and up to that time the producers were authorized to enter into an agreement among themselves to ask 26c. from the public and get it if they could. The producers promptly entered into such an agreement, but promptly, also, found that they could not get the price.

A few thousand tons of copper was sold during the second half of November to the Government and its Allies, on doubtless what were belated orders, and thus established a market price. From Dec. 1 to Dec. 31, however, no copper was sold to anybody, and with the conditions existing, viz. the producers being bound to each other not to sell at less than 26c. and nobody being willing to pay anything like that, there was neither any market nor could there be said to be any market price.

With the advent of January the newly formed export association named a price of 23c. for export. Some of the small producers made sales at 21@20c., and later in the month as low as 18¾c. These sales were sporadic and but small in the aggregate, the total for the month being only about 25,000,000 lb. There was a good deal of vagueness about them, and it was impossible to determine just what they represented. The big producers did not sell anything, and with them out of the market there could hardly be said to be any market. There was no way of telling what the market would have been if copper had been freely offered by a big producer or if the small producers, in their fishing, had hooked into a real demand.

Among the big producers there was neither any collusion nor illusion, at least there was no illusion after the first week or two. The gravity of the situation, especially as to the accumulated stocks both here and abroad, and the probability that Europe would not buy any copper for a long time, was scarcely appreciated even in high quarters. Washington had contributed to dulling the perceptions by making official statements of big orders to come from Europe, which our readers will recall we characterized as moonshine at the time they were made, and persuading the producers to maintain production until Dec. 31. Our discernment of the situation here, and our advices from Europe from an early date, were contrary to all optimistic ideas, and ever since November we had been unswervingly declaring the situation and indicating to weak producers that they ought to shut down as quickly as they could.

However, as conditions became clear to the big producers during January, the shock that there would be to labor with restoration of the sliding scale of wages and a drop overnight from the basis of 26c., which had been used up to Dec. 31, to something less than 20c., became a paramount consideration. It was necessary to talk things over with the labor leaders and make some arrangements. In this both parties—the companies and the representatives of the miners—were clear-eyed and generous. The Department of Labor and other branches of the Government were intelligently helpful. During these negotiations the big producers had to avoid making a market and forcing the issue. But with the beginning of February the situation changed, and one after another appeared as a seller of copper ready to meet the market or to make a market. Thus were natural market conditions restored, and this was the most hopeful first step for the remedy of a bad situation.

There are troublesome days ahead, and they may last for a long time. We must expect a convulsive market for a while, and also we must look for lower prices being made, perhaps so low that they will be a jolt. We have a situation now in copper, as well as in lead and zinc, wherein cost of production does not mean anything in the market. Many producers will find it necessary to cease producing. The more is production curtailed, the better will it be for correction of the surfeited condition. In this connection let us point out, however, to those companies whose treasuries are in a good state—and fortunately that can be said of many—that this is a good time to resume development work, which had to be neglected during the high pressure of 1915-18. Copper producers must now be cool, patient, and philosophical, and we trust that they will accept our confident assurance that in letting nature take its course the restoration of normal, healthy conditions will come quickest.

Danger Signals

DANGER signals are flying in the delay in resuscitating the industrial consumption of commodities. Nobody possessing common-sense needs to be told what is going to happen if mines and mills and factories are closed owing to inability to sell their products. Even the railway men—those dictatorial aristocrats of labor—will become aware that there is something wrong when reduction in working forces begins owing to diminution in freight to be moved.

What is the matter? Primarily it is that we are no longer on an exaggerated war basis. Before the war the American people were estimated to be making net earnings of about $7,500,000,000 per annum. The earnings were reinvested mainly in new railways, new houses, new factories, and public improvements to meet the needs of the growing population, and it was that new construction that created a great market for commodities.

The people have to live and will buy food, fuel, and clothing at all times, but there will be mighty little buying of steel and copper and other metals and things if there be no new construction going on.

During the war the net earnings of the people rose probably to about $15,000,000,000, and the major part of it was squandered in warfare. We do not pretend that the figures that we have mentioned are much more than guesses, but they are good enough to afford some orientation. The prices of commodities and the wages for labor both doubled.

Commodities and labor still stand at high figures, but quotations do not mean anything if goods are not being sold and if labor be unemployed. If business could be got going in a normal way tomorrow, there is no reason to estimate that the net earnings of the people in 1919 would be any more than they were in 1914; certainly not if the production of things recedes to the rate of five years ago, which seems not unlikely.

But we are still incurring war expenses. We are feeding and clothing a large army, maintaining a large navy, paying big bills for bringing the soldiers home, building ships, and doing much other work, started during the war, that could not be stopped. We have got to meet a big tax bill this year and another huge loan. When the war bills are defrayed out of the diminished earnings of the people there is not going to be much left for new houses and railways. The people will have to continue to crowd for some time longer. True, we are in a strong financial position, and can furnish a great buying power out of resources and credit, and, fortunately, we can lend a lot of money to Europe for her to buy of us (which we shall have to do), but neither Europe nor ourselves are going to capitalize new constructions at inflated prices. It would be folly to do so.

Hence is it that buying halts. The one way to start it is to let nature take its course, and by that we mean to remove all impediments from the markets and let them find their own levels. Representations that reduced prices will not stimulate buying are buncombe, closely related to the silly talk of a while ago that high prices would not check consumption and the mad doctrines about repealing the law of supply and demand.

Congress can help more than anybody or anything else by promptly passing a law that would liberate the wheat market.

The steel magnates can help by declaring a wide-open market in iron and steel, which sooner or later they will have to do anyway.

Bureaucrats, who linger on the stage and are doing some belated interfering with market conditions, can help by keeping their hands off.

Labor leaders can help by facing squarely the facts that economic laws are in action that nobody can resist.

We were astounded last week to read in the newspapers that high officers in the Government are meditating a plan for some more price-fixing. They want to arrange a sort of an economic ladder so as to bring things down gradually and equally. We have had too much of price-fixing. That is one of the main troubles now. The one thing for Washington to do now is to keep its hands off in the matter of markets and prices. The last proposition would be what the New York *Sun* tersely described as "the touch that is death."

The price for the dislocation and destruction of the war had to be paid anyhow. Added to the price is the penalty for the economic crimes that were committed. To Congress, magnates, bureaucrats and labor leaders we reiterate that danger signals are flying. If they be heeded, it will not be too late. If not heeded, no one can foretell the consequences.

There is one other great obstacle to readjustment, and it may be the greatest of all. This is the delay of the conference in Paris to make peace. This is a time when action is necessary, not the debating of abstract ideas and ideals.

Havoc Wrought by Germans at French Mines

THE seizure by Germany of the French coal fields about Lens, during 1914, marked but one step in her attempt at world domination. Knowing well that there was slight probability of her being able to hold the territory permanently for commercial purposes, the wanton destruction which has characterized Germany's type of warfare was brought into action, with the result that the once-prosperous coal fields are today a mass of ruins. Under "Havoc Wrought by Germans at French Mines," we reproduce a continuation of the photographs which appeared in the *Journal* of Feb. 1. As may be seen, the construction of headframes and buildings was of steel and masonry, and of an advanced type. The expense necessary for the complete rehabilitation of the industry will be enormous; practically nothing of salvage value is left.

The district, covering an area of 400 square miles, produced about 70% of the coal mined in France, which is mostly bituminous and of good quality. The seams, for the most part, lie at depths ranging from 1000 ft. to 3000 ft. and vary from 2 to 25 ft. in thickness. The long-wall system of mining was practiced extensively in the thinner beds, and considerable timbering was necessary, owing to the weakness of the roof.

For Americanization

THERE was recently presented in Congress a bill (S. 5464) the object of which is to eliminate illiteracy in the United States. Briefly stated, the purpose of the bill is to promote the education of native illiterates and those unable to use the English language, through the coöperation of the Federal Government and state educational departments, with the aim of preparing both classes for successful living and intelligent American citizenship.

We do not argue for the passage of this particular bill or all of its provisions, but we do wish to express our earnest support of its object.

The United States occupies its present prominent position in the industrial world largely because of the small percentage of her illiterate citizens, and the reduction of this small percentage to the vanishing point would go a long way toward converting our prominent position to a dominant one. Though we may congratulate ourselves upon our record as to illiteracy, we are handicapped as is no other country by the large percentage of our workers who do not speak our tongue. This is particularly noticeable among the mines both in the East and in the West, where many of the unfortunate situations that arise, if not caused by the lack of an understanding of English by the workmen, certainly grow out of that circumstance and are difficult to handle because of that lack.

Born and raised under suppressive European conditions, and suddenly translated to a land of unlimited liberty and opportunity, but with no real knowledge of the country and no knowledge at all of our language, it is impossible for the immigrant miner quickly to grasp and appropriate the American spirit. With all repression removed, he is likely to go too far. He resembles a boiler carrying a pressure of 250 lb. and capable of doing a lot of work if its energy is properly handled. If the valve is suddenly thrown wide open, there is a rush of steam, and all of the latent energy is wasted through its sudden release.

The bill mentioned calls for a six years' program. It is conceivable that the major portion of our illiterate minors between the ages of 16 and 21 might be given a rudimentary education during that period, but the teaching of English and American life to foreign-born residents is a task that will be with us for many years, so that some provision should be established for making continuous the work of educating foreign classes. The fact that so many of us are not good American citizens has been particularly emphasized during the last three or four years. The trouble has been here all the time, but we were so busy about other things that we did not bother with it, nor did we realize how serious a matter it would become. In the program of reconstruction, the elimination or reduction of this condition should receive prompt, vigorous, and greatly needed attention.

Ability to converse with our employees means the ability to give orders that will be understood; it means the possibility of exchanging ideas, the possibility of conveying the American point of view to one who has had no conception of it; it will enable the employer and employee to approach each other through a common medium; it presents the probability of removing misunderstandings.

We will always have some illiterates; we will always have many workers who cannot speak English; but we may aim high and hope for much of the improvement that we know is possible.

We trust that our legislators will give the subject of this bill serious consideration, and that they may find a suitable way in which to coöperate with the states in a practical endeavor to make good American citizens of all the people who by accident or intent have elected to live in our country.

Disillusionment

WE FELL asleep at our desk yesterday and had a dream. We saw ourselves commuting into town in a comfortable car, on time and unjostled, with no unlucky fellow standing in the aisles, leisurely opening the morning paper. And on the first page was headlined that the President had cabled this message:

"To all officers of the Government: The several chairmen of the metals producers' committees (here followed the names, which we omit) are hereby appointed to take charge of the liquidation of the Government's stocks of metals in both manufactured and unmanufactured forms. All officers of the War, Navy, and all other departments will immediately cease all actions on their own accounts, will take prompt steps to ascertain what stocks the Government owns, will report same to the several chairmen, and will leave the further management of the business to them. If the chairmen, out of any delicacy, are unwilling to accept this appointment, they are authorized to delegate the business to an administrative committee of three men, experienced in the metal trades and unassociated with any commercial interest therein, upon whom they may agree. The sole purpose of this order is to get the liquidation of the stocks into experienced hands."

We had got so far, and were thinking what a fine thing this would be, and how it would promote the readjustment of troublesome things and be so greatly to the national interest, when Mr. McAdoo's engine driver inadvertently put the brakes on too hard, jolted us awake, threw the man who was sitting on the arm of the seat over upon our shoulder, and we became alive once more to the grim realities of a world in chaos.

BY THE WAY

The Government is shipping coal to Alaska for its own railroad, which has been built largely for purposes of developing the great Matanuska coal fields, it was stated in Seattle on Jan. 9. An order has been placed with the Alaska Steamship Co. to deliver a full cargo at Seward for use on the railroad and in the machine shops.

"Two of the richest countries in the world are Mexico and Russia," says Charles W. Barron, in the *Boston News Bureau*. "One is the richest country in minerals and the other the richest in possibilities of agriculture. Both of these countries have been bedevilled by poison I. W. W. socialism that would put hands and feet at the top and the head underneath, upturning all government and order."

The mill with which the —— Mining School is equipped marks the highest point toward which the world's metallurgists have attained, writes a contributor to a Canadian contemporary. The plant and machinery designed and installed by men who have attained to the height of the profession of mining and metallurgy, is among the most modern and flexible ever constructed. —Some height, we would anticipate.

Mexican silver dollars, the purest of silver coins, are being converted into bullion by their holders in order to take advantage of the price of silver, stated a correspondent recently in the *Economist;* and the only silver money left consists of 50-cent pieces, which are, or were recently, at a premium of 8%. The government is considering the issue of token coins in silver or a baser metal, and, meanwhile, is coining gold pieces of 2½ pesos, which are inconveniently small. Two-peso gold pieces are also to be issued, and it may be difficult to avoid confusing the two.

Aladdin's lamp would probably be listed in the *Patent Gazette* as an oil device. An invention that would fall in the same category plays a part in a lawsuit recently reported in the New York *Tribune*. More than $3,000,000 and a device to discover oil pools, described as a "radium device," are involved in this suit for $600,000, which was filed on Jan. 25 in the Supreme Court by Dr. Hugo J. von Hagen against Karl J. Schumacher. Dr. von Hagen, owner of the "oil finder," alleges that he agreed with Mr. Schumacher in May, 1917, to allow him the use of the magic instrument, the plaintiff to receive one-sixth of the sum realized from the discovery of oil tracts, which, the inventor says, has amounted to more than $3,000,000. Dr. von Hagen alleges that oil was discovered on 20 different tracts, covering 23,704 acres of land, in Texas, Pennsylvania, Oklahoma, and Kansas.

Speaking of the way Dr. F. G. Coltrell's mind works, Buckner Speed, in a recent issue of *Journ. Ind. and Eng. Chem.*, says: "I recall about 12 years ago, when he was working on the precipitation of smelting smoke, I asked him for help on what seemed to be scarcely an allied problem, the freeing of California crude oil from its emulsified water. Instantly his mind worked with a snap. 'Why,' he said, 'it's the same problem. For air put oil; for smoke particles, the minute water particles,' and then his favorite form of expresion: '*What will happen* if we put a high electrostatic stress on the oil?' Then in his characteristic quick manner, in a few minutes there were thrown together a beaker of oil, a spark coil, and two pieces of copper, and lo, the de-emulsification of the California oils had been solved. Within a few minutes on a block of paraffin under the microscope there was spread out a drop of the emulsified oil, with two electric wires touching its edges. When the spark coil was put in operation the water drops were seen to arrange themselves in the field of the microscope like the iron filings between the poles of the magnet, to dance about and jiggle themselves into larger drops; and in these few minutes of experimentation the problem was solved by which millions of barrels of unmerchantable California oil were rendered fit both for refining and for fuel purposes. It was a familiar phrase to be heard in the University of California anywhere from the botany to the physiology departments when any question of any description came up: 'Oh, go over and talk to Cott about it. He doesn't know anything about the subject, but he will put some idea in your head before you have talked with him 10 minutes,' and this he invariably did."

Playin' Tha Game

By D. E. Charlton

M'son, w'en thee's talkin' o' minin'
An' methods o' 'andlin tha h'ore,
Did thee ever jus' sit down an' figger
W'ot thee needs mos' of all, an' befor'
Thee can start with sinkin' or driftin',
An' naw tha fine points o' tha game,
W'y there's one thing thee's boun' to remember,
'An thee'll fin' it worl' over tha same?

There's tools, an' there's pumps, an' there's h'engines,
An' h'office, an' ware'ouse an' shop;
So it gaws, thee can count without nummer,
An' thee's jus' made a start at the top.
Then figger tha price o' tha labor
An' extras an' such that's thrawn in,
Then, m'son, thee can add up tha total,
An' thee'll fin' w'ot it costs to begin

Now, dam-me, it starts me to thinkin',
If I 'ad tha money to spare,
An' wuz puttin' tha mos' o' my fortun'
In a 'ole w'ere I 'ad to play fair
With tha chaps I 'ad as my partners,
I think that I'd see tha job through,
An' see to it they got w'ot wuz commin',
An' I naw that's w'ot mos' men would do.

Some men, I'll h'agree with thee, sonny,
Ain't h'earned not a single day's pay.
There are h'others, an' thee'll not gainsay me,
'Ave worked 'ard an' 'ave put un away.
Now these chaps for 'oo we are workin'
'Ave 'ad their 'ard knocks an' they naw
That they're playin' tha game as they see it.
It's as square as they make it in law.

So, stop this 'ere fussin' an' grumblin',
An 'elp 'ere a bit with tha set.
'Ow in 'ell do thee 'ope to make wages
If thee dees nothin' more than jus' fret?
It all simmers down to tha question
As to 'ow far thee's willin' to gaw.
An' there's this 'ere thee's boun' to remember—
Give tha bes' an' tha super, e'll naw.

NEW PUBLICATIONS

Methods of Shutting off Water in Oil and Gas Wells. By F. B. Tough. Pp. 122, illus. Bull. 163, U. S. Bureau of Mines, Washington, D. C.

The Oxidized Zinc Ores of Leadville, Colorado. By. G. F. Loughlin. Pp. 87, illustrated. Bull. 681, U. S. Geological Survey, Washington, D. C.

The Geology and Coal Resources of Buchanan County, Virginia. By Henry Hinds. Pp. 278, illus. Bull. 18, Virginia Geological Survey, University of Virginia, Charlottesville, Va.

Preparation of Crucible Graphite. By George D. Dub. War-Minerals Investigations Committee's Pamphlet No. 3, U. S. Bureau of Mines.

This report describes graphite investigations made by the Bureau of Mines in connection with the War-Minerals Investigation Committee, and presents information and facts in connection with the industry.

Efficiency in the Use of Oil Fuel. A Handbook for Boiler-Plant and Locomotive Engineers. By J. M. Wadsworth. Pp. 86; illus. U. S. Bureau of Mines, Washington, D. C.

This compendium is intended as a handbook of information for the man familiar with the use of oil fuel. The data given are compiled by the Bureau of Mines from its own investigations and from those of leading authorities in coöperation with the U. S. Fuel Administration.

Rock Quarrying for Cement Manufacture. By Oliver Bowles. Pp. 160, illustrated. Bull. 160, U. S. Bureau of Mines, Washington, D. C.

This bulletin is the fourth of a series of reports by the Bureau of Mines on different phases of quarrying in the United States. The first part of the bulletin describes the chief types of cements, the growth of the cement industry in this country, and the character of the raw materials used. The bulk of the report deals with quarrying methods and equipment, and gives especial attention to drilling and blasting. A chapter on rock mining and one on prospecting are included. Methods of manufacture are mentioned briefly, as that subject, except as related to quarrying, lies outside the scope of this report; but transportation methods and the effects of the manner of mixing the materials at the quarry or crushing plant on quarrying methods are discussed.

California Mineral Production for 1917. By Walter W. Bradley. Pp. 179, illustrated. Bull. 83, California State Mining Bureau, San Francisco, Calif.

It is the endeavor of the staff of the State Mining Bureau in these annual reports of the mineral industries of California to so compile the statistics of production that they will be of actual use to producers and to those interested in the utilization of the mineral products of the state, at the same time keeping the individual data confidential. In addition to the mere figures of output, the bulletin gives descriptions of the uses and characteristics of many of the materials, as well as a brief mention of their occurrences. Some of the data relative to properties and uses of many of the minerals described are repeated from preceding reports, as it is intended that this annual statistical bulletin shall be to a degree a compendium of information on California's commercial minerals and their utilization.

Thirty-Ninth Annual Report of the Director of the U. S. Geological Survey to the Secretary of the Interior, for the Year Ended June 30, 1918. Pp. 163, illus. U. S. Geological Survey, Washington, D. C.

A detailed and classified account of the activities of the U. S. Geological Survey during 1918. The contents of professional papers issued are summarized in a manner which facilitates reference. A notable proportion of the work done during the year was in connection with war needs. Charts are given to show the details of such work; and, in this connection, it is refreshing to note that the credit claimed of having taken an active part in the investigation of special war problems is well deserved. Also, the achievements in this field are modestly recorded and with a minimum of pretension.

American Methods in Foreign Trade; a Guide to Export Selling Policy. By George C. Vedder. 5½ x 8¼, pp. 204. McGraw-Hill Book Co., New York.

The author maintains that the imperialistic business principles of the German method for development of foreign trade are fundamentally wrong, and that although success apparently attended the German system, the method would, in time, bring about its own destruction. Nationalization of foreign trade, he believes, is contrary to good business principles. Business of a permanent nature rests solely on the merits of the goods produced. The development of business may be slow where merits of goods are depended upon to make sales, but such business becomes permanent. Manufacturers should not lower the quality of goods in order to meet competition, as the practice leads only to transitory business, of no advantage to producer or consumer. The author believes that the principle of the Webb-Pomerene act is wrong, that either it or the Sherman law should be repealed, and that our home laws should square with our foreign practice. The proper use and duties of export commission houses, export selling agents, and export managers are fully discussed, as well as selling plans and the making of markets. Foreign credits and banking are studied, and considerable space is devoted to government relations in foreign business. The book will be found to be useful to manufacturers who are new to the foreign market, and it also contains some valuable hints for those who have already done business abroad.

Sulphur Dioxide Method for Determining Copper Minerals in Partly Oxidized Ores. By Charles E. Van Barneveld and Edmund S. Leaver. Pp. 14, illus. Technical Paper 198, U. S. Bureau of Mines, Washington, D. C.

This pamphlet describes a series of investigations undertaken in consideration of the need for a correct and rapid method for the selective determination of the quantity of copper in the sulphide form on the one hand, and in the form of combined oxides, carbonates, silicates and native or metallic copper, on the other, in partly oxidized ores and in the mill products resulting from the crushing and treatment of these ores. The conclusions reached with reference to the sulphur dioxide method may be summarized as follows:

(1) Cuprite, melaconite, malachite, azurite, chrysocolla, and fine metallic copper are dissolved rapidly and completely.

(2) Chalcocite and chalcopyrite are not affected.

(3) Metallic iron in ordinary quantities, even up to 2%, dissolves rapidly and has no effect on the determination, provided there is a strong excess of SO_2, introduced as SO_2 solution.

(4) There is no gelatinization of silica and the possible loss of copper from this cause, noted in analyses by the other methods described, is eliminated.

(5) The method is applicable alike to high-grade and to low-grade ores. The manipulation is simple and the possible sources of error are few. One chemist can keep a six-unit electrolytic outfit working to full capacity on porphyry ores.

(6) Crushing fine enough to liberate completely the mineral particles is essential. Ores containing an appreciable proportion of chrysocolla should always be pulverized to 150 mesh.

(7) Any metallic copper present as flakes or large particles would, of course, be removed during the preparation of the sample and treated as scales. Fine metallic copper remaining in the pulverized sample would be dissolved and reported with the metallic copper. If a separate determination of metallic copper is considered necessary, this can be made by amalgamation, preferably in an amalgamated copper pan.

Personals

Have You Contributed to the Association of the 27th Engineers?

P. G. Spilsbury has been in the Lordsburg district of New Mexico on professional business.

James B. Pearce has recently been appointed engineer for the Inspiration Consolidated Copper Co., at Miami, Arizona.

J. P. Hutchins, consulting mining engineer, expects to sail Feb. 17 for Southern Russia via London, the Mediterranean, and Constantinople.

Cecil A. Fitch, superintendent of the Chief Consolidated Mining Co., and **Walter Fitch, Jr.**, of Walter Fitch, Jr., Inc., were in New York recently.

W. H. Aldridge has accepted the position of president for the Texas Gulf Sulphur Co. The company's mine at Matagorda, Tex., is now nearing production.

Arthur W. Burgren, mining engineer, has returned to Matehuala, S. L. P., Mexico, where he is employed by the American Smelting and Refining Company.

Chester B. Neiswender, formerly chemist for the Pacific Mines Corporation, Ludlow, Calif., is now with the concentrator department of the Inspiration Consolidated Copper Co., at Miami, Arizona.

J. W. Crowdus, engineer, recently discharged from the service, has returned to his consulting practice in El Paso, Tex. As first lieutenant of engineers, he was attached to the General Staff Mechanical Section, Division of Purchase, Storage, and Traffic, at Washington.

Frank R. Wicks, consulting engineer, recently resigned as superintendent of mills for the Chino Copper Co., at Hurley, N. M., and has opened an office at 404 Union Oil Bldg., Los Angeles, Calif., where he will specialize in concentration and flotation, crushing and fine-grinding problems and plant management.

W. F. Kohagen, formerly private secretary to **M. H. Godfrey**, district manager for the Oliver Iron Mining Co. at Hibbing, Minn., has been appointed assistant superintendent of the Burt, Sellers, Morris and Philbin mines in that district. **John McDowell**, superintendent of these properties, is now in Florida.

Judd Stewart has resigned from the American Smelting and Refining Co., with which he had been associated since its inception, and in recent years had been one of its chief officers and a member of its board of directors. Mr. Stewart has been associated continuously with the silver-lead smelting business for over 36 years, beginning Jan. 1, 1882, at Argentine, Kan. He has been a valuable factor in the organization and systematization of methods in some important branches, and his retirement is a real loss to the industry in its broadest sense.

Obituary

James Cumming, one of the pioneer mining men of the Canadian West, died at Vancouver, B. C., Dec. 3, 1918.

Frank Henry Husted, mining engineer, manager of the New London copper mines east of Frederick, Md., died Feb. 3, aged 53 years.

Ernest L. Godbe, of Salt Lake City, Utah, died at Bath Lake, Calif., Jan. 16. He specialized in chemistry and metallurgy, and for many years was engaged in mining, in the Pioche, Nev., district, having been vice-president of the Prince Consolidated Mining and Smelting Co., up to a few years ago. He was 51 years old.

Frank G. D. Smith, superintendent of the silver refinery at the East Chicago, Ind., plant of the United States Metals Refining Co., died of complications resulting from influenza, Jan. 20. For some time prior to 1916 he was manager of the Santa Domingo Silver Mining Co., at Batopilas, Chihuahua, Mexico, but revolutionary activities made it impossible to continue operations there.

Hubert Ingersoll Ellis, mining engineer, died Jan. 6 in eastern Washington. He was born in June, 1889. In 1905 he entered the College of Mines, University of Washington, where he remained about three years. He then went to Alaska and engaged in mining. In 1915 Mr. Ellis took a position as underground miner for the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho, but was soon promoted to the position of operative on experimental metallurgy and later to that of chemist. He was a member of the American Institute of Mining Engineers.

Alan Feaser McCormick, assistant superintendent of the El Paso Smelting Works, of the Consolidated Kansas City Smelting and Refining Co., El Paso, Tex., died of pneumonia on Dec. 23, 1918, aged 43 years. He was born in the Province of Ontario, Canada, and began his career in the smelting business about 20 years ago at Trail, B. C. From there he went with the Granby Consolidated Mining, Smelting and Power Co., and subsequently was connected with mining companies in Montana. In 1911 he became assistant superintendent in charge of copper reverberatory smelting and converting operations at the El Paso Smelting Works, where he remained until the time of his death.

Societies

Engineering Council will hold its annual meeting on Feb. 20 at the Engineering Societies Bldg., 29 West 39th St., New York.

Utah Society of Engineers and the local sections of the American Institute of Mining Engineers, the American Institute of Civil Engineers and the American Institute of Electrical Engineers recently held a banquet, at which the consolidation of the branches of the engineers' societies was discussed.

Founder Societies held a joint meeting Feb. 10 at the Engineering Societies Bldg., 29 West 39th St., New York. The delegates to the Joint Engineering Congress held in Paris, who recently returned to New York, spoke informally on matters relating to the work of that congress, and on general conditions in France.

American Society of Civil Engineers held a meeting Feb. 5 at the Engineering Societies Building, 29 West 39th St., New York. Francis Lee Stuart, late chairman of the budget committee of the Eastern railroads, spoke on "The National Railroad Situation of Today and a Suggested Basis for Legislation." The subject was thoroughly discussed by those present.

American Institute of Mining Engineers, Montana section, held its sixth annual meeting at the Silver Bow Club, Butte, Mont., on Feb. 7, when officers were elected. A technical session was held immediately after the election and included the following: "The Metallurgy of Aluminum and Magnesium," by Prof H B Pulsifer; and "The Manufacture of High Explosives and Their Use in Metal Mining," by J. C. Horgan, of the Du Pont Powder Company.

Chemical Alliance, Inc., is to be continued in its present form. Though the organization was created for war purposes, it has demonstrated its usefulness to such an extent that the members are unanimous in desiring its continuation. The officers for the coming year are: Horace Bowker, president; Henry Howard, vice-president; and J. D. Cameron Bradley, secretary-treasurer. The directors are Horace Bowker, Henry Howard, E. R. Grasselli, A. W. Hawkes, W. D. Huntington, D. W. Jayne, A. D. Ledoux, F. A. Lindbury, C. H. MacDowell, J. D. Pennock, C. L. Reese, Donald I. McKissen and C. G. Wilson.

Industrial News

Ampromet Co., Pittsburgh, Penn., has opened a sales office in the Schmulbach Building, Wheeling, W. Va., under the direction of E. A. Short.

Powdered Coal Engineering and Equipment Co., Chicago, Ill., announces that John F. Senlis, recently discharged from the Aero Observers' branch of the service, has now entered its employ as advisory engineer. Lester E. Armstrong, recently in the Air Service, has also accepted a position with the company as advisory engineer.

Matthew Addy Co., engaged in marketing alloys, pig iron, coal, and coke, celebrated its sixtieth anniversary Jan. 29. A dinner was given at the Queen City Club, Cincinnati, Ohio, at which James A. Green, president of the company presided. In a speech he reviewed the business history of the company and told how Matthew Addy, now deceased, had requested his associates to carry on the business in his name and provided adequate capital for that purpose, which capital was soon repaid in full to the estate.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Drilling Holes, Method of. George H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,286,994; Dec. 10, 1918.)

Dumping-Car Door. Clarence H. Williamson, Altoona, Penn. (U. S. No. 1,287,548; Dec. 10, 1918.)

Electrolytic Apparatus for Producing Tin Fluosilicate Electrolytes. Robert L. Whitehead, Perth Amboy, N. J. (U. S. No. 1,287,156; Dec. 10, 1918.)

Flotation, Separating Minerals by. Anson G. Betts, Stockhouse, N. C. (U. S. No 1,286,922; Dec. 10, 1918.)

Fuel and Process of Forming With Anthracite Culm and Pitch. Donald Markle, Hazleton, Penn. (U. S. No. 1,287,382; Dec. 10, 1918.)

Furnace, Annealing. Thaddeus F. Baily, Alliance, Ohio, assignor to Electric Furnace Co., Alliance, Ohio. (U. S. No. 1,286,908; Dec. 10, 1918.)

Furnace, Regenerative. Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio, assignors to Electric Furnace Co., Alliance, Ohio. (U. S. No. 1,286,907; Dec. 10, 1918.)

Furnace Shields To Protect Workmen When Repairing. James R. Rishebegar, Braddock, Penn. (U. S. No. 1,287,104; Dec. 10, 1918.)

Hoisting-Engine Control. Ilien Ilieff, Washington, D. C. (U. S. No. 1,288,597; Dec. 24, 1918.)

Hydrofluoric Acid, Production of. Edwin Stanton Fickes, Pittsburgh, Penn. (U. S. No. 1,288,409; Dec. 17, 1918.)

Manganese Peroxide, Process of Preparing. Morduch L. Kaplan, Brooklyn, N. Y. (U. S. No. 1,287,041; Dec. 10, 1918.)

Metallurgical Process. John Tyler Jones, Pittsburgh, Penn., assignor to Thomas J. Howells, Pittsburgh, Penn. (U. S. No. 1,288,422; Dec. 17, 1918.)

Mine-Car Dump, Rotary. John H. D. Petersen and Albert J. Sayers, Chicago, Ill., assignors to Link-Belt Co. (U. S. No. 1,287,093; Dec. 10, 1918.)

Ore Dressing—Apparatus for Clearing Clayey Ores. Edward F. Goltra, Thomas S. Maffitt and Jesse D. Dana, St. Louis, Mo., and Robert W. Erwin, Waukon, Iowa, assignors, by mesne assignments, to Mississippi Valley Iron Co., Wilmington, Del. (U. S. No. 1,288,404; Dec. 17, 1918.)

Potash—Process of Obtaining Potassium Chloride From Brines. John W. Hornsey, Summit, N. J., assignor to General Reduction Gas and Byproducts Co. (U. S. No. 1,288,592; Dec. 24, 1918.)

Potash—Process for Rendering Water-Soluble the Potash in Cement-Mill Dust. Albert R Merz, Washington, D. C (U. S. No. 1,288,437; Dec. 17, 1918.)

Potash—Process for Separating Borax and Potassium Chloride. John W. Hornsey, Summit, N. J., assignor to General Reduction Gas and Byproducts Co. (U. S. No. 1,288,591; Dec. 24, 1918.)

Potash—Process for Separating Salts from a Mixture of Salts in Solution. John W Hornsey, Summit, N J., assignor to General Reduction Gas and Byproducts Co. (U. S. No. 1,288,593; Dec. 24, 1918.)

Potash — Process of Recovering Potassium Chloride from Saline Waters. George B. Burnham, Berkeley, Calif (U. S. No 1,286,932; Dec. 10, 1918.)

Rock Drills, Steel Puller for. Earl M Bruner, Denver, Colo (U. S. No. 1,287,209; Dec. 10, 1918.)

Shaft-Kiln. Arnold Steiger and Wilhelm Steiger, Zurich, Switzerland. (U. S. No. 1,287,505; Dec 10, 1918.)

Steam-Shovel Bucket. William G. Wood, San Francisco, Calif., assignor of one-half to Frank B McKevitt, Sacramento, Calif (U. S No 1,287,165; Dec. 10, 1918.)

Steel Alloy Containing C, Cr, V and Mo. Joseph W Weitzenkorn, Washington, Penn., assignor to Electric Reduction Co., Washington, Penn (U. S. No. 1,287,153; Dec. 10, 1918.)

Well Drilling, Sand Point for. Edward Master, Neosho, Saskatchewan, Canada (U. S. No 1,288,100; Dec. 17, 1918.)

Zinc, Refining of. Guy Carey Fricker, Luton, England. (U. S. No. 1,287,949; Dec 17, 1918.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Feb. 7

Eight Fatal Accidents in the two months from Oct. 12 to Dec. 12, 1918, are reported by the mining division of the California Industrial Accident Commission. Of these five were caused by falling ground, one fatality resulted through a misfire, one man was crushed by a dredger mast, and one died of shock from blood poisoning.

The Suit Against the Santa Fe for concellation of lease on Midway oil lands has been dismissed, and J. W. Jameson and W. J. Wramplemeier, it is reported, will accept the $1,500,000 long ago tendered in settlement of the claims. Delay in acceptance of this amount is said to have been due to the danger of jeopardizing larger claims. The amount recovered was due on royalties.

The Metals Exploration Co., of New York, has taken over the controlling interest in the Gold Point Consolidated Mines, Inc., in the Grass Valley district, Nevada County, Calif. The recent purchase by the Gold Point of the Idaho-Maryland and the Eureka mines has added valuable holdings to the Union Hill and South Idaho, controlled and operated for the last four years by the Gold Point interests, under the management of Errol MacBoyle, mining engineer, Hobart Bldg., San Francisco. Under Mr. MacBoyle's practical direction and constant attention the Union Hill particularly was re-opened and developed not only as a gold producer, but as a large producer of scheelite, an uncommon occurrence in the state. The situation of the Union Hill and the South Idaho in relation to the Eureka-Idaho-Maryland, and the past history of the latter mines, made a consolidation of all these properties desirable for operation on a large scale. The possibilities of this combination attracted Bulkeley Wells, vice-president of the Metals Exploration Co., and there was no great delay, except that occasioned by the interference of war conditions, in investigation and investment. Mr. MacBoyle's associates in the development of the properties were F. W. McNear, F. W. Snook, S. S. Lowery, Roy H. Elliott and Edwin Letts Oliver, who formed the Gold Point Consolidated. The present directors of the company, recently chosen, are Bulkeley Wells, Errol MacBoyle, Rufus Thayer, F. W. McNear, John McCrossen, Roy H. Elliott and Edwin Letts Oliver. Mr. MacBoyle will also serve the company in the position of consulting engineer. The original purchases, additional acquisitions, and development of old ground and exploration of new have brought the total investment in the undertaking to date close to $1,000,000. But the entire holdings cover an area extending for a distance of two miles adjoining the eastern side line of the town of Grass Valley, a territory that has produced more than $20,000,000 and containing a large amount of virgin ground. The plans of the present operators include the continuation of development at Union Hill, and, as soon as conditions are again normal in gold mining, the Eureka-Idaho-Maryland will also be developed at depth by a central shaft, the site of which has already been tentatively selected. The geographical and topographical situations of these properties conform to the possibility of economical development and operation on a scale in accordance with the practice of the other great mines in the district.

PHOENIX, ARIZ.—Feb. 7

Abolition of the Use of Fuses in Blasting is called for in one of the bills introduced early in the present Arizona Legislature. Provision is also made in the same bill for equipping every mine with apparatus for firing blasts by electricity.

The Copper Queen and Calumet & Arizona companies are continuing their efforts to establish their men in homes of their own and offer to provide a site and building money, repayable by employees in 100 monthly installments, with interest at 6%. To this end, another addition has been laid out to the town of Warren. Grading, laying of sewer and water mains, and installation of electric lighting and telephones are being pushed on the addition.

The United Verde Copper Company at Jerome shows full faith in the future in its plans made in anticipation of the expected revival of the copper industry. Oil fuel is to be succeeded by pulverized coal, handled in a crushing plant that will cost $500,000. It will be similar to that at the nearby Extension works, but with five times its capacity. A Cottrell dust collector will be installed, to avoid present complaints of damage to vegetation. Twelve eight-hearth roasters are to be added to the 12 smaller roasters now handling 1200 tons a day. The fine-crushing plant is to be moved to the smeltery from the mouth of the Hopewell tunnel, now decided to be the wrong site. It will be enlarged to 3000 tons' daily capacity. Three reverberatory furnaces are to be added at Clarkdale. In the mine, at Jerome, the new No. 5 shaft, concreted, is being operated to the 2300 level, and plans are being made for a sixth shaft of two compartments, for men and material only, equipped with an immense balanced cage for the workmen or a regular passenger-elevator system. Ventilation is to be bettered by the placing of an immense fan on the 1000 level, at the junction of the Hopewell tunnel and No. 4 shaft. There is to be underground machine shoveling by means of a Marion shovel, operated by compressed air or electricity, instead of steam, and with a bucket of ⅝-cu.yd. capacity. Within a month the broad-gage railroad will be completed from the mouth of the Hopewell tunnel to the 500 level, when a big Marion steam shovel will be hauled up the hill to start work on the hillside back of the old smeltery. As the ground on which they stand will be removed as ore, the office, shops and power house are to be moved to new buildings.

BUTTE, MONT.—Feb. 9

A Strike in the Butte District ordered by the I. W. W. at a meeting in Butte on Feb. 7 resulted in practical suspension of mining in this field. The strike followed the announcement on Feb. 6 by the Anaconda company of a wage reduction at the Great Falls and Anaconda smelteries. The new wage scale announced is a reduction of $1 a day from that recently paid. The I. W. W. are demanding $6 for a six-hour day though no demands have been presented to the companies. Several hundred strikers picketed the approaches to the mines, turning back miners who wanted to work. Such pickets were mainly foreigners, Finns predominating. Work proceeded at some mines where repairs are under way, though the forces employed were reduced The companies are said to be doing all they can to maintain operations, in spite of the fact that with metal prices as they are producers can operaate only at a loss. Entrances to the mines are being guarded to prevent any attempts at destruction. Several hundred U. S. troops with many civilians are so employed.

The Injunction Against Butte & Superior restraining it from using the oil flotation process will stand without modification, according to a decision handed down on Feb. 4 by U. S. District Judge George M. Bourquin at Helena in the case of Minerals Separation against Butte & Superior, in denying an application of the latter for a modification of the injunction. This leaves the status of the case the same pending a decision by the U. S. Supreme Court. The original ruling of Judge Bourquin in the case was overruled by the Circuit Court of Appeals, and, based on the decree of the Circuit Court, Judge Bourquin granted the injunction. The Circuit Court fixed the ratio of oil required in the process as 0.1%. Butte & Superior asked that the injunction be modified to establish a minimum amount instead of merely an average or standard ratio. "Herein defendants' motion to modify injunction is denied," says Judge Bourquin's decision. "This court in its decision did not set a lower limit of oil used in operating the patent process; in reversing that decision, the Circuit Court of Appeals set no lower limit, although it ambiguously indicates there might be one short of the smallest appreciable amount of oil. The decree sets no lower limits and virtually demands that the injunction set no lower limit. The injunction follows the decree. In any case, it is believed the injunction must be held intact until such time as the appellate tribunal defines a lower limit of oil." Butte & Superior has been trying to secure court permission to use less than one-half of 1% of oil to the ton of ore treated by flotation. The original injunction relative to the amount of oil used by Butte & Superior was fixed by court at not less than 1% of oil to the ton of ore handled by flotation. A modification of a higher court reduced the minimum to one-half of 1%. This protects the Minerals Separation Co. on all quantities of oil from one-half of 1% downward Butte & Superior recently petitioned the Federal Court of Montana for a modification of the injunction, so that it might use as little as 0.02% of oil to the ton of ore, but Judge Bourquin refused to grant the plea, as stated above.

WALLACE, IDAHO—Feb. 7

The Bunker Hill & Sullivan Company, having overhauled and improved the Sweeny mill, which it acquired through the settlement of litigation with the Federal Mining and Smelting Co., is now using the plant for retreating a large pile of tailings, the accumulation of many years while the mill was being operated by the Federal on Last Chance ore. In addition to yielding a small profit, the mill product is especially desirable for the Bunker Hill smeltery on account of the unusual amount of iron.

DENVER, COLO.—Feb. 7

The Mining Bureau of the Denver Civic and Commercial Association elected the following directors at its annual meeting: Richard A. Parker, R. A. Gordon, W. L. Loveland, C. H. Harrington, E. E. Chase, George L. Nye, Robert Hursh, W. H. Leonard and Fred Carroll. These directors will meet soon to elect the bureau's officers for the year.

"**The Announced Reduction in Wages** paid miners in the copper districts of the country shows the fairness of the copper producers toward the miners, in that they will continue production rather than throw thousands of miners out of employment at this time." This statement was made by Charles H. Moyer, president of the International Union of Mine, Mill and Smelter Workers, in discussing wage reductions of $1 a day, announced at Butte, Mont., on February 6.

SALT LAKE CITY, UTAH—Feb. 7

The Oil-Shale Boom, in common with mining in general in Utah, has been adversely affected to a marked degree, by present economic conditions, although the causes of the lessened interest are somewhat different. In the present uncertainty new enterprises, especially those that are still in the experimental stage, are the first to exhibit the decline in public favor. Also the bringing in of new wells in Texas and Mexico is a factor. It is to be hoped that experimentation with oil shales will be continued, despite the present conditions.

The Question of Mine Taxation is again exciting the concern of those interested in the industry. The bill now before the state Legislature proposes to tax metalliferous mines at some multiple of their net proceeds, plus an assessment of $5 an acre on all mining claims, whether placer or lode. Mills and smelting plants for the treatment of ores of a mine, whether at the property or not, are also to be taxed as part of the mining property in question. This proposed law, together with the new occupation tax, which the state is seeking to impose, is being actively opposed by mining men. The present method of taxation, namely on the annual net proceeds plus the value of surface equipment, is felt to be sufficiently heavy, and those interested in the industry, already halting under the burden of adjustment to post-war conditions, must view with concern any proposal to increase those burdens in any way. In the case of nonmetalliferous mines, it is proposed to make assessment at their actual cash valuation. The arbitrary nature of such a procedure, as well as the difficulty of arriving at a just figure, has already been pointed out in these columns.

DULUTH, MINN.—Feb. 6

Employees of the United States Steel Corporation on the Minnesota and Michigan ranges were benefited to the extent of $37,146.60 in 1918 by the operation of the corporation's pension fund. Details of the eighth annual report of the fund show that out of a total of $709,052.82 disbursed, employees of the Oliver Iron Mining Co. received $34,628.44, employees of the Duluth & Iron Range R.R. $1476.60, and employees of the Duluth, Missabe & Northern, $1041.60.

The Annual Report of the State Auditor of Minnesota shows that the state trust funds were enriched by $1,227,000 during 1918 through royalties and rentals from state-owned iron lands. Of this amount $1,177,359.25 was received as royalty at 25c. a ton on the 4,709,437 tons shipped from state-owned mines, and approximately $50,000 accrued from rentals and minimum royalties. The state owns the fee on approximately one-ninth of the mineral-bearing lands so far discovered in Minnesota.

Fire Broke Out in the Belgrade Mine, at Biwabik, Minn., in the underground workings, on Feb. 1, one miner losing his life through suffocation. All shafts were immediately sealed. The Government mine-rescue car arrived from the Michigan ranges the next day. The fire is reported well under control, and operations will probably be resumed soon. The Belgrade is one of the larger underground properties of Pickands-Mather & Co., producing at the rate of 20,000 tons per month during 1918.

The Shenango Furnace Co. took a new step in welfare work on the Minnesota ranges when on Jan. 15 the company put in force $300,000 of life insurance for the benefit of those of its employees eligible under the plan. The amount of insurance is based on length of service, starting with a minimum of $1000 at the end of six months' continuous service, $100 being added for each additional year of service until the maximum of $2000 is reached. The entire premium is paid by the company, and the face value of the policy is payable to the beneficiary regardless of place or cause of death.

HOUGHTON, MICH.—Feb. 8

Freight Haulage Rate on Copper Ore has been reduced, according to a ruling of the regional railway director just received by the Franklin Mining Co. This ruling is likely to assist Franklin still further in keeping the balance on the right side of the ledger. The ruling reduced the rate from mine to mill from 20c. a ton to 16c. Before the Government took over the railway service, the Franklin paid 9c. a ton for this haulage. The first advance was to 12c., and from 12c. the rate was raised to 20c. a ton, an unfair proposition from any point of view. The Franklin management vigorously protested, but was unable, for a long time, to get a hearing on its case. However, after the matter had dragged along from one office to another, the case finally reached the regional director, and the decision refunds to the Franklin company the excessive amount paid for freight on copper rock.

With Many Men Unemployed in other industrial centers of Michigan and throughout the northwest, not a man in the Lake Superior copper district is without work, although production of copper has been curtailed at the majority of the larger producing properties and there has been a reduction in wages at several of the smaller ones. On the other hand, the mining companies continue to take on old employees, who are returning to the district in considerable numbers, and are also giving employment to returning soldiers and sailors. At present, curtailment of production has become necessary, although some producers are sold far ahead, notably Copper Range, and others are contracted for the first quarter of this year. Some small shipments of copper are being made to France in the form of billets, by Calumet & Hecla. Mohawk and Wolverine are not reducing production, the management stating that "customers must be supplied," giving the inference that these companies are also contracted well ahead. The copper companies, it is understood, do not approve of the proposed legislation for restricting immigration for four years after the signing of the peace treaty. Whether or not they will make representations to Washington in this regard has not been stated. Such restriction, it is maintained, will mean cutting off the greater portion of the supply of unskilled labor of the character used in this district.

January Tonnage of Copper Mines in Lake Superior region showed increase over that of December and November, despite the facts that influenza kept many men away for many shifts in January and that the mines went on three-quarters time on Jan. 20, thus cutting off two shifts in addition to New Year's Day. It is another illustration of the increase in efficiency per man when conditions begin to look serious. Putting the mines on three-quarters time is not likely to cut into production to any extent, but will probably decrease copper costs per pound. Without appreciable increase in underground working forces at the Calumet & Hecla, the rock tonnage two days last week went as high as 11,000 per day, the best showing made inside of a year. Every day it ran over 10,000. Up to the middle of January it rarely went over 9500 tons per day. The Osceola mine produced 20,300 tons in January, about the same as December and comparing with 19,630 tons in November. The Kearsarge branches of the Osceola property produced 73,500 tons in January, 69,250 in November, and about the same in December. Ahmeek's output was 81,400 tons in January, compared with 81,000 in November and December. Allouez showed 38,500 tons in January, an increase of 300 tons over November and December. Superior continues to ship, but the mine is apparently ending its career of activity, and last month produced only 5550 tons of copper ore. La Salle was the only Calumet & Hecla subsidiary which showed a falling off as compared with last December, being 300 tons short of December but 1000 tons better than November. Isle Royale continues to make a fine showing, the rock tonnage for January being 71,800, compared with 71,100 for November. Mass showed 16,100 for January, against 15,330 for November. Franklin produced 23,950 in January, an increase of 1000 tons over November and 1200 tons over December. Hancock Consolidated produced 17,280 tons in January and 17,000 tons in December.

ISHPEMING, MICH.—Feb. 8

The McClure Hydroëlectric Plant on Dead River is expected to commence the generation of power for the operation of the Cleveland Cliffs Iron Co.'s mines and shops in Marquette County the latter part of the month. The plant will have a capacity of 8000 hp. and is the largest hydro-electric unit in the upper peninsula. The company already has four hydro-electric plants in operation, one on Dead River, one on the Carp River, another just below Au Train Falls, in Alger County, and the fourth, which is of small capacity, at the Republic mine, Republic. With the additional power secured from the new plant, the company will be able to electrify practically all of its plants in Marquette County.

MARION, KY.—Feb. 6

The Advanced Price of Fluorspar during the war period resulted in much new development in mining that mineral in the western Kentucky-Illinois district. However, no new mine of potential importance was brought in, and, although some may have looked for an overproduction of fluorspar in 1918, the output was actually little different from that of 1917. Production continued from the old properties, there being only a few established producers in the district. It is believed now that, more than ever, the resources of these mines will be rapidly depleted. Up to the end of 1918, fluorspar operators were optimistic, but January saw a change to pessimism. Fluorspar is generally sold on annual or time-period contracts. Under the stress of rushing business prior to the armistice consumers doubtless had 60 to 90-day stocks on hand, which will now probably last twice as long. This has tended to promote cancellations. January witnessed great retrenchment, many operations closing down or stopping all work except development and pumping. The eastern Kentucky fluorspar field made a substantial production in 1918 for the first time. The deposits in this field are small and thin and do not promise a long-lived industry. It is not thought that the western deposits can figure materially in the large eastern markets. The occurrence of fluorspar in commercial quantity is restricted to localities in Kentucky, Illinois, Colorado, New Mexico and New Hampshire, with possibly an important deposit at Madoc, Ontario. The impression has prevailed in the past that the resources of the western Kentucky-Illinois field were illimitable, whereas the tonnage of available fluorspar in sight is small. Much money has been lost hitherto in attempting to mine and market the mineral at low prices, about or near production cost, when wages were low and cost of supplies was normal.

VICTORIA, B. C.—Feb. 6

The Northwest Kootenay Mining Association is being organized by the mining companies of the Golden and Windermere districts of British Columbia. The object will be to encourage mining in that section and to assist in any way that may suggest itself in advancing the industry.

Legislation Affecting the Policy of the Granby Consolidated Company, as well as of other mining and manufacturing companies, in maintaining what are termed "closed towns" in those areas near their plants where homes are provided for, is proposed by T. D. Pattullo, Minister of Lands for British Columbia. The companies' explanation for their course in this regard is that it is in the interest of their respective businesses that agitators and idlers, and people generally with no particular business, shall be kept out of such centers. On the other hand, the Minister of Lands takes the position that the right of any private corporation arbitrarily to prohibit intercourse between the members of its particular community with the outside world is questionable; that it results in the restraint of free competitive trade, and is an unjustifiable interference with the freedom of the subject. It is not proposed by the Government, however, to place any law on the statutes which will force the companies to throw open their towns to the same extent as are the usual run of municipal corporations. The Lieutenant Governor will be given power to declare certain communities company towns, within the limits of which the public shall have free right of ingress and egress over the ways and roads used by the companies as avenues of traffic, but it is not intended that the ways immediately adjacent to the works themselves, and used solely in connection with actual industrial operations, shall be deemed avenues of traffic. In other words, the prohibition will be lifted as regards avenues of traffic which are in the townsite proper and on which are situated the various public offices and public buildings. Provision also will be made for wharf accommodation for public traffic and use in cases of those towns where water transportation is the only means of approach.

TORONTO, ONT.—Feb. 7

Mine Operators of Cobalt are encouraged to increase their output by the decisive decrease in the cost of supplies. Steel plate has dropped from 12c. to 6c. per lb.; copper wire has decreased 9c. per lb., and dynamite and chemicals are rapidly declining in price. Full forces are now available, and inefficient workers are being replaced with a better class of men. With decreased costs and greater labor efficiency, it will be found profitable to treat large tonnages of low-grade ore formerly classed as waste.

The Influx of Labor into the Porcupine camp has been increased by the arrival of many laborers laid off by the International Nickel Co. at Sudbury. The leading gold-mining companies are anxious to increase their working forces, but the principal difficulty in the way is the lack of house accommodation. At present there is no room for new arrivals. The Hollinger Consolidated is planning the erection of 50 dwellings for its employees, but if the demands by the companies for additional workers are to be met, accommodations on a much more extensive scale must be provided.

A Bounty on Canadian Iron Ore was advocated on Feb. 4, when a large deputation representing Port Arthur, Sudbury, North Bay, Copper Cliff and other northern Ontario districts waited on the Canadian government at Ottawa. The delegation was introduced by F. H. Keefer, M. P., and received by Sir Thomas White, Minister of Finance and Acting Premier, and other members of the cabinet. A resolution submitted emphasized the fact that the iron and steel requirements of Canada are already substantial and will increase enormously in the future. Such requirements have hitherto been largely supplied from outside of Canada, particularly iron ore, of which about 95% has been imported. The deputation urged the payment of a bounty of at least 50c. per ton on Canadian iron ore for a term of 15 years, payments to be made monthly to mine operators, and to be reckoned: (1) when ore is milled or treated, on the long ton weights going into the milling or treating process; (2) when ore is not milled or treated, on long ton shipping weights going to the furnace. Sir Thomas White promised that the request would receive the careful consideration of the government.

The Mining News

ARIZONA

Cochise County

PHELPS DODGE (Bisbee)—January production of copper was 11,878,733 lb., (December, 12,563,000) of which 10,622,733 came from company's mines and 1,256,000 from custom ores. Company's Mexican mines contributed 2,453,000 lb. to total.

CALUMET & ARIZONA (Warren)—This and New Cornelia company at Ajo reduce operating schedule to 60% capacity.

Gila County

OLD DOMINION (Globe)—January production of copper was 2,812,000 lb.; December, 2,686,000 pounds.

SUPERIOR & BOSTON (Globe)—William G. Rice elected chairman of board of directors. T. R. Drummond, general manager of Castle Dome Development Co., elected director and president.

INSPIRATION (Miami)—January production of copper was 6,500,000 lb.; December, 7,350,000 lb. Train service begun Feb. 1 between new station in Lower Miami and mine, connecting with all shifts. Long-used passenger trucks will go out of operation.

MIAMI COPPER (Miami)—January production of copper was 5,273,260 lb.; December, 4,989,435 pounds.

Pima County

NEW CORNELIA (Ajo)—Foundations almost complete and much machinery on hand for experimental flotation plant to handle company's sulphides. Maximum capacity 600 tons a day, but much less to be treated at first. New equipment includes Gates gyratory crusher, Symons crushers, 9-ft. and 10-ft. Marathon mills, 8-ft. Hardinge mill, 28-in. conveyor, 16-in. Inspiration-type and Cole-Bergman flotation machines, classifiers, Deister tables, Dorr thickeners, and similar apparatus. More power equipment added, to care for new mill's demands. Steam-shovel operation in surface-ore handling notably economical, about 400 men being needed for extracting and treating about 5000 tons of ore a day. Working force mainly Mexican or Papago Indian.

Pinal County

RAY CONSOLIDATED (Ray)—January production of copper was 4,470,000 lb.; December, 5,800,000 pounds.

GRAND PACIFIC (Superior)—Repairs completed to compressor plant, damaged by fire. Shaft being sunk, with air hoist, at point on main tunnel, 1000 ft. from portal.

SILVER KING OF ARIZONA (Superior)—New 1000-ft. shaft decided on at annual meeting at Phoenix. Will be outside of old area mined. Milling capacity to be increased to 500 tons a day, with better stoping to be afforded. Mine to have full electric equipment. A W. Hillebrand president and John Fowle manager.

Yavapai County

BRADSHAW REDUCTION (Crown King)—Closed down gold mill and mines, owing to high operation costs.

ARKANSAS

Boone County

BOO-GRA-LOO (Zinc)—Installation completed of battery of tables and set of cleaning jigs.

GLORIA (Zinc)—George Miller, superintendent, opening up rich strike of free silicate of zinc. Extent of body not yet determined.

Marion County

BIG BELL (Rush)—Work resumed after several weeks' shutdown. Mine and mill both in operation.

EDITH (Rush)—Operations suspended owing to influenza. Will start again when conditions are normal.

Independence County

HARVEY (Batesville)—Force at work in manganese body in cave recently discovered by J. B. Harvey at Penters Bluff. One car shipped from property.

CALIFORNIA

Alameda County

WESTERN MAGNESITE DEVELOPMENT (Livermore)—Legal affairs satisfactorily adjusted in San Fransico Superior Court. Suit resulted from failure of owners to make proper distribution of holdings. Claims amounted to about $63,500, of which amount, $40,500 was for attorneys' fees and court costs.

Eldorado County

BURGER (Placerville)—Working quartz vein on property within city limits. Under lease and bond to N. H. Burger, Placerville; A. L. Conger, Berkeley; and T. B. McLane, Seattle. Will install 30-ton concentrator, electric hoist and mine pump immediately.

MANZANTA (Kelsey)—Old ledge reopened and producing large tonnage medium-grade ore. Additional milling capacity planned. Was one of claims owned by Marshall, reputed discoverer of gold in California, situated near site of Marshall's first blacksmith shop. E. N. Fessier, owner.

Madera County

KAST-BEVER (Raymond)—Recent work discloses payable gold and copper ore. Owners plan to install treatment plant provided further development warrants.

San Benito County

NEW IDRIA QUICKSILVER (Jamestown)—Curtailment in progress; reducing working crews to about 150 men, until conditions warrant adding to quicksilver on hand.

Sierra County

TIGHTNER (Alleghany)—To resume operation, suspended owing to high costs and labor shortage. For about 10 years produced high-grade ore. Now developing large bodies of medium-grade milling ore.

Tuolumne County

GYPSY QUEEN (Tuolumne)—Formerly known as Virginia Quartz, optioned by Cherokee Gold Gravel Co. to Guy H. Canfield.

COLORADO

Boulder County

CARIBOU (Caribou)—Drifting on 600 level opened vein of silver ore. Development continues east of Caribou shaft. John G. Clark, owner and manager.

CONGO CHIEF (Caribou)—Shaft sunk to 180 ft. and two levels opened on vein. Developing promising oreshoot. Will let contract to sink shaft 100 ft. deeper. Will purchase new electrical equipment. S. H. Corfield and A. C. Mead, operators.

UP-TO-DATE (Caribou) — Developing Dardenelles mine.

GOLD COIN (Ward)—J. T. Weber, purchaser, will reopen and resume development in March.

Clear Creek County

GEORGETOWN TUNNEL (Georgetown)—Ore of milling grade opened in recent development. Erection of small mill planned near portal of main tunnel.

WEST SIDE (Georgetown)—Has taken over Hall Tunnel property. Advancing tunnel, now about 3000 ft. long; also drifting on some veins cut by tunnel. First 200 ft. of main crosscut walled with rock, and roof retimbered. During last few months several caves removed, and about 6000 cars of debris cleaned out.

KOBOLD (Idaho Springs) — Drifting from bottom of new 70-ft. shaft. Small vein of rich ore opened with considerable milling-grade ore. Charles L. Jaynes, of Idaho Springs, superintendent.

SILVER GEM (Idaho Springs)—Has purchased Silver Horn property in Ute Creek. To begin development within 60 days. New equipment ordered.

DENBIGH (Silver Plume)—Will install double-drum electric hoist, and another electrically driven air compressor. H. S. Bushnell, manager.

Gilpin County

FIFTY GOLD MINES (Black Hawk)—Planning to unwater Gregory incline and resume development on lower levels.

STAR TUNNEL (Blackhawk)—To reopen North Clear Creek property, and overhaul and operate Iron City mill.

BECKY SHARP (Central City)—Property in Russel Gulch, owned by Old Town Mining Co., being developed by Mollard, Giller & Ingels, lessees. Shaft sunk to 400 ft. and drift run 75 ft. on vein. Payable ore opened.

Moffat County

DOUGLAS MOUNTAIN COPPER (Craig)—Building wood-burning reverberatory to smelt 18-20 tons copper ore daily; about 8000 tons 15% copper ore broken or blocked out, which cannot be handled profitably without reduction, owing to situation 71 miles from railroad. All material purchased and on ground. Completion delayed by influenza; probably ready for firing in April.

Montrose County

CASHIN (Montrose)—Copper property being examined by J. M. McBride, former superintendent, with view to reopening after 12-year shutdown.

San Juan County

ARIADNE (Gladstone) — Advancing crosscut tunnel to prospect property at depth. A. B. Iles manager.

GOLD KING (Gladstone)—Operated under lease by John Clements and Michael Kohler. Recent development opened body of high-grade gold quartz ore.

CONGRESS (Red Mountain) — King, Lovingood & Co., lessees, developing and operating. Shipping two wagon loads daily of payable copper ore to Durango, via Silverton. Hauling by wagon to latter point, Silverton Northern road having discontinued service to Red Mountain district. Storage facilities provided at mine for ore produced when wagon road is snowbound.

SILVERTON SHIPMENTS in January were: Sunnyside, 27 cars; Iowa-Tiger, 18; Mayflower Leasing 3; Caledonia and Dives Leasing 2 each; Little Nation, 1; miscellaneous, 24; total, 77 cars.

LACKAWANNA (Silverton) — Development continues with favorable results. Second-level drift advanced 60 ft. in payable ore. Heading on first level advanced 200 ft. in milling ore. Development continued on both levels. Two-compartment raise, recently completed for 140 ft., timbered with square sets.

RUBY (Silverton)—Leased by Radiant Mining and Reduction Co., of Silverton. Henry M. Kinsley president of new company, and O. L. Keen secretary. Tunnels cleaned out and being retimbered. Will overhaul and equip mill to treat 50 tons ore per day. Active operations will begin soon.

WAR EAGLE (Silverton)—Property on Treasure Mountain leased to Peter Holmgrain. Will begin development soon.

San Miguel County

TELLURIDE SHIPMENTS in January were: Smuggler-Union and Black Bear, 70 cars to Durango, and 10 to Pueblo; Tomboy, 40 cars to Durango and 3 to Pueblo; total, 123 cars. January shipments last year were 122 cars.

NEW ERA (Sawpit)—High-grade roscoelite ore developed by D. H. Donegon, operator. Ore being hauled by wagon to Primrose Chemical Co. at Vanadium; about 200 tons mined recently.

PRIMOS CHEMICAL (Vanadium)—Developing vanadium-ore deposit about three-quarter mile north of Placerville. Two-bucket tramway built from mine to railroad. Compressor plant built and steam-driven compressor installed. Blacksmith shop equipped with drill-steel sharpener. Air line laid to mine and air drills installed. Loading switch put in by railroad.

Teller County

GRANITE (Victor)—Will develop on large scale in 1919. Work now under way from Gold Coin and Dillon shafts. Much payable ore opened from Dillon shaft. C. M. MacNeill president and C. C. Hamlin vice-president and general manager.

MARY McKINNEY (Victor)—J. L. Wilson, lessee, opened oreshoot through Anaconda tunnel, at junction of Virginia M and Work veins. Trial shipment made.

TRILBY (Victor)—Being operated to depth of 1400 ft through Jackson shaft of Gold Sovereign M. and M Co., by Evan J Williams & Co., leasing from Cresson company. During January 125 tons milling ore shipped to Golden Cycle plant at Colorado Springs.

IDAHO

Shoshone County

BIG CREEK (Wallace)—New compressor building completed week after old one burned down. New motor delivered. Will repair old compressor and receiver.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Installing two new heads at Point Mills. Work delayed by late delivery of steel and equipment. At Lake Linden, using new Hardinge mills recently installed and pushing construction of flotation plant

KEWEENAW (Calumet)—Plans dropped of reopening in spring, as intended when work stopped. Necessary funds not available.

SENECA (Calumet)—Two-thirds, or 200 ft., of concrete work done in shaft on turn. Men working during this period on flat rate. On resuming shaft operations, will put shaft through vein, sinking for 100 ft.; will then drift west 60 ft., afterward opening on vein. Estimated six weeks necessary for this work. Crusher expected Mar. 1; will crush first rock by April 1.

FRANKLIN (Demmon)—Running both No. 1 and No. 2 shafts. No water trouble at No. 2, as water all goes into No. 1. Twenty good miners added to working force at this shaft, and 10 more will be put on as soon as possible. No underground exploration work being done, all energies being directed to mining ore opened up. Wages cut 20 per cent.

HANCOCK (Hancock)—Closed down, some of best miners going to Franklin, at Boston location; others to Quincy.

QUINCY (Hancock)—Excavating progressing for plant for recovering mineral from sands.

MASS (Mass)—Operating full time. Wages cut 15 per cent.

MOHAWK (Mohawk)—Will resume mining at No. 1 shaft, idle since May. One shift working; tonnage 300 daily of well-selected rock. Two shifts at shafts Nos. 4, 5, and 6, tonnage being 2200, averaging 23 lb. per ton. Showing in Nos. 4 and . improving, in No. 6 getting lean.

BALTIC (Painesdale)—Mill now handling output of Michigan mine formerly sent to Winona mill, latter having suspended operations

COPPER RANGE (Painesdale)—Experimenting for some time with finer regrinding process; loss of copper reduced to five pounds per ton; eventually three pounds

Iron District

PENN IRON (West Vulcan)—To suspend at No. 3 East Vulcan shaft. Will provide for some men employed there, discharging about 10. At West Vulcan and other mines, will reduce forces slightly. Wage reduction averaging about 10%, scheduled at all company's mines to date from Feb 1, being practical return to last October's scale.

MINNESOTA

Cuyuna Range

FEIGH (Ironton)—Foundations for headframe completed, and steel headframe will be erected at once. Will completely electrify equipment. Iron ore producer

Mesabi Range

HAWKINS (Nashwauk)—Wisconsin Steel Co.'s property closed down for six weeks to permit general overhauling of equipment.

MONTANA

Silver Bow County

ANACONDA (Butte)—January production of copper was 17,900,000 lb. December 21,900,000 lb. Operations curtailed about 75%, working force being confined to married men and those with dependents. No Sunday work being done. Foregoing correct to Feb. 7 when I. W. W. ordered strike mentioned on p. 337

EAST BUTTE (Butte)—January production of copper was 2,291,950 lb., December 1,3[illegible]9,770 pounds.

TUOLUMNE (Butte)—January production was 250,000 lb. copper and 11,000 oz. silver.

NEVADA

Humboldt County

CONTROLLING INTERESTS IN ROCHESTER MINES, Nenzel-Crown Point, Rochester Merger, Rochester Elda Fina, and Rochester Combined companies have filed stipulations covering consolidation under new organization title. Pending litigation between Rochester Mines and Elda Fina companies will be eliminated through this agreement. Announced February 7.

RYE PATCH MINES (Rye Patch)—Following officers and directors elected: B. F. Bauer, George W. Morgan, Judge H. A. Smith, Clinton D. Day, C. W. Peck, Sr., Lorin Hall and Joseph E. Ray, all of Salt Lake City. Development planned. Operations of last year under direction of American Mining and Exploration Co. Ore bins constructed at property and unloading platforms built at railroad, three miles away. Road improved from mine to railroad.

UNIONVILLE (Unionville)—Directors decide to push construction of amalgamation and cyaniding mill.

Lincoln County

RONNOW (Comet District)—Lessees shipping carload of lead-silver ore from new orebody recently encountered.

TUNGSTEN-COMET (Comet District)—Rebuilding boarding house, recently destroyed by fire, preparatory to resuming operations.

PIOCHE DISTRICT ore shipments for week ended Jan. 30 were: Prince Consolidated, 31 cars; Virginia-Louise, seven; Consolidated Nevada-Utah, two.

CONSOLIDATED NEVADA-UTAH (Pioche)—Several sets of lessees at work. Combined Metals lease recently opened up shoot of high-grade silver ore, of which one carload is being broken weekly. McCormac lease, employing 15 men, shipped five cars, and Ronnow and Willoughby lease one car, during January. Hagel and Carman dump lease have carload ready for shipment.

HARNEY (Pioche)—Leased to Stindt and Donohue, who have recently developed small shoot of high-grade ore.

VIRGINIA-LOUISE (Pioche)—December production 1135 tons of iron-manganese fluxing ore, averaging 0.01 oz. gold, 1.6 oz. silver and 4.48% lead, per ton. January production estimated at 1500 tons. New areas of highly basic fluxing ore recently opened up. Development work, previously confined to portion of property immediately adjacent to Prince Consolidated ground, now in progress in hitherto unexplored territory, into which orebodies have been proved to extend.

Mineral County

EDWARD WAGNER TUNGSTEN (Mina)—Completed 60-ton concentrator Dec. 15; ground broken Sept. 1; estimated cost, $2500. Property in Silver Dyke Gulch. J. H. Ratcliffe, superintendent

Nye County

TONOPAH KAWICH (Tonopah)—Development resumed Feb. 1 at property at Bellehelen. Shut down since Christmas. Will center operations in drift started from 350 level of shaft, working one shift

White Pine County

NEVADA CONSOLIDATED (McGill)—January production of copper was 1,100,000 lb.; December, 5,800,000 pounds.

NEW MEXICO

Grant County

LAST CHANCE (Lordsburg)—Rehandling dump. Mill capacity 70 tons

OTTO (Lordsburg)—Repairing machinery. Will start mining soon. E. J. Ernest, superintendent

85 MINE (Lordsburg)—Annual meeting of directors Jan 27 decided tentatively to install battery of boilers and 1000-hp. steam turbine to replace Diesel engine which exploded recently, causing shutdown of mine and mill

GREAT EAGLE SPAR (Red Rock)—Working steadily getting out high-grade fluorspar

CHINO COPPER (Santa Rita)—January production of copper was 4,241,000 lb., December 5,508,000 pounds

TEXAS

Matagorda County

TEXAS GULF SULPHUR (Matagorda)—Mine nearing production. W. H. Aldridge made president

UTAH

Beaver County

UTAH LEASING (Newhouse)—Company treating Cactus dump of South Utah company by flotation reported seeking lease of Cactus mine.

Juab County

TINTIC STANDARD (Eureka)—Hoisting equipment arrived last week in January; of latest type, electrically driven and large enough for future demands. Recent additional work on 1350 level taxing present hoist to limit. Will start new work on 1450 level when new hoist is installed. About 1400 tons ore shipped week ended Feb. 1.

Salt Lake County

QUEEN LEASING (Salt Lake City)—C. R. Greene and associates operating under this title pushing extraction of ore in upper Cardiff workings. Expect to ship 30 tons weekly. Ore hauled to Utah Sampling Co.'s Murray plant by teams, permission having been given by county commissioners.

UTAH COPPER (Salt Lake City)—Wages of miners and millmen reduced approximately 75c. per day, effective Feb. 7. With copper below 22c. and down to 18c., employees at mines who received basic wage in excess of $4.15 per diem will be reduced at rate of 12½c. for each 1c. decrease in copper price, but all other employees will be reduced at rate of 10c. for each 1c. decrease. January production of copper was 10,500,000 lb.; December, 13,835,000 pounds.

Summit County

SILVER KING CONSOLIDATED (Park City)—Spiro tunnel in 9250 ft.; advancing 10 ft. per day with two shifts. New mill shipped third car concentrates recently. Mill operating two shifts.

WASHINGTON

Ferry County

KNOB HILL (Republic)—Operated at loss in 1918, costs being 75% more than in 1917. Prospecting for new bodies. Gold producer.

CANADA

British Columbia

GRANBY CONSOLIDATED (Grand Forks)—Notice posted at smeltery that company purposes reducing wages according to schedule affected by drop in copper price.

FLORENCE SILVER (Ainsworth)—Produced 350 tons of concentrates in January. Preliminary settlement on 140 tons shipped early in month brought $9500, or 90% of net value, according to F. R. Wolfle, president. Mine and mill force reduced to 60 men since Dec. 1, through adoption of economic methods in handling ore. Raising 240 ft. from fifth to third level to give outlet for waste and ore; on completion will run mill three shifts, insuring output of 500-600 tons concentrates monthly. Fifth level 700 ft. deep.

Nova Scotia

NOVA SCOTIA STEEL AND COAL COMPANY (Sydney Mines)—Steel plant closed down temporarily on Feb. 3. No more pig iron will be manufactured for time being. Openhearth blast furnaces and coke ovens will undergo extensive repairs. Four batteries of coke ovens will be kept in operation.

Ontario

COBALT SHIPMENTS by three mines in week ended Jan. 31 totaled 241,192 lb. Shippers were: Buffalo, 87,685 lb.; Beaver 86,460 lb., and La Rose, 87,317 lb. Nipissing shipped 200,000 fine ounces silver bullion in same period.

HOLDINGS OF DOME MINES and Dome Extension Mines, at Porcupine, amounting in all to about 600,000 shares, purchased from De Lamar estate by syndicate headed by J. S. Bache & Company.

TEMISKAMING (Cobalt)—At annual meeting on Feb. 1 shareholders agreed to purchase the Dolly Varden and Wolfe silver mines, in British Columbia, for $900,000

VIPOND-NORTH THOMPSON (Porcupine)—Reports of consolidation with Porcupine Crown and Thompson-Krist officially denied

INTERNATIONAL NICKEL (Sudbury)—Cream Hill mines closed down, 800 men laid off. Will draw ore from high-grade deposit at Creighton mine

AFRICA

CITY DEEP, LTD. (Transvaal)—Reported in November to be sinking new circular shaft to be between 6000 and 7000 ft. deep. Shaft situated behind Wood House Place. Then down about 200 feet.

The Market Report

SILVER AND STERLING EXCHANGE

Feb.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Feb.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
6	4 7575	101⅛	48 7/16	10	4 7580	101⅛	48 5/16
7	4 7580	101⅛	48 7/16	11	4 7580	101⅛	47⅞
8	4 7580	101⅛	48 7/16	12	.	..	

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Feb.	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
6	18	66⅞	5	4 70	6 10@6 20
7	18	66⅞	5	4 65	6 30@6 40
8	17¾	66⅞	5	4.65	6 35@6 45
10	17½@17¾	66¾	5	4.65	6.35@6 40
11	17	66¾	5	4.65	6 17½@6 22½
12	.		...	.	..

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
Feb.	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
6	83@85	76½@77½	105	239½	236¾	29½	26	48
7	83	75	100	233	230	29½	26	48
8	.	. .	.	.		. . .	.	
10	80	71	100	225	223½	29	25	48
11	.	. . . .	.					
12			.			. .		

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Feb. 11, 1919

With the reëstablishment of free competition, copper was naturally the metal of most interest this week. Lead was dull and uninteresting. In zinc there was a little speculative rally, which did not amount to anything.

Our European advices are to the effect that the manufacturing position in Great Britain is grave. Uncertainty as to prices, uncertainty as to politics, extravagant claims of labor, and, above all, the operation of the excess-profit tax, stifle all enterprise. Overshadowing also, is the "absence of government," absence of authority, and consequent decline in law and order. While the peace delegates are stumbling with their heads in clouds of ideals, business men are praying that they will soon stoop to earth and see what is really needed.

France is excluding new importations, and aiming to liquidate its stocks and its own production.

The stocks of metals in the possession of the British Minister of Munitions on Feb. 1, 1919, were as follows, the corresponding figures for Jan. 1, 1919, being stated in parentheses: copper, 93,815,680 lb. (80,640,000); lead, 96,872 short tons (70,394); zinc, 35,435 short tons (33,924); aluminum, 29,328,080 lb. (26,783,680); nickel, 5,349,120 lb. (4,695,040); antimony, 4178 short tons (3928). The increases doubtless reflect arrivals of metals afloat and stagnation in industrial consumption.

Copper, Tin, Lead and Zinc

Copper—Beginning with Feb. 6 all of the big producers came into the market and made sales if they could. Inquiry from buyers was not very general, however, and nothing but small quantities were requested. Business of the week was therefore mainly in lots of 100,000 to 250,000 lb., but even for those there was sharp competition. There were a few transactions in large lots, which were taken by interests that were willing to make sharp cuts, after which the whole market would fall to the new level. On Feb. 6 such business was done at 18c., while on Feb. 11 two lots aggregating 2½ million pounds were done at 17c. The total business of the week was about 6½ million pounds.

Our direct advices from Europe are to the effect that France has a stock of 100,000 tons of virgin copper. This is the largest estimate that we have seen. Other private advices put the figure at 50,000 tons. Anyhow, there is no doubt that France has a large stock of copper.

The delegates from the Copper Export Association were due to arrive in Paris today.

Copper Sheets—The base price of copper sheets is 27c. per lb. Copper wire is quoted at 20½@21c. per lb. f.o.b. mill, carload lots.

Tin—Considerable gossip went the rounds, but there is nothing new to be positively reported.

Lead—The American Smelting and Refining Co. reduced its price to 5c. on Feb. 7, and since then has had the market, taking most of the business that was offered, although the aggregate was light. Other producers seemed to be unwilling to seek business by further cutting of prices, but at the close there were signs that the market might possibly be becoming a little weaker.

Zinc—After the price had touched 6.10c. on Feb. 6, the producers who had been selling seemed to have finished, and, some speculative interest having been excited, there was a rally in the market. However, this was quite unconvincing, the demand coming from unimportant, if not undesirable, quarters, and there was no time when producers would not sell to consumers at lower prices than the speculators were bidding. On some non-speculative business, therefore, the market declined again today.

Zinc Sheets—Unchanged at $13 per 100 lb.

Other Metals

Aluminum—31@32c. per lb.

Antimony—Dull and weaker. We quote spot at 7⅛@7¼ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Dull and weaker. We quote California virgin at $92@95. San Francisco reports, by telegraph, $95.

Silver and Platinum

Silver—Silver exports for the week ended Feb. 8 for London were 273,000 oz. The demand for Europe at present is light. The bulk of our exports are still for India. It is understood that China would be a buying factor in the market, but for the export license, which is still in force.

Mexican dollars at New York: Feb. 6, 77½; Feb. 7, 77½; Feb. 8, 77½; Feb. 10, 77½; Feb. 11, 77½; Feb. 12, —.

Platinum—We quote refined ingot at $100.

Palladium—We quote $115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 8—Blende, per ton, high, $47.40; basis 60% zinc, premium grade, $45; Class B, $42; Prime Western, $41@40; sludge, $37.50; calamine, basis 40% zinc, $25. Average selling prices: Blende, $40.47; calamine, $32.54; all zinc ores, $40.39.

Lead, high, $58.50; basis 80% lead, $55@50; average selling price, all grades of lead, $57.17 per ton.

Shipments the week: Blende, 9747; calamine, 106; lead, 1456 tons. Value, all ores the week, $480,980.

Reports of mills, now aggregating a dozen, closing down on account of the low basis price of ore continue coming in from the Oklahoma field. The falling price of lead, in addition to that of zinc, has been the final determining factor. The Eagle-Picher Lead Co. has closed down its refinery in Joplin, but is still running the smeltery at Galena, Kan. Rumor, unconfirmed, says the American Zinc, Lead and Smelting Co. will close down its lead smeltery at Granby, Missouri.

Platteville, Wis., Feb. 8—Blende, basis 60% zinc, $45 for premium grade and $40 base for high-lead blende. No sales of lead ores reported for the week. Shipments reported for the week are 1364 tons blende and 53 tons galena. For the year to date, the totals are 9368 tons blende and 463 tons galena. During the week 2219 tons of blende was shipped to separating plants.

Other Ores

Tungsten Ore—One lot of five tons of Bolivian ore, of 68% grade, with less than 0.1% impurities, was sold at auction this week at $7.75. Another lot of 15 tons of similar grade was sold at $7.50. These are about the prices that have been intimated as indicative of the market for a fortnight or more back. It is believed that some domestic producers are still operating. Unless they are prepared to meet this level of prices, they would best cease.

Molybdenum Ore—Some business was reported done this week at 85c. for molybdenite of 90% grade.

Other Minerals

Pyrites—Unchanged. Ocean freights are obtainable at 22s. 6d. per ton.

Iron Trade Review

PITTSBURGH—Feb. 10

The January decrease in unfilled obligations reported by the Steel Corporation, 694,884 tons, is a small rather than a large one under the circumstances and compares with a decline of 745,511 tons in December and one of 228,630 tons in November. In the decreases for the three months there is seen no trace of any large cancellations of business previously considered sound, and it is doubtful whether the Corporation management was able to segregate, and keep out of its tonnage statements, all orders that the sudden ending of the war made unnecessary of fulfillment. Shipments in each of the three months were about 1,200,000 tons a month, while bookings of strictly new business were universally recognized as being light. Any considerable volume of cancellations could have made the decrease in unfilled tonnage in any of the three months actually greater than the shipments.

The demand for finished steel products has on the whole undergone no improvement in the last week, but has rather suffered a further diminution from its already small proportions. Jobbers, for instance, having placed shipping instructions immediately after the war for a little replacement of stock, are now in position to proceed more conservatively, and are ordering only such material as it is certain can be distributed at once. Manufacturing consumers, while in general operating at moderate rates, are keeping stocks down to the lowest possible level. The automobile industry is one of the few consuming industries that is buying freely and its orders are altogether satisfactory to producers, representing on an average as large a tonnage from week to week as has ever been experienced from this industry. The building trades are almost altogether quiescent. Railroad buying amounts to little, which is natural when the final disposition of the railroad properties remains in doubt, while the Fleet Corporation is finding more cases of overshipment of steel than of undershipment, in relation to the shipping orders it has placed.

Finished and unfinished steel prices are being firmly maintained all along the line, there being no hint of any shading. How long this condition will continue no one ventures to predict, but the trade seems to have an idea that price cutting will be forestalled as necessary, by general and plainly marked reductions by leading steel producers, so that at all times a steady, if inactive, steel market may be maintained. For the last three or four weeks a rumor has been persistently in circulation that formal price reductions following those made about the middle of December will be announced in the near future and several weeks before Apr. 1, the date which many had set as the time for the next reductions. Government steel prices averaged about $40 per net ton above the average quoted prices during the 10 years before the war, to Jan. 1, 1914, so that the December reductions, amounting on an average to a trifle more than $4 a net ton, did not go very far toward restoring pre-war conditions. It is recognized in practically all quarters, however, that not for several years at least can prices decline to pre-war levels.

Pig Iron—Sales are infrequent and cover only small tonnages, for prompt shipment only, running from carloads to 100 tons or possibly 150 tons. They are sufficient to show the market situation, which is one of extreme inaction but of steady prices. Shipments on old contracts are of fair proportions. We continue to quote: Bessemer, $35.20; basic, $30; foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel

Steel—The 29 companies which report to the American Iron and Steel Institute report 3,082,127 gross tons of ingot production in January, against 2,992,291 tons in December, the apparent increase being due to greater number of working days in January. The output was larger than had been generally expected, but February is undoubtedly bringing out a material curtailment to the rate. Prices on regular unfinished steel are strictly maintained. Billets, $43.50; sheet bars and small billets, $47; slabs, $46; rods, $57. Discard steel and shell steel are being offered at low prices, demand for such descriptions of steel being far below the supplies.

Ferroalloys

Ferromanganese—The furnace asking price on 70% ferromanganese, $200 delivered, is purely nominal as there are no bids even at far below that figure, and resale lots of any size cannot be sold at all. The market may be considered nominal at $175 to $200.

Coke

Coke—Offerings of odd lots of coke loaded on track and requiring to be moved to save demurrage are frequent, and some lots could be picked up at $4 or $4.50 for alleged furnace grade, though probably of poor quality. For any tonnage of standard grade furnace is quotable at $5 and foundry at $6, per net ton at Connellsville ovens. Production has been curtailed, but hardly rapidly enough for the declining consumption, particularly in view of the fact that all furnaces are well supplied with cars ready for unloading and with much coke in transit to them.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75 630	88 702	101.125	36 682	44 356	48 438
Feb	77 585	85 716	......	37 742	42 792	. .
Mar....	73 861	88 082	......	36 410	43 620	. .
April.	73 875	95 346	......	36 963	47 215	. .
May.	74 745	99.505	.	37 940	48 980	. .
June	76 971	99 500	......	39 065	48 875	. .
July.. .	79 010	99 625	. ....	40 110	48 813	. ....
Aug . .	85 407	100 292	.....	43 418	49 077	......
Sept....	100 740	101 125	.	50 920	49 500	
Oct ...	87 332	101 125	.	44 324	49 500	
Nov .	85 891	101 125		43 584	48 969	
Dec	85 960	101 125		43 052	48 492	
Year	81 417	96 772	.	40 851	47 516	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan .	23 500	(a)	110 000	92 238	125 000	106 619
Feb	23 500		110 000		125 000	
Mar....	23.500	. .	110.000		125 000	
April..	23.500	. . .	110 000		125 000	
May.	23 500	.	110.000		125 000	.
June..	23 500	. .	110.000		125 000	
July....	25 904	. .	119.91	.	134 91	
Aug .	26 000	.	122.000	.	137 000	
Sept .	26 000	.	122.000	. .	137.000	
Oct .	26.000	. .	122.000	.	137.000	
Nov....	26.000		122.000	.	137 000	
Dec...	(a)		118 447	. . .	133.167	
Year	24 628		115 530		130 507	

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85 500	67.702	293 227	248 557
February...	92 000		311 525	.
March	(a)		318 875	.
April	(a)		329 905	.
May	(a)		364 217	.
June	(a)		331 925	.
July	(a)		360 347	.
August	(a)		380 900	.
September	(a)	....	343 905	. ....
October.	(a)	....	335 543	....
November.	(a)	....	323 550	....
December	(a)	......	267 736	....
Av. year	(a)		330 138	.

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January ...	6 782	5 132	6 684	5 316	29 00	37.227
February...	6.973		6 899		29 00	
March......	7 201		7 091		29 00	
April......	6 772		6 701		29 00	
May	6.818		6 704		29 00	
June	7 611		7 511		29.00	
July	8 033		7 750		29 00	
August .	8 050		7.750	. . .	29 00	
September .	8 050		7 750	. .	29 00	
October . .	8 050		7 750	.	29 00	
November	8 050		7 750	.	31 [illegible]	
December	6 564		6 324	.	40 00	
Year	7 413		7 222		30 10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January .	7 836	7 272	7.661	6 922	54 000	50 045
February	7 814		7 639		54 000	
March	7 461		7 286		54 000	
April	6 890		6 715	.	54 000	
May	7 314		7 114		54 000	
June	8 021		7 791	.	54 000	
July .	8 688	. .	8 338		54 000	
August .	8 985	. .	8 635		54 000	
September	9 11	. .	9 092		54 000	
October	8 80		8 451		54 000	
November	8 491		8 141		[illegible]	
December	8 163		7 813		56 050	
Year	8 159		7 890		54 180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37 [illegible]	$33 60	$33 95	$31 40	33 95	$32 40
February	37 [illegible]		33 95		33 95	
March	37 [illegible]		33 95		33 95	
April	36 [illegible]		32 95		33 95	
May	36 [illegible]		33 00		34 00	
June	36 36		33 16		34 16	
July	36 60		33 40		34 [illegible]	
August	36 60		33 40		34 [illegible]	
September	36 60		33 40		34 [illegible]	
October	36 60		34 40		[illegible]	
November	36 60		34 40		35 40	
December	36 60		[illegible] 40		35 40	
Year	$36 67		$33 70		$34 4[illegible]	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Feb. 10
Alaska Gold M . .	3
Alaska Juneau .	1
Am.Sm.&Ref.,com..	63
Am.Sm. & Ref., pf...	104
Am.Sm.Sec., pf., A.	91
Am. Zinc	11
Am. Zinc, pf	39
Anaconda	57
Batopilas Min	1
Bethlehem Steel....	59
Butte & Superior.	16
Butte Cop. & Zinc	5
Cerro de Pasco	31
Chile Cop	17
Chino	33
Colo. Fuel & Iron.	35
Crucible Steel	53
Crucible Steel, pf	90
Dome Mines	12
Federal M. & S.	9
Federal M. & S., pf	33
Great Nor., ore ctf	37
Greene Cananea	42
Gulf States Steel	52
Homestake	97
Inspiration Con	42
International Nickel	26
Kennecott	30
Lackawanna Steel	63
Mexican Petrol	165
Miami Copper	22
Nat'l Lead, com	65
National Lead, pf	106
Nev. Consol	16
Ontario Min	7
Ray Con	20
Republic I.&S.,com	72
Republic I.&S., pf	101
Sloss-Sheffield	46
Tennessee C. & C.	12
U. S. Steel, com	89
U. S. Steel, pf	113
Utah Copper	66
Va. Iron C. & C.	55

BOSTON CURB*	Feb. 10
Alaska Mines Corp	1.12
Boston Ely	95
Boston & Mont	46
Butt. & Lon'n Dev	11
Calaveras	1
Chief Con	3
Contact	05
Corbin	‡ 25
Cortez	13
Crown Reserve	55
Crystal Cop..	19
Eagle & Blue Bell	2
First Nat. Cop	1
Houghton Copper	30
Intermountain	‡ 05
Iron Blossom.	45
Iron Cap	13
Majestic	19
Mexican Metals .	28
Mines of America	06
Mojave Tungsten	04
Nat. Zinc & Lead	09
Nevada-Douglas	.20
New Baltic	75
Oneco	20
Pacific Mines	‡ 35
Rex Cons	05
Yukon Gold	75

SAN FRAN.*	Feb. 4
Alta	02
Andes	03
Best & Belcher	02
Caledonia	03
Challenge Con	‡ 03
Confidence	04
Con. Virginia	‡ 05
Gould & Curry	02
Hale & Norcross	11
Jacket-Cr. Pt	03
Mexican	08
Occidental	40
Ophir	09
Overman	01
Savage	07
Sierra Nevada	03
Union Con	08
Utah Con	‡ 01
Belmont	3 50
Jim Butler	39
MacNamara	25
Midway	27
Mont.-Tonopah	15
North Star	08
Rescue Eula	09
West End Con	1 20
Atlanta	04
Booth	13
Comb. Frac	1 02
Florence	12
Jumbo Extension	12
Kewanas	04
Nevada Hills	03
Nevada Packard	25
Round Mountain	32
Silver Pick	04
White Caps	16

COLO. SPRINGS*	Feb. 4
Cresson Con	4 87
Doctor Jack Pot	01
Elkton Con	04
[illegible]	14
Gold Sovereign	‡ 02
Golden Cycle	‡ 74
Granite	11
Isabella	05
Mary McKinney	07
Portland	1 00
United Gold M	14
Vindicator	44

BOSTON EXCH.†	Feb. 10
Adventure	‡ 60
Ahmeek	70
Algomah	29
Allouez..	‡43
Ariz. Com.	11
Arnold	‡ 20
Bingham Mines	‡9
Bonanza	‡ 10
Butte-Balaklava.	.30
Calumet & Ariz	57
Calumet & Hecla.	430
Centennial	13
Copper Range	40
Daly West	‡2
Davis-Daly	5
East Butte	‡9
Franklin	3
Granby	‡79
Hancock	4
Hedley	‡12
Helvetia	‡ 20
Indiana	‡ 80
Isle Royale	24
Keweenaw	1
Lake	‡3
La Salle	‡2
Mason Valley	‡2
Mass	‡4
Mayflower	3
Michigan	2
Mohawk	50
New Arcadian	‡1
New Cornelia	15
New Idria	8
North Butte	10
North Lake	‡ 40
Ojibway	‡1
Old Dominion.	34
Osceola	‡52
Quincy	57
St. Mary's M. L.	‡43
Santa Fe	‡ 25
Seneca	‡13
Shannon	‡2
Shattuck-Ariz	‡14
So. Lake	‡1
So. Utah	‡4
Superior	4
Superior & Bost.	2
Trinity	‡2
Tuolumne	‡ 82
U. S. Smelting	43
U. S. Smelting, pf	46
Utah Apex	2
Utah Con	7
Utah Metal	1
Victoria	‡2
Winona	‡ 90
Wolverine	18

N. Y. CURB†	Feb. 10
Big Ledge	75
Butte & N. Y.	‡1
Butte Detroit	‡ 01
Caledonia	29
Calumet & Jerome.	[illegible]
Can. Cop. Corpn	2
Carlisle	‡2
Cashboy	07
Con. Ariz. Sm	1
Con. Copperminos	5
Goldfield Con	20
Goldfield Merger	05
Greenmonster.	[illegible]
Hecla Min	4
Howe Sound	‡3
Jerome Verde.	‡ 50
Louisiana	[illegible]
Magma	25
Marsh	03
McKinley-Dar-Sa	45
Milford	‡ 75
Mother Lode	29
Nixon Nevada	30
Ohio Cop	[illegible]
Rawley	‡2
Ray Hercules	2
Richmond	‡ 56
Rochester Mines	32
St. Joseph Lead	12
Standard S. L.	25
Stewart	16
Success	‡ 11
Tonopah	‡3
Tonopah Ex	2
Tribullion	[illegible]
Troy Arizona	‡ 10
United Eastern	4
United Verde Ext	‡35
United Zinc	1
Utica Mines	‡ 08

TORONTO*	Feb. 10
Adanac	22
Bailey	03
Beaver Con	40
Chambers Ferland	‡ 09
Coniagas	2 00
Hargraves	03
Kerr Lake	‡5 37
La Rose	31
Lake Shore	90
Min. Corp. of Can	2 00
Nipissing	‡8 75
Peterson Lake	09
Temiskaming	14
Wettlaufer Lor	04
Davidson	[illegible]
Dome Exten	27
Dome Lake	20
Hollinger	6 12
McIntyre	1 62
Newray	12
Porcu. Crown	‡ 28
Teck-Hughes	27
Vipond	19
West Dome	15

* Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

February 22, 1919

Volume 107 *Number* 8

OPENING UP A PROSPECT IN THE STATE OF PUEBLO, MEXICO

Examining and Developing the Mine Prospect

BY HARRY T. CURRAN*

Often the failure of a mine prospect is due to incorrect or exaggerated reports regarding the property, and these result from the lack of sufficient development to thoroughly "prove" the prospect, or to an excess amount of exploitation in a vain effort to "make a strike" when returns are lacking. Such instances are detrimental to local development, injurious to the engineering profession, and shake the confidence of investors. In this article the author outlines in a general manner what should constitute sufficient information to justify the development of a prospect.

THE principles to be observed in the examination and development of the mine prospect form an interesting subject and one open to much argument and discussion. The loose application of the term "mine" is a matter which engineers would do well to consider, for their own protection, as well as for the protection of the public. Of many mining claims in a district, only a few customarily have mineral showings that would entitle them to even the name of mining prospect. Among the prospects only a few are sufficiently promising to be called mines in the making, or, one might say, proved prospects, and from these few only one will ever develop into a mine. Two varieties of reports regarding prospects are entirely too prevalent. The first usually condemns the property without proper study, simply because it is a prospect, and the other attempts to camouflage the property into presenting the appearance of a mine through the use of a lot of psuedo-geology. Prospects, especially proved prospects, are receiving more attention than formerly from companies which are looking for mining properties. When the chances are fully understood, the development of good properties is one of the most attractive of mining investments.

Too many engineers are so satisfied with their ability to make a successful diagnosis after the property has passed into a productive stage that they lose sight of the fact that it is a greater accomplishment to be able to predict the future of a prospect through deductions reached by analytical observation and the application of correct theory of ore deposition. Of course, many a beautiful theory is "knocked into a cocked hat" by a little digging, and analogy is dangerous unless modified by a good deal of experience. However, an experienced engineer, fortified by a thorough knowledge of mining geology, should at least be able to predict what a certain amount of work, rightly placed, will do toward proving the property, and whether or not surface indications warrant the expenditure necessary for its accomplishment. If the engineer has stated conditions plainly, there can be no reflection on his judgment if the advised work proves the property to be worthless.

---

*Mining and metallurgical engineer, Idaho Springs, Colorado.

If mining geology is of any value it is certainly applicable to the higher geological horizons, even though it is not as easily proved as in the lower. Surface signs and indications exist, and conclusions can be drawn from them by sound reasoning. Beyond facts that can be demonstrated—such as ore blocked out and other established conditions—the conclusions drawn in a report form only an opinion, regardless of who writes them, and should be as freely given in one class of mining property as in another if the engineer is to cover his field completely. Many reports show not one iota of individuality, but simply follow an antiquated form, with a conclusion tacked on at the end that shows absolute lack of analytical observation.

Need of Determining Geological Conditions

Sizing up a prospect is a different problem from examining developed mines, in which the ore blocked out can be easily measured, the ore "in sight" determined within reasonable limits, and the probable and possible ore approximated. Examining and reporting on developed mines is to a much greater degree a matter of measurements and mathematics than with the prospect. Before attempting to express an opinion on the latter, an engineer should have had a varied experience in many different districts and a firm grasp on practical mining geology. He should be able to determine quickly whether the geological conditions of the district are favorable or not. What is needed is the ability to determine relative ages, to recognize the relation of ore to a certain rock, or rocks, in the district, and to follow that formation.

Determining Relative Age of Series

The relative age of a series may often be determined by following a few simple rules. By the rule of superposition, the younger of two strata is usually the upper one; if the folding has been so great that the beds have been overturned, some other method can often be found. The more metamorphosed of two rocks lying close together is probably the older, or often the one which shows the most evidence of disturbance, such as faulting and folding, is the older. Where a conglomerate is found, one may often trace the pebbles back to their origin. If it is possible to determine to which types—fundamental, intrusive, or extrusive—the rocks over a given area belong, the engineer has still another basis for correlation.

Physiography has a certain relation to mining, though probably to only a limited extent in many cases, but it should not be overlooked. The late Doctor Van Hise, speaking of the horizontal element, said:

> Commonly, ores deposited by ascending waters would be found below the valleys, or at least below the lower parts of the slopes; for these are the places where the waters are ascending in the trunk channels. Commonly, ores deposited by descending waters would be found below the crests or below the upper slopes of elevations; for these are the places where water would be descending. Probably the upper slopes would be more favorable places than the crests; for at an annular belt upon the upper slopes of an elevation the quantity of the descending waters would be greater than at the crests. Commonly, ores which receive a first concentration by ascending waters and a second concentration by decending waters would be on the slopes, in many instances nearer the valleys than the crests.

Study of the earth's surface imparts a general knowledge of the topography caused by faults and folds. When it becomes necessary to solve some function of a fault with no more than surface indications as a guide, a clear understanding of the causes which are accountable for the present topography is necessary. This is also true when applied to problems of secondary enrichment, which will be discussed later.

In general, areas of regional vulcanism are most favorable for ore deposition. Almost invariably, lode deposits of gold and silver are found in areal association with intrusive igneous rocks. The genetic connection that exists is often largely problematical, but that they are genetically related is well established from the fact that this intimate association has been noted in nearly every region where such deposits have been studied. Faults and fractures are developed and conditions necessary to ore deposition are present. As each district has its peculiar rock and metal association and surface characteristics, it also has its peculiar type of topography, governed by natural distribution, relative hardness, nature of faulting, folding, and other attributes. A much-faulted region is likely to be marked by step-like outlines. Low, rounding hills are often the results of complex faulting with at least two systems of intersecting faults.

The Relation of Surrounding Mines to a Prospect

The underground workings of a prospect are generally so meager that the engineer, before submitting a report or forming a conclusion, should visit as many mines and partly developed mines in the district as opportunity affords. Veins in a given area often follow definite systems, and a developed property in the district may throw considerable light on the region as a whole. There seem to be no general laws that can be safely applied to the influence of country rock on mineral veins. However, the vein structure and vein filling are both influenced by the inclosing rocks. The first is a physical effect; the second, mineralogical or chemical.

As chemical reactions in a laboratory are governed to an extent by the physical conditions, so will the vein filling be governed by the vein structure to greater or less degree. The engineer will be more interested in the physical effect, as it is more practically applicable and primarily governs the conditions under which the chemical reaction must take place. In other words, whether the channels are favorable or unfavorable receptacles for ore deposition depends to a great extent upon the physical conditions. The rocks, primary to vein formation, must be either porous or fractured, to permit the circulation of enriching waters. It is evident that, over a given area, there is a probability that the rocks of the same type will not vary much in toughness, hardness, and porosity, and that the physical aspects of ore deposition will be governed by the nature of the rocks.

All forms of vein deposits are to some extent affected in size, shape, and richness by the character of the fissure, and by passing from one type of inclosing rock into another. The vein is likely to widen in an easily shattered material, pinch in a tough rock, and split into small stringers in brittle or soft rock, with the mineral so disseminated that the deposit becomes worthless; or the fissure may be replaced by a flexure and the deposit be entirely lost. Also, the type of deposit may be entirely altered, as, when a vein system passes from an area of granitic rocks, or rocks of similar physical characteristics, to an area of schists, it often changes from a system with few open fissures to one with many small, tight fractures. Though fissure filling would be the predominating process of ore deposition in the former, replacement would take place in the latter.

As one type of rock may present entirely different physical characteristics in different districts, no rules can be given for all localities, as each district may present certain peculiarities over a considerable area. Though no general laws have been formulated for rock and mineral association, a certain definite relation prevails in some districts, and often a developed mine will establish this relation for the district. However, each individual mine in a district, in fact different sections of the same mine, may present problems entirely separate and distinct from others in the same mine and locality. These peculiar characteristics may, nevertheless, be duplicated, and all distinctive conditions should be studied and applied along broad lines, such as can reasonably be expected to be fundamental to the ore deposition of the district.

Walter Harvey Weed draws the following conclusions from his observations:

> The structural character of vein fissures, such as course, width, etc., varies with the nature of the country rock. The mineral contents of veins formed wholly by the filling of open fissures are not affected by the nature of the vein walls. The mineral contents of ore deposits formed by metasomatic replacement vary with the nature of the inclosing rocks. As metasomatic processes vary in character with the nature of the solutions, no invariable general relation can be established between certain rock types and rich ore deposits.

A great majority of lode deposits are the result of a partial deposition in preëxisting fissures and are partly replacements of wall rocks through a process of metasomatic action. Open spaces probably can exist to great depth, but fissure veins formed only by the deposition in open spaces are rare. In refractory rocks, such deposits are undoubtedly found, especially where the trunk channels are simpler. However, metasomatic action is usually seen in the inclosing rocks of fissures. Edson Bastin,[1] speaking of the alteration of wall rock in the Central City Quadrangle, says:

> The association of minerals formed by replacement in the walls of filled fissures is in general different from that deposited in the fissure itself, in spite of the fact that both mineral associations were obviously formed almost contemporaneously and under the same general conditions of pressure and temperature. One of the most striking exemplifications of these contrasts is the scarcity or entire absence of galena and sphalerite in the walls of many fissure fillings in which these minerals are very abundant; in such walls pyrite is the dominating sulphide. Carbonates may be present in a filled fissure but absent from its walls. Conversely, sericite, the commonest alteration product in the walls, is never found in the fissure fillings.

The influence of wall rocks in many cases has a great bearing on vein fillings. Where the vein cuts different kinds of rock the replacement is usually selective. This may indicate a replacement of the rock as a mass, as in limestone; a replacement of fragments, as in a conglomerate; or replacement of certain constituent minerals, such as ferromagnesian minerals, in basic rocks. This mineralogical effect is not easily studied in a district without a developed mine, or, better, several developed mines. In a region where there is an impervious stratum, either horizontal or vertical, cutting a large area, this is the limit of circulation in that direction, and often a line by which the district is entirely divided in the character of its deposits, both physically and mineralogically. When in folds, any of the combinations of porous strata with impervious layers may form a trunk channel and a favorable lodgment for many important ore deposits.

Preliminary Mapping of Geological Conditions Is of Great Advantage

A rough survey of the property and of the immediate vicinity under consideration is in many cases indispensable to intelligent analysis. A pocket transit will often give sufficiently accurate results, and the ground may be quickly covered. With the property and vicinity mapped, the general geological relations and their bearing on the ore deposits can be more readily determined, and with greater accuracy. Both longitudinal and cross sections are valuable. In conjunction with surface maps they are often a great aid, and will enable one to trace the surface migration of vein outcrops under surface material, which is often necessary when tunnel or shaft work is to be done at such concealed places.

Cross-sections are, of course, an easier matter where sedimentary rocks are present, as they generally conform to one another, whereas, with igneous rocks, this is seldom the case, nor do their boundaries have so constant direction as with sedimentary rocks. To reason out accurately the outlines of an igneous body below the surface is a difficult undertaking, although by careful work it may be approximated and a basis can be established on which to determine the rock type.

Different outcrops of veins, deposits, or impregnations are generally found to have a distinct bearing on one another. The intersection of two water courses is undoubtedly the cause of a large proportion of oreshoots. This may be the intersection of any combination of channels that offer free circulation to mineralizing waters. As this is true, the study of the physical structure or texture of the rocks is of paramount importance in determining the opportunity they afford for ore deposition through the circulation of aqueous solutions. The richest portion of an oreshoot in strong veins is likely to be at the intersection of fractures or small veins, or where the fracture is complex, such as crushed zones, or zones of brecciation.

Underground circulations have often followed the larger openings, but the deposits are likely to be richer where there is greater opportunity for reaction between solutions and the rocks, such as fissures composed of many small openings. However, in many instances small fissures will so scatter the mineralization that the deposit is worthless.

---

[1] Professional Paper 94, U. S. Geological Survey.

A small amount of work, rightly placed, will assist materially toward an understanding of these conditions, if the property is properly mapped and all details are tabulated and closely studied in the light of sound reasoning. Significant indications cannot always be found on the surface, but where they appear they may suggest concentration of large bodies at depth, or show a general impregnation of a large area, giving reason for the conclusion that the ore is scattered in small unworkable bodies.

It sometimes happens that a true difference in geological horizon can be found, due to erosion, and this may throw some light on the orebody with depth. A case of this kind was recently noticed on a property where the erosion was so rapid on one steep slope that permanent sulphides, such as could be expected to continue to a considerable depth, are found on the surface at a point more than 300 ft. deeper than the existing deepest workings. On the whole, erosion had just about kept pace with oxidation on this property.

Importance of Physiographical Features

Properties of merit generally exhibit surface indications that are noticeable with considerable distinctness even when in the prospect class. The type of deposit or vein can often be determined, and whether occurring under advantageous conditions or at auspicious contacts. Favorable decomposition of the rocks along the ore fissure, and oxidation that would suggest solfataric action conducive to ore deposition, are often to be observed, as are indications, in the outcrop, of thorough impregnation with ore, even though it be low grade, over a substantial width and length.

Primary ores are found on the surface when erosion has been so active that the top of the deposit is removed faster than oxidation proceeds. In this case a thorough impregnation of unworkable low-grade ores is of no value. In other words, there is no chance of secondary enrichment, and little chance of the ores increasing in value. Where the rate of erosion and oxidation is substantially uniform, the conditions are most favorable to enrichment.

A deposit that is porous or permeable and has impervious walls represents ideal conditions for enrichment. If the walls in general are shattered and porous, the enriching solutions may be dissipated and scattered. Climatic conditions and topography are factors directly responsible for or against enrichment. Here again the study of the physiographical features of the district is important, as the enriched zone generally conforms in a rough way to the topography that existed during the time of greatest enrichment. Later, the valleys or gulches have been cut faster than oxidation proceeded, and the only place to look for enriched ores is beneath the remnants of the old topography. Also, where enrichment has taken place under conditions formative of the present topography, the steep slopes are more unfavorable for the deposition of good ore than the gentle slopes. Though the topography to an extent governs the formation of secondary ores, it does not bear the same relation to primary ores. If an oxidized zone is too low grade to be of value, it, nevertheless, shows the presence of mineral, and often a close study of the rock alteration and of the oxidized ores that can be found leads to a clearer understanding of what may be expected with depth.

If a property has sufficient work accomplished to prove that a zone of secondary enrichment exists, the problem is greatly simplified. A thorough investigation of the ground should then be made, to determine, if possible, the extent of the zone and whether the primary ores that will be found at depth are workable. These questions are not always easily solved, but an approximate answer can often be given. A study of the topography, the probable ground-water level, and of climatic conditions will often make it possible to determine the probable depth of the secondary zone. The character of the primary ores can generally be determined by a study of the original sulphides that have been replaced. This often necessitates petrographical knowledge beyond the man in the field, but not beyond his reach.

Though favorable surface indications do not always guarantee valuable ore deposits, they are propitious guides to follow, and if entirely lacking the chances of finding ore are limited. Close observation and mapping are essential clearly to bring forth structural relationship that might otherwise be unnoticed. It is unusual to find more than one strong vein on a property, but seemingly unimportant stringers may often have a considerable influence on the vein.

It is true that "gold is where you find it," and, to a lesser extent, an analogous observation may be said to apply to many other mineral deposits. No inflexible rules can be formulated as to the examination of undeveloped mining properties, but there are usually many factors that point to favorable or unfavorable conditions, as the case may be. All indications of favorable conditions for ore deposition, as well as those which denote unfavorable conditions, should be seriously considered. The engineer should go into the field with an open mind, and not with the preconceived idea that a property is not worth thorough study, just because it is a prospect.

Developing the Prospect Into a Mine

The price paid for a developed mine usually represents the full value of the property, allowing for a reasonable margin of profit, plus the return of the capital invested. The intrinsic value is so readily determined from data available that there is no occasion for selling under this value. The great fortunes made in mining have been made by those who have developed the prospect into a mine. In development enterprises, one must, of course, keep in mind the element of chance. However, this can be reduced to a minimum by knowledge of precisely what the element of risk may be, by the provision of sufficient capital to develop a number of good prospects, and by engineering skill.

Developing prospects requires a combination of qualifications that it is not absolutely essential for a man who is in charge of a paying mine to have. In the latter case a good business man without special technical training is often entirely successful; the mine will stand the overhead expense of trained men for each department. With the company developing prospects, the condition is entirely different, and the average business man, or even the so-called practical man, without technical training, is often a failure. A man in charge of this class of work should have considerable technical ability, combined with business training and an aptitude for hard work. Overhead expenses are a vital consideration, and often the man in charge is called upon to be combined bookkeeper, assayer, surveyor, and mine manager. He should have had experience qualifying him to appraise the property with the smallest amount of work possible, know when to drop a property and when to carry the work still further, and where to place the work so that it will be effective. Most of the money lost by companies developing prospects is caused through the persons interested considering the property as a mine, and continuing work upon it as long as the money lasts, which, obviously, is the biggest kind of a gamble. If the following points were seriously considered there would be less money lost in prospecting:

Correct Understanding Necessary Between Stockholder and Company

The company should let every stockholder know that it is prospecting and developing, and not mining. Its officers and stockholders should know the chances they are taking and should have plenty of money to take up several good prospects if necessary. The physical conditions of a district should be thoroughly considered before development work is started. The questions of transportation, fuel and water supply, severe winters, and similar factors should be seriously weighed against indications of a good prospect in out-of-the way places. A property that promises to develop into a big-tonnage mine may warrant development work in an isolated district, with the expectation that it will be large enough to create future transportation facilities through its own merits. One must, in all cases, weigh the adverse physical conditions in a district against the promises of the property.

It should always be remembered during the development stage that the property is a prospect, and not a mine. To make a company see the advisability of giving up a prospect after a considerable amount of development work has been accomplished, and has proved it to be not what was first expected of it, is a difficult undertaking. Often the man who risks his money in this way has a confused idea of what makes a mining property valuable. Work rightly placed is of value, whether it proves the prospect to be or not to be a mine; but it can impart a value to the property only in the former case.

The Prospect Requires Practical Management

In prospecting, overhead expenses should be cut to a minimum. This is important, as they often amount to a greater sum than is put into actual development work. Far too many men are so impressed with their own importance, when given the place of manager, that they firmly believe a corps of assistants to be necessary, regardless of the number of miners employed. This, however, is much oftener the case with the man who knows nothing about mining than with engineers or practical men. The man in charge can also carry the reverse policy to excess and allow important matters to take care of themselves, while he is attending to small details that might better be left to subordinates.

The ore should be followed. Crosscut tunnels are not advisable in the early stages of development, except in unusual cases; either shafts, or adit tunnels where possible, offer the best means for exploration. A good cross-tunnel site is a temptation that often leads to the foolish expenditure of large sums of money. The amount thus spent is in many cases sufficient to indicate that several prospects are worthless, or to prove a good property to considerable depth. As a general rule, long crosscut tunnels should not be driven unless the ore is rather well proved to the depth that will be obtained by such work. Where the topography is favorable, adit tunnels are, of course, the cheapest method of development, and should be driven in at frequent intervals. However, the topography is often such that shafts must be put down, and they should follow the vein as long as the property is in the prospect class. Drifts, as with adit tunnels, should be driven at frequent intervals.

It is advisable to do the underground work in the cheapest and quickest way possible, in the early stages of development, even if some of the work will not be available for future use. If a mine is found, the property will stand the extra expense; if not, money is saved for the next property. Careless, slipshod methods are not to be sanctioned, but large, vertical shafts and features of construction that are warranted and necessary with a developed mine are foolish until the property is well proved.

Unnecessary Expenditures To Be Avoided

The installation of expensive equipment, for the sake of time saved or the saving of a few dollars per foot, is not advisable until the prospects of return warrant it. A mill is often installed after a few hundred tons of ore is developed. Nearly every mining camp is dotted with these monuments to over-optimism, and such premature expenditure needs no further comment. There are cases where conditions justify the erection of a small prospect mill after a few hundred tons of ore of suitable grade and character has been developed, and when the installation will materially help in a financial way. Each and every prospect presents its own peculiar problems, and these can be determined only by the man on the ground. What would be a foolish expenditure in one case might be a necessary one in another. However, one feature of mining which should not be overlooked in any case is the bodily comfort of the men. The labor expense is proportionately high in all mining operations, and it pays to keep the men satisfied.

One should not hesitate to throw up a property and look for another when a prospect is not making good. After a few hundred feet of development work has been accomplished on a property, it is often considered a mine, regardless of the amount of ore developed. This point of view is probably the greatest cause for losses in development enterprises. It is better to take a bond and lease on good prospects, even at a higher figure, than it is to buy them outright.

Because an old, abandoned mine has produced a large tonnage of good ore in the past is no criterion that it will do so in the future. The investor is often attracted to old properties on account of their past record, but the great majority of such mines have degenerated into the prospect class and should be considered strictly on that basis. The geological conditions are more clearly proved, and often greater confidence can be placed in a campaign of development work than is possible with the surface prospect. Mexico is a field where the results obtained from old, abandoned mines have amply justified the confidence placed in them. However, the great majority of these mines had a large tonnage of low-grade ore on the dumps, as fillings in old stopes, and low-grade primary ores in place in the mine that were not amenable to the earlier crude metallurgy of the country.

Often a man in charge of development enterprises will have his attention called to a rich but small vein. Though such deposits are highly attractive to the individual, or lessee, they seldom would be remunerative enough for a company and should be approached with caution.

Thoroughgoing and conclusive assaying should be resorted to during development, and complete assay maps should be made. If a company should find it to advantage to place the property on the market at some future date, it will find such maps to be a valuable asset.

Development enterprises should be backed by an open-minded policy and good judgment, plus plenty of capital and frankness in all dealings, so that the backers may feel that they have invested in a business that has the average chance for success.

Mineral Exports of New Caledonia*

In the last three years recorded, New Caledonia exported the following quantities of ores and mattes:

EXPORTS OF ORES AND MATTES FROM NEW CALEDONIA

	1917	1916	1915
Ores and mattes of nickel, tons	32,017	35,614	54,105
Chrome ore, tons..	41,892	74,115	57,474

Scarcity of tonnage resulted in a reduction of amounts exported. During 10 years previous to 1915 a decrease in the export of nickel ore was generally balanced by an increase in the export of chrome ore. Since that date nickel ore has been treated in New Caledonia, and mattes have been produced, and it is probable that ferronickel will ultimately be manufactured there, and, doubtless, ferrochrome also, thanks to electric furnaces and the abundant waterfalls in the region. Mr. Hugoniot, the engineer whose name is associated with the creation of the arsenal at Roanne, was sent on a mission some months ago to New Caledonia, to establish these industries, he having already had similar experience, before the war, at the Tao factory.

The following is a list of the exports of Caledonian ores for 1916, showing the countries of destination:

EXPORTS OF ORES AND MATTES FROM NEW CALEDONIA IN 1916
(In Kilograms)

To	Nickel Ore	Nickel Matte	Chrome Ore
France	7,807,000	783,000	9,300,561
England	20,129,045	800,000	31,308,377
Japan	2,743,100		15,728
United States		3,352,067	33,490,876

From this it will be seen that only an insignificant proportion goes to France, the greater part going to England, the United States, and, since 1917, to Japan. The sole exporters of nickel are La Société Nickel and La Société de Hauts Furnaces de Nouméa. The first sends its products principally to the factories of Havre and Glasgow; the second exports mattes chiefly to the U. S. Nickel Co., New Brunswick, N. J. The smeltery of the Société Nickel started work in 1912. It is situated near the sea, and is connected with the mines by eight miles of railway. Besides the two cupolas of 50 tons each by which 45% mattes are obtained, the company installed, in 1916, a bessemer converter for secondary fusion, by which the grade of the mattes can be raised to 76%. In 1916 the company bought out the Tao factory, which was in the market as a result of the liquidation of the Société Electro-Metallurgique de Tao. There are four electric furnaces, capable of treating five tons of ore per day, installed in this plant.

La Société de Hauts Furnaces de Nouméa, situated at the end of Donambo, at Nouméa, began operation in 1910. The ore was then treated by eight cupolas, each containing 12 to 14 tons. A 60-ton cupola was set up in 1915, and, in 1916, another of 50 tons. The company is now putting in a bessemer converter, by which the grade of the mattes can be raised to 75 per cent.

La Tiebaghi Co. and M. Rigaulib are the exporters of chrome ore. Le Chrome Co. stopped its works in order to use the waters of the lake plain, and to construct a powerful electrometallurgical plant at Yate, but Hugoniot's visit will probably cancel this plan, because it would result in the direct manufacture of ferrochrome and ferronickel.

New Caledonia taxes exports for the profit of the colony. The value of ores is fixed by the Official Commission of Averages. The value of nickel ore increased from 30 to 60 fr. a ton from 1914 to 1916, whereas that of nickel mattes increased from 600 to 900 fr. a ton.

The values of ores at the port of export were fixed as follows for the first three months of 1918:

Chrome ore containing 50% and below, 75 fr. per wet ton; plus 2 fr. (50c.) for each unit above 50 per cent.

Nickel ore containing 5.74% and below, 75 fr. per wet ton; 5.75 to 5.99%, 69 fr.; 6 to 6.24%, 75 fr.; 6.25 to 6.49%, 80 fr.; 8.50 to 8.74%, 86 francs.

Antimony ore containing 15 to 29%, 200 fr. per ton; 30 to 49%, 400 fr.; 50% and above, 700 francs.

Cobalt ore containing 4% and below, 40 fr. per wet ton; 4 to 5%, 50 fr.; 5 to 6%, 70 fr.; 6% and above, 90 francs.

Copper ore, 50 fr. per wet ton.

Phosphates, 60 fr. per ton.

Samples of all other products, 5 fr. per ton.

The "ad valorem" duty provided by the law of Sept. 3, 1913, is calculated at the rate of 50% of these amounts.

The Value of Quinine in the treatment of malaria has again been demonstrated. Dr. R. C. Derivaux, medical officer in charge of malarial investigation of the U. S. Public Health Service, has recently insured a reduction of 64.45% in the number of cases of the disease, as indicated by blood examination The experiment was carried out at Lake Village, Arkansas

---

*Translated from *Metaux Alliages et Machines*.

Inclined-Shaft Timbering and a Method Of Alignment

By ARTHUR NEUSTAEDTER*

Advantages of sinking an inclined shaft, when conditions favor that type, are such that careful timbering, grading, and alignment will secure results equivalent to those obtainable in vertical shafts. Certain points must be given consideration in inclined-shaft timbering, and matters of suspension and support are paramount. An interesting and accurate method of inclined-shaft instrumental alignment is felicitously described.

IN THE Sept. 7, 1918, issue of the *Journal* appeared an article under the title "A New Timber Set for Inclined Shafts," by James E. Harding. An important point brought out was the necessity of allowing a rise above that of a right angle to the dip for the hanging-wall member of an inclined shaft set. This does not seem to be universally known or applied, and an extended article covering this point more fully, and dealing with the details of inclined-shaft timbering and the method of aligning and squaring, will doubtless be of value.

As pointed out in the article mentioned, both vertical and inclined shafts have their respective advantages, but ordinarily not as much care is taken in the alignment and proper timbering of an inclined shaft as is the case with vertical shafts. In consequence, troubles have arisen which have militated against the adoption of the inclined shaft where conditions were in its favor. In choosing between a vertical or an inclined shaft, there need be no hesitancy in deciding upon the latter if the conditions favor it. If timbered in an approved manner, properly aligned, and with sufficient attention paid to the uniformity of slope, the inclined shaft is as safe as a vertical shaft, can be equipped for the same hoisting capacity, and maintained as easily or more easily.

CONDITIONS GOVERNING THE "RISE" IN INCLINED SHAFTS

The collapse of the four inclined shafts on the south end of the Comstock Lode, commented upon by Mr. Harding, was due, no doubt, to the hanging-wall members falling away after they became loosened in the process of moving below the position at right angles to the dip, although it would seem that something must have happened to the bearer timbers, as doubtless there were bearers in those shafts.

The amount of rise above the right angle allowed for in some of the inclined shafts on the Rand was, I believe, about ¼ in. to the foot; one shaft began with an allowance of about ½ in. to the foot, and this was thought to be too much. I have measured the downward movement of the hanging-wall members of a few inclined shafts in which the original sets were placed at right angles to the dip, and found a drop of from one to three inches below the right-angle position. The amount of rise necessary depends on the dip of the shaft, the nature of the ground, and whether the shaft is sunk with the vein or some distance back in the foot wall. I believe that the allowance for shafts dipping 75 to 50° should be from ¼ in. to ⅜ in. per foot above the right angle of dip and from ⅛ to ¼ in. per foot for those dipping 45 to 30°. The hanging members which have been given a rise may not lower to the right-angle position, but any settlement would at least tend to tighten the sets, and it would seem advisable to provide for this.

NECESSARY CONSIDERATIONS FOR INCLINED SHAFTS

The speed and safety of hoisting from an inclined shaft depend upon the proper timbering, alignment, and uniform grade and true vertical curve where a change in direction of dip may be desirable. The accompanying drawings illustrate several points to be emphasized in inclined-shaft timbering, and from them any good timber framer could design a similar set to meet local conditions, and the underground surveyor could readily follow and apply the principles involved in alignment, grade, and squaring up. Should the task fall to the shaft crew, the foreman no doubt could be depended upon to place the sets with the proper rise and make the alignment by means of wires or chalk lines and plumb-bobs. A slope-level triangle, made of seasoned hard wood surfaced to 1¼ in. square, with 18 to 24 in. as the length of the hypotenuse, and conforming to the angle of the dip of the shaft, if used in connection with a good level and straight-edge will give good results in placing the sets to grade. It will be found advisable to make three of these slope-level triangles at the start, all matched in every essential, so that if anything should happen to the one in use, the others may be depended upon to give a like slope.

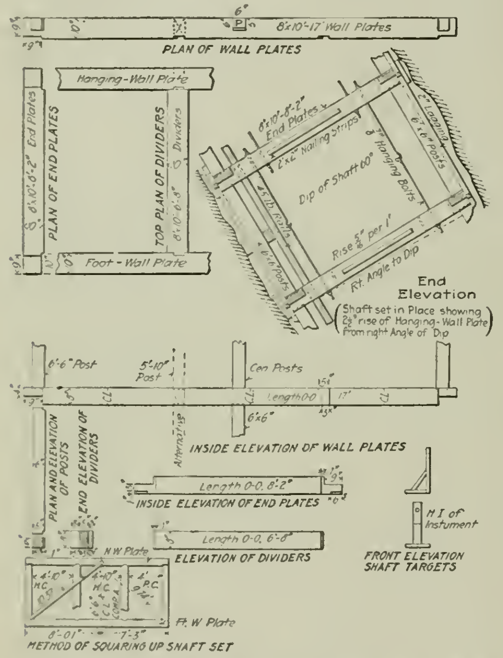
The section of the shaft shown in the drawing is represented as being in ground that requires lagging on all sides. In shafts where the walls are good and that do not require timbers to support the hanging wall, sills, placed lengthwise across the foot wall and to grade, supported in hitches at the ends of the shaft and with supporting posts, are all that is required. If the distance between sets is greater than 6 ft., a false sill or tie between the regular sills is put in to support the tracks.

END PLATES SUPPORT THE WALL PLATES

It will be noted that the hoisting compartments are each 4 ft. 10 in. by 6 ft. 6 in. in the clear, and this area will accommodate a skip running on a 36-in. gage track with ample clearance, and a special mule car which will permit a 900-lb. mule to stand on the level floor while being transported. The pump compartment, though only 4 ft. in the clear lengthwise of the shaft, has ample room for a ladderway in the center, an air line on one side and a water column on the other, and the width between wall plates permits of sufficient room for any other necessary pipes or wires. This inclined-shaft set is framed substantially as a regulation vertical shaft set, with the exception that the end plates support the wall plates, so that the hanging bolts are naturally suspended from the end plates. There are no guides, and the vertical pressure is less; so that the posts may be of smaller cross-section and it is not necessary that they shoulder over on the full end cross-section of the plates, nor overlap the divider tenon, as in vertical-shaft timbering. However, if the ground be heavy enough to require larger posts, they may be placed in the same way. All posts are notched on one side, and so placed that, should one become loosened, it may be seen. The members of a set are squared, no allowance being made for the lack of squareness as affecting the hanging- and foot-wall position of the timbers, as otherwise there would be a tendency to defeat the object sought. Though the lower edge of the inside of the foot-wall plate projects slightly, and the posts do not butt up squarely, the deficiency is hardly noticeable, and is not of moment.

---

*Mining engineer, 30 Wegman Parkway, Jersey City, N. J.



DETAILS OF TIMBER SETS FOR THREE-COMPARTMENT INCLINED SHAFT

Templets Used in Framing of Timber

The framing of the members of a shaft set is done by means of templets which are carefully made from the specimen set and put away when not in use. It is advisable to keep the specimen set on top, so that it can be referred to by the framers until they can go ahead mechanically. Plate members having the same thickness, whether below or above the standard size sought, should be selected. The centers of all the compartments of the foot-wall plate, and the center of the hanging-wall plate of the middle compartment only, are marked by a saw cut to be used as a guide in aligning, squaring, and indicating centers of the tracks and ladderway.

After a section of the shaft has been trimmed and made ready to place the next set, or, better still, prepared so that three or four sets can be placed, the end plates are sent down and hung to the set above. Wall plates, posts, and dividers follow, with a supply of blocking and wedges, and after placing the timbers and moderately tightening up the set, the timbers are wedged lightly, lined and set to grade by eye. Assuming that more than one set is to be lined up, the procedure is to place the lowest set first with the transit, and then the others are brought to line and grade by the use of a chalk line and straight-edge.

Method of Instrument Alignment of Sets

In lining up the sets with a transit, the wooden base to which the instrument is secured in the transit case should have four holes bored through it, so that it may be screwed down centrally over the saw cut on the inside face of the middle compartment. Having secured the instrument base centrally to a set known to be exactly in line and to grade, the instrument is screwed to it with one set of leveling screws placed in the line of sight down the shaft and the cross axis leveled with the other set, as near as may be. One of the targets, as shown in the sketch, is provided with fine wire cross hairs fixed over a hole, the purpose of which is to permit the observer to see the cross hairs by reflected light against a background of tracing cloth. The cross hairs should coincide with the height of instrument above its position, as the target is held centrally over a checked set some distance down the shaft when the sights are taken. A similar target is held centrally on the set to be lined up and is then brought to the grade line, as projected from the instrument to the first target, by wedging. This brings the set to grade at the center of the middle compartment. Next, place the striding level on the cross axis of the transit and level up. Repeat the operation of sighting for alignment, but this time the set should be wedged in such a way as to bring the saw-cut centers of both foot- and hanging-wall plates in the line of collimation. To square up the set and prevent the tendency of the shaft to "corkscrew," place a measuring stick, which is provided with marks corresponding to the hypotenuse length of the squared set from the saw-cut of the hanging-wall plate to the inside corners of foot-wall plate (10.37 ft. and 9.74 ft. in the set illustrated), and wedge the set to coincide with the marks. The alignment and grade should be checked, and it is well to see, also, how the grade line in the other compartment checks with the sets above. By means of lights held near the track, any inequality of grade may be detected when the skip is hoisted.

The rise from a right-angle position is given a set at or near the collar of the shaft and again below every bearer set. A templet is made of 3 x 3-in. dressed lumber with 30- to 36-in. sides, and is used to set the rise. One side is held against a straight-edge placed against the inside slope of the foot-wall plates. The end plate is then elevated to conform with the other side. Both wall plates are leveled along their ength, and the other end plate is then checked up. As the method of framing will make the distance from center to center of both hanging- and foot-wall plates of any adjoining sets the same, the rise will be maintained, though it is well enough to check up about every eighth or tenth set. The first set below any of the bearers will require that the posts from this set to the bearers be cut to measure, as they will vary in length; also, they will have to be spiked to the bearers, as it is inconvenient to tap them when in place. Bearers are placed every 80 or 100 ft., or near a station.

Credit must be given my son, Harold A. Neustaedter, mining engineer, for devising the instrumental method of inclined-shaft alignment.

Prevention of Illness Among Mine Employees*

By A. J. Lanza

The prevention of illness among the employees of mining companies is especially desirable, in view of the importance of the industry, the unsettled conditions of labor, and for humanitarian reasons. The burden of chronic illness is altogether unwarranted and unnecessary. If the industry is to maintain an efficient labor force, it is essential that it make every effort to keep employees in good physical condition.

The basic principles underlying health conservation are the same for any industry, but they are here applied especially to the mining industry, and more particularly, perhaps, to metal mining, as it is with this phase of the industry that I am most familiar. Moreover, metal mining presents more health hazards than coal mining.

The first step in the prevention of illness lies in securing employees who are in sound health and free from organic disease. I do not mean that all men who go underground should be physically perfect, but they should be free from organic defects of the heart, lungs, and other organs, or from anatomical defects that would markedly increase their liability to accident. The number of men working underground in mines in this country whose physical condition totally unfits them for such work presents a situation that should not be allowed to continue, and which I believe is not equalled in any other industry in the country. There is only one way to secure men who come up to the required standard, and that is by a thorough physical examination before employment. I am fully aware of the objections felt toward such a procedure by many employers and employees. There is much to be said on both sides, but to any one who is at all familiar with the mining industry as it is today in this country, and who approaches the matter with an unbiased mind, there can be no doubt as to the necessity for physical examination. As a purely logical proposition this is self-evident; but there remains the further necessity of placing physical examinations on such a basis that they can be carried out in a just and equitable manner and free from the abuses and suspicions to which they have been subject.

The best way of conducting physical examinations is by properly constituted authorities of the various states. That is, if John Jones wished to work as a miner, when he appeared at the employment office of the Smith Mining Co. he would have in his possession a certificate from the state authorities declaring him to be free from organic or other defects that should, in the natural order of events, bar him from underground work. Such a system would presuppose reciprocity among the mining states and a basic standard of physical fitness. It would be well within the province of the Federal Government to establish such a standard for adoption by the various states. This arrangement may seem idealistic and impracticable, and it is offered here largely for the purpose of causing reflection and argument; but at the same time, unless the mining industry can put into effect a system that will be fair both to employer and employees, and that will prevent obviously unfit men from working underground, it will be almost useless to make any other effort toward prevention of illness among employees. I believe that the time has come for the American Institute of Mining Engineers to consider seriously the necessity for and the means of carrying out physical examinations, and to take a definite stand.

The second requisite for the prevention of illness among employees is the maintenance of working conditions underground on a high plane of sanitation and efficiency, so that illness arising from unsanitary conditions may be reduced to a minimum. The greatest need in the improvement of underground conditions is the elimination of dry drilling. The relationship between hard-rock dust and miners' phthisis has been so clearly demonstrated that it is not subject to argument. Suffice it to say that the efforts made in England and in British colonial possessions to deal with this evil have shown the possibilities of abating it, though in this country little has been attempted. So long as dry drilling is permitted in hard-rock mines, just so long will we have an inordinate amount of pulmonary disease among the miners. That this has worked an economic hardship on the industry, aside from its humanitarian features, and that it has been one of the causes of the better grades of mine labor leaving the industry, is apparent to any one familiar with the conditions; and it is hard to understand why the subject of dry drilling has received so little attention in this country. Dry-drilling apparatus may be as deadly as a machine gun, if somewhat slower, and its continued use is a matter of reproach. Though it may be true that the water varieties of machine drills are not so satisfactory as they might be, at least the question of their improvement should receive serious attention. It is incredible that American ingenuity, which has produced the telephone, the telegraph, and the flying machine, should be unable to cope with the production of a water drill that would make miners' phthisis largely impossible.

Proper toilet facilities underground are important as a health measure, but vary so much according to the size and locality of the mine that they need not be gone into in detail here; besides, their principles are well understood. Adequate provision for medical and surgical service is also necessary, so that minor illness and injuries may be promptly treated and not become of major importance. The "safety-first" movement has become highly specialized and efficient. Health service, if I may use this term, has not been developed in the same proportion. Although many of the larger mining companies maintain first-class hospitals, the prevention of sickness among miners has not kept pace with the prevention of injury. It is just as feasible to distribute posters and other educational matter dealing with the proper care of common colds, constipation, and other minor troubles, which are forerunners of serious ailments, as it is to impress on the miners the necessity of having the smallest injury promptly attended to by the company doctor. There is a need for a closer coöperation between the doctors and the miners in handling the minor ailments when they first appear. In former days, the miner was an English-speaking person, with all the advantages of a knowledge of the country and its institutions. At present, underground workers are largely foreigners, and the employer must provide for their health during working hours, and often in their homes, if he desires to keep them on the job.

---

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E., February, 1919.

It is probable that the mining industry will always be hazardous to health and life as compared with other industries, but at present it is needlessly so, because the wastage of human material can be prevented by securing physically fit labor, and by keeping its health unimpaired.

Average Prices of Principal Metals For 24 Years

The table herewith presented records in convenient form the average prices of the principal metals from 1895 to 1918, inclusive, in New York, and in the cases of some metals the average yearly price at London and St. Louis. Quotations for copper, lead, tin, spelter, antimony, and aluminum, in New York or St. Louis, are in cents per pound. Quicksilver prices are per flask of 75 lb. Silver and platinum are quoted in dollars per ounce. All London quotations are given in pounds sterling per long ton.

The quotations for copper are for electrolytic copper beginning with 1899, but for Lake copper in the preceding years; London copper quotations are for spot standard copper. The lead prices are for common lead; spelter for ordinary brands or prime western; tin prices at New York are for spot Straits tin and the London quotations for spot standard tin; antimony quotations are for spot, ordinary brands; aluminum prices are for No. 1 ingot, but represent the uncontracted market, which is in the main metal offered for resale, the bulk of the aluminum production entering consumption on long-time contracts. Silver quotations at New York are for bar silver, 999 fine.

AVERAGE PRICES OF PRINCIPAL METALS 1895–1918

Year	Copper Electrolytic New York	Copper London	Lead New York	Lead London	Tin New York	Tin (a) London	Spelter New York	Spelter St. Louis	Spelter London	Antimony, New York	Quicksilver, New York	Aluminum, New York	Silver, New York	Platinum, New York
1895	10 76 (b)		3 23		14 05	63 333	3 63			7 560	39 58	58 66	65 250	
1896	10 88 (b)		2 98		13 29	59 496	3 94	....	.	6 650	37 00	50 75	67 060	
1897	11 29 (b)		3 58	12 367	13 67	61 400	4 12	.....	..	6 750	38 50	39 00	59 290	
1898	12 03 (b)		3.78	12 983	15 70	71 204	4.57	......	.....	8 690	40 70	30 58	58 260	
1899	16 67		4 47	14 933	25 12	122 429	5 75	..		9.430	43 63	32 72	59 580	15 22
1900	16 19		4 37	16 987	29 90	133 575	4 39	...	.	9 500	51 00	32 72	61 330	18 09
1901	16 11		4 33	12 521	26 74	118 633	4 07	..		8 250	47 00	33 00	58 950	20 00
1902	11 626	52 460	4 069	11 262	26 79	120 720	4 84			6 120	48 03	33 00	52 160	19 00
1903	13 235	57 970	4 237	11 579	28 09	127 320	5 40	5 191		6 000	41 32	33 00	53 570	18 91
1904	12 823	58 884	4 309	11 983	27 99	126 733	5 100	4 931		6 371	41 00	35 00	57 221	19 50
1905	15 590	69 465	4 207	13 719	31 358	143 083	5 882	5 730	25 433	10 250	38 50	35 00	60 352	20 34
1906	19 278	87 282	5 657	17 370	39 819	180 646	6 198	6 048	27 020	21 230	40 90	35 25	66 791	28 04
1907	20 004	87 007	5 325	19 034	38 166	172 638	5 962	5 812	23 771	14 840	41 50	45 00	65 327	30 98
1908	13 208	59 902	4 200	13 439	29 465	133 124	4 726	4 578	20 163	8 004	44 84	28 20	52 864	16 32
1909	12 982	58 732	4 273	13 042	29 725	134 774	5 503	5 352	22 185	7 466	46 30	22 00	51 502	24 87
1910	12 738	57 054	4 446	12 920	34 123	155 308	5 520	5 370	21 050	7 386	47 06	22 25	53 486	32 70
1911	12 376	55 973	4 420	13 970	42 281	192 353	5 758	5 608	25 281	7 540	46 54	20 07	53 304	43 12
1912	16 341	72 942	4 471	17 929	46 096	209 420	6 943	6 799	26 421	7 760	42 46	22 01	60 835	45 55
1913	15 269	68 335	4 370	18 743	44 252	201 679	5 648	5 504	22 746	7 520	39 54	23 64	59 791	44 88
1914	13 602	61 524(c)	3 862	19 076(c)	34 301	156 564(c)	5 213	5 061	22 544(c)	8 763	48 31	18 61	54 811	45 14
1915	17 275	72 532	4 673	22 917	38 590	163 960	13 230	13 054	67 553	30 280	87 01	33 98	49 684	47 13
1916	27 202	116 059	6 858	31 359	43 480	182 096	12 804	12 614	72 071	25 370	125 49	60 71	65 661	83 40
1917	27 180	124 892	8 787	30 500	61 802	232 563	8 901	8 730	52 413	20 690	106 30	51 59	81 417	102 82
1918	24 628(d)	115 530	7 413	30 100	(e)	330 138	8 159	7 890	54 180	12 581	123 47	33 53	96 722	105 95

(a) Prices of tin, London, from 1895 to 1914 from statistical report of Metallgesellschaft, Frankfurt-am-Main. (b) Prices 1895 to 1898 are for Lake copper (c) Averages of nine months, no quotations being made during August, September, and October (d) Average of 11 months, no quotations being made in December (e) No average computed

Cape Copper Co., Ltd.

The accounts for the Cape Copper Co., Ltd., a corporation owning mines in Namaqualand, Cape Colony South Africa; in the Raqua Hills, in India, and in Newfoundland, show that there is a deficit of £64,146 for the year ended Apr. 30, 1918. Conditions brought about by the war seriously affected the company's operations during the year. In Africa it was found impossible to work the smeltery for more than 170 days, on account of lack of coke. Copper production was therefore reduced to less than half of the previous year's output. Cost of production has increased in inverse proportion.

In India, the blast furnace could be worked for only about two months, for the same reasons that restricted the African production. Operations during this trial run were, however, satisfactory. Materials for the erection of a refinery were delivered; and a Minerals Separation flotation unit has been added to the concentrating mill. A portion of the converter plant was erected during the year, and small-scale tests resulted in the production of blister copper assaying 98.8 per cent.

The company, which has paid dividends amounting to £3,108,750 on the ordinary, and £403,425 on the preference shares, since its inception in 1899, anticipates a return to normal prosperity when the war restrictions on commerce have been removed and more stable and normal operations become possible.

Southport Miners Ask Increase

The Southport Miners' Federation, says a London dispatch, which demanded on Jan. 15 that the government demobilize all miners in the army, also decided by a majority of more than two to one to demand an advance of 30% over the present wages other than those classified as war wages.

Magmatic Iron Ore in Arizona

By SYDNEY H. BALL* and T. M. BRODERICK†

INTERESTING genetic relations warrant the description of a group of iron orebodies in Arizona, which from their titanium content, small size, and relative inaccessibility may never be important enough to be mined. These iron orebodies are differentiates of a gabbro, the gradation from gabbro to iron ore being particularly clear. At one locality the gabbro is massive, and here the iron ore occurs as irregular bunches in the rock; at another the gabbro is gneissic and the iron ore occurs in dike-like masses. Compared to other geological occurrences, the iron orebodies resemble some of those in the Adirondacks, New York,[1] described by Kemp. The senior author of this paper is responsible for the cursory field examination and the junior for the petrographic and chemical work.

The Eureka mining district is situated in western Yavapai County, Ariz., about 40 miles west of Prescott. The rock foundation of the region consists of contorted mica schists and basic igneous schists, which are intruded by gabbro and granite. This part of the rock series is probably of pre-Cambrian age. It is intruded by a monzonite boss of presumably late Cretaceous or early Tertiary age. After the period of intrusions the country was deeply and ruggedly carved by erosion, the irregularities being later leveled by the deposition of a conglomerate which resembles the Gila conglomerate at Globe and is approximately of the same age (Quaternary). Basaltic flows and intrusive sheets followed. The present topography is that of a slightly uneven upland, deeply dissected by steep valleys.

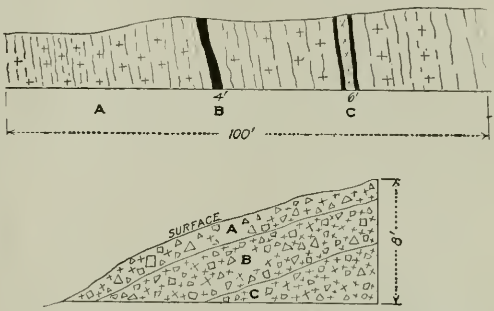
MINERALOGICAL OCCURRENCES IN THE EUREKA DISTRICT SHOW REPLACEMENT

In addition to the iron-ore deposits, the district includes the property of the Bagdad Copper Co., a typical "porphyry copper," the country rock being the monzonite; the Copper King, a series of lenses of zinc blende replacing schists along a fracture zone; and the Hillside mine, a vertical vein cutting nearly horizontal mica schist and carrying gold and silver.

The iron-ore deposits occur along the medial line of a gabbro band, three-fourths of a mile to one mile wide and extending northeasterly and southwesterly. Cattlemen state that this band and its sporadic iron-ore deposits can be followed for 15 or 20 miles. The gabbro is intrusive in ancient schists and is cut by granite and aplite dikes.

The most northeasterly point examined by us is on the south side of Boulder Creek just below the mouth of Copper Creek. At this point the gabbro is a coarse-grained massive rock, the constituent feldspar and either hornblende or pyroxene grains being ¼ in. in diameter. Locally, through shearing, the dark minerals pass into a chlorite belt. Epidote is also locally developed. Some parts are practically without magnetite; elsewhere magnetite is an important constituent. Such rock grades rather suddenly into irregular masses, which are composed almost entirely of titaniferous magnetite. In one case a stream-polished exposure shows the gradation within 15 ft. from gabbro, in which magnetite is but an accessory mineral, to magnetite ore. In other examples, magnetite and gabbro are in fault-contact with one another.

A few tunnels and pits corroborate the surface evidence that the orebodies are small, although numerous. A typical occurrence as exposed on the side of an open cut is shown in Fig. 1. The iron ore varies from a compact fine-grained to a distinctly granular ore, the individual grains being ¼ in. in diameter. A little pyrite is visible.



STRUCTURAL SECTIONS, MAGMATIC IRON ORE

Fig. 1 (upper). Side of Open Cut Near Boulder Creek, Showing (A) Fine-Grained Iron Ore With a Few Feldspar Grains Grading Downward Into (B) Magnetite-Rich Gabbro Grading Downward Into (C) Normal Gabbro Containing Bunches of Magnetite-Rich Gabbro.

Fig. 2 (lower). Exposure Along Milholland Creek, Showing Dike-Like Occurrence of Iron Ore in Gneissic Gabbro. (A) Gneissic Gabbro Grading Sharply Into (B) Magnetite, Which Is Cut by (C) Gneissic Granite Pegmatite.

As seen under the microscope, the Boulder Creek gabbro is relatively fresh. The pyroxene is only partially replaced by hornblende, and the feldspar (labradorite) is fresh and unaltered. The alteration of pyroxene to hornblende has taken place chiefly around the outside of the grains, leaving in most cases a core of the original pyroxene. Magnetite, ilmenite, pyrite, and apatite are accessory minerals. Secondary minerals, in addition to uralitic hornblende, are zoisite, leucoxene, epidote, and chlorite. There has been some strain upon the rock mass since it solidified, as is evidenced by the bending and wedging out of the albite twinning of the plagioclase. The ore is a magnetite-rich phase of the gabbro. Besides magnetite and ilmenite, a little original plagioclase and apatite and secondary uralite are present. Two samples gave the following analyses:

	Per Cent	Per Cent
Fe	60.09	62.02
Ti	9.80	8.20
Mn	Trace	Trace

Tests for vanadium, chromium, and nickel gave negative results.

A second exposure of the iron ore, on Milholland Creek, about 1¼ miles southwest of the locality just described, was also examined. Here the gabbro is distinctly gneissic, and the iron ore occurs in discontinuous dike-like forms, which, however, grado into the normal gabbro. Several dikes are parallel to one another, all having a common extension parallel to that of the gabbro belt. The magnetite dike-like bodies, which are from 3 to 8 ft. wide, weather strongly in relief above the gabbro. The ore is slightly gneissic, and this is emphasized by narrow, parallel, lit-par-lit intrusions of gneissic pegmatite. The relations are shown in Fig. 2.

---

*Of Rogers, Mayer & Ball, 42 Broadway, New York.

†Dept. of Geology and Mineralogy, U. of Minn., Minneapolis, Minnesota.

[1] J. F. Kemp, 19th An. Rep., U. S. Geological Survey, Part 3, 1899, p. 377-422.

Under the microscope, the rock associated with the magnetite in this locality is seen to be a hydrothermally altered gabbro. The feldspar and the pyroxene have almost entirely disappeared, the former being replaced by a fine-grained mosaic consisting chiefly of epidote grains, and the latter by hornblende, chiefly of the fibrous variety, uralite. Magnetite, ilmenite, and pyrite are accessory constituents. In addition, there are a few small grains of a mineral having the properties of enstatite.

The ore is a massive titaniferous magnetite, with dark red bands consisting of secondary hematite. Scattered small patches of fibrous amphibole show that, before alteration, pyroxene was intergrown with the oxides. A partial analysis of the ore is given in the following table:

	Per Cent
Fe	60.35
Ti	8.40
Mn	Trace

Tests were made for vanadium, chromium, and nickel, with negative results.

Similar dike-like bodies of titaniferous magnetite which extend parallel to the banding of the surrounding gabbro, and grade into it, occur in other places. The origin of the primary gneissic, or fluxion structure of igneous rocks, in conjunction with the occurrence of bands of differing composition (such as the dike-like bodies of magnetite) parallel to the fluxion structure, has recently been studied by Grout.[3] As a result of his study, he suggests that the fluxion and banded structures may have developed during the crystallization of the magma as a result of processes of differentiation aided by convection currents. It is, however, possible that while this part of the partially differentiated gabbro mass cooled it was rendered gneissic by stresses from northwest to southeast, or vice versa.

Notes on Colloidal Metals*

By Jerome Alexander

It is an outstanding fact that many of the properties of substances are dependent, not on their chemical composition, but on the kind and degree of aggregation of their constituent particles. Thus, carbon, in one crystalline state of aggregation (diamond), is the hardest known substance; whereas in another crystalline state (graphite), it is so soft that it is used as a lubricant. Laying too much stress on the mere chemical analysis of substances is likely to obscure the fact that the nature of the aggregation of their particles is always a factor of importance, and sometimes the most important factor.

Colloid chemistry deals with matter in a fine state of subdivision. Its sphere begins with particles just a little smaller than a wave length of light and extends down until they blend into molecular dimensions. With particles of this size, such phenomena as surface tension and adsorption, which depend on the development of free surface, become enormously magnified. Thus a cube of 1 cm. edge has a surface of only 6 sq.cm.; but if it is reduced to colloidal dimensions by being cut up into cubes each having an edge of 0.01 *u* (0.00001 mm.), it will yield one million, million, million (1,000,000,000.-000,000,000) such cubes, having a combined area of 600 sq.m., or 21,274 sq.ft. The tiny force with which a drop of rain clings to the window pane becomes a factor to be reckoned with, if the surface involved is increased millions of times.

From the colloid-chemical point of view, metals and alloys may be regarded as jellies or sponge-like structures, the viscosity or stiffness of which at ordinary temperatures is exceedingly great; and, like all jellies, their properties are dependent on the composition and degree of dispersion of their constituent phases. These, in turn, depend on chemical composition, mutual solubility, speed of chilling, subsequent mechanical and heat treatment, and other considerations. In fact, in preparing metals and alloys for practical use, it is usual to remove undesirable constituents (as in the conversion of pig iron into steel), add desirable constituents (as in case-hardening or making alloy steel), or to control the composition of particle size of the phases by chilling, rolling, or tempering.

It is a matter of importance which is the dispersed phase and which is the dispersing phase. For example, cream is an emulsion or dispersion of fat in water and wets paper, whereas butter is a dispersion of water in fat and greases paper. Though I have not yet examined the experimental facts in the case of metals, it seems probable that the relative surface tensions of the phases toward each other are important factors in determining the constitution of the matrix or dispersion medium, and in determining which substances shall constitute the dispersed phases. Substances that lower surface tension tend to collect at the interfaces and thus produce in the matrix, as well as in the dispersed phases, a fine degree of subdivision. Thus, according to Putz, the predominant effect of vanadium in steel is to decrease the size of the ferrite grains and make the material harder; it renders the ordinary structure due to pearlite fine-grained and homogeneous.

I believe that the application of the ultramicroscope to the study of the minute structure of metals will reveal much that is of interest. The great difficulty is in preparing sections of sufficient tenuity for examination. One means of preparing such thin metallic films was devised by Faraday, who floated gold leaf upon dilute cyanide solutions; and an intimation of what results may be obtained was given by Sir George Beilby in his Hurter Memorial lecture entitled, "The Surface Structure of Solids."[1]

Colloids exert a powerful influence on crystallization. Thus, plaster of paris crystallized from pure water shows characteristic long interlacing crystals. The addition to the water of even 0.01% of gelatine delays the set and practically inhibits the crystalliation, there being formed, instead, spherocrystals. With the addition of 0.5% of gelatine, the time of set was increased from 40 min. to 960 min. Most metals have a powerful tendency to crystallize, which in many cases is strongly inhibited by various substances present; and because even small quantities may produce the result, it is obvious that they are in a finely dispersed state, and, in many cases, probably colloidal.

---

[3] Grout, Frank F., "Internal Structures of Igneous Rocks: Their Significance and Origin, With Special Reference to the Duluth Gabbro." *Journal of Geology*, Vol. 26, p. 439-458, 1918.

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E. February, 1919.

[1] *Journ.* Soc. Chem. Ind., Vol 22, p. 1166.

The change in dispersion of a substance with varying chemical composition of the dispersion medium may be illustrated by an experiment with ordinary soap, which dissolves in alcohol into a clear crystalloidally dispersed solution; even in the ultramicroscope no particles are visible. In water, however, soap forms a cloudy colloidal solution; and, if sufficient water is added to the alcoholic solution, a turbidity at once becomes manifest. If water is added to the slide under the ultramicroscope, the alcoholic solution literally explodes into millions of actively moving ultramicrons of colloidal dimensions. Another strong analogy to metals is exhibited by transparent soap. When quickly chilled, it shows very small ultramicrons, whereas when slowly cooled the ultramicrons are much larger and may make the soap cloudy. Still another analogy is found in gold ruby glass. When quickly cooled, this is colorless and shows no ultramicrons; but when reheated, the invisible nuclei of metallic gold grow into visibility in the ultramicroscope, and the glass develops a color. If the colorless glass has been formed under conditions insuring the formation of a large number of nuclei, the glass when reheated develops a large number of small ultramicrons, and the color is rich ruby red. If the initial chilling has been too slow, the nuclei are too few and too large, and when reheated there are formed a relatively small number of large masses of metallic gold, which give the glass a violet or dirty blue color. In such spoiled ruby glass, the aggregations of gold may be visible to the eye.

From what has just been said one can easily understand that when metals are heated so as to reduce their viscosity sufficiently their particles move to establish the tendencies toward aggregation that were arrested by the high viscosity consequent upon solidification. This accounts for most of the phenomena consequent upon tempering or annealing. Even at ordinary temperatures gold and lead diffuse into each other, but the motion of their particles is so slow that it is entirely invisible in the microscope and can be determined only after a long lapse of time. In fact, a cork, if given sufficient time, will gradually float to the top of a barrel of tar or asphalt.

Finally, I might mention the diffusion of gases into and through metals. The adsorption of gas is primarily a surface phenomenon. Particles within the mass of a phase are on all sides surrounded by particles of the same kind. Particles at the surface, however, have one side in contact with a different phase. The free surface or interface thus becomes the seat of a residual attraction or surface affinity. This is exhibited by freshly cleaved sheets of mica, which adhere if promptly put together, but in a few moments this property is lost, owing to the adsorption of atmospheric gases.

In the case of finely dispersed metallic systems, with enormous free interfaces, the adsorption of gas may weaken the attraction between the particles and render the metal brittle. In the case of gases with actively moving particles, the metal may be actually penetrated by the gas, as those who have to handle hydrogen know to their sorrow.

In conclusion, I would emphasize the fact that in nature all transitions are gradual. Ordinary coarse suspensions pass imperceptibly into and through the colloidal zone into actual crystalloidal subdivision, or so-called "true solution." Solutions pass so gradually into gelatines that we cannot determine the exact point where one ends and the other begins, and there is no sharp line of demarcation between physics and chemistry, which are connected by a twilight zone of colloidal phenomena partaking of the nature of both.

University of Illinois Research Work

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen research graduate assistantships in the engineering experiment station. The assistantships, for each of which there is an annual stipend of $500 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of master of science will be conferred. Not more than half of the time of a research graduate assistant is required in connection with the work of the department to which he is assigned.

Nominations to these positions, accompanied by assignments to special departments of the engineering experiment station, are made from applications received by the director of the station each year not later than the first day of March. The nominations are made by the executive staff of the station, subject to the approval of the president of the university. Nominations are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate purposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring, and become effective the first day of the following September.

The engineering experiment station, an organization within the College of Engineering, was established in 1903 for the purpose of conducting investigations in the various branches of engineering, and for the study of problems of importance to engineers and to the manufacturing and industrial interests of the State of Illinois.

Additional information may be obtained by addressing: The Director, Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Zinc Smelting in India

AT THE annual general meeting of the Burma Corporation, Ltd., held recently, the chairman, Sir T. R. Wynne, made the following report:

The Indian market offers an excellent field for the disposal of lead. During the war the company's lead has obtained a very firm footing in India, which has relied on our product to supply its entire wants, and at the present time our lead is also in great demand for China and Japan. Lead, moreover, is a marketable product at all times, and I feel fairly confident in thinking that with our cheap labor, high-grade ores and other advantages, it will always be possible for us to produce this commodity at less cost than our competitors. With regard to our zinc concentrates, there are two courses open. The first is to sell our concentrates, and the second is to smelt them ourselves and sell the products. Dealing with the first course, in my opinion, this corporation might reasonably claim from the government the same treatment which has been given to Australia, namely, the purchase by it of our zinc concentrates output for a period of years. I take it that for the period of the arrangement with Australia the British government will control the sale of zinc concentrates produced in the empire, and dispose of them in such a manner that enemy interests may be prevented from securing any control over such important raw materials. Again, the industry of zinc smelting in England is developing, and will no doubt create a market for such zinc concentrates as we shall have for disposal after meeting our own requirements. With mutual good will, I see no reason why, when we have concentrates for sale, we should not be able to arrange for their purchase, on terms acceptable to both parties, by some of the new smelting works now being erected in England. I say "after meeting our own requirements," because it is extremely probable that it will be more profitable to smelt the major part of our zinc concentrates in India in works constructed and owned by the Burma Mines.

POSSIBILITIES OF ZINC SMELTING IN INDIA

In 1916 I suggested to the board that the government of India would, I thought, be ready to assist in the establishment of zinc-smelting works in India, and it was decided to approach it with a proposal. There were two reasons why such a proposition was attractive: (1) Because, owing to the great strides made in the development of Indian industries during the last few years, and especially during the war, India, with its freedom from labor troubles, cheap coal, and its proximity to the mines, offered an attractive opportunity for the establishment of zinc-smelting works; (2) because the Tata Iron and Steel Co. was anxious to secure a steady supply of zinc and sulphuric acid for its own purposes and for subsidiary companies, and was prepared to enter into a long-term contract with the zinc works for spelter and acid, and give every assistance in their construction and operation. The negotiations with the Indian government extended over a considerable period of time.

The terms offered provide for: (1) The grant of a new mining lease for 30 years; (2) the fixing of the royalty on the basis of 2½% of 30% of gross metal value of the ore at pit's mouth; (3) a loan not exceeding £200,000 up to half the cost of the new zinc-smelting works; (4) concessions as regards railway freight. In addition to the grant of a new mining lease for 30 years, the present lease having only 18 more years to run, we have received another letter from the government of India stating it would be prepared to recommend to the Secretary of State that the area of the lease should be increased to the full area allowed by the mining rules, namely, 10 square miles. The area of the present lease is only 3.8 square miles. The addition of this area is a valuable concession.

Under the terms of the existing lease, the royalty payable is 2½% on the salable value of the ore at the pit's mouth. The reduction to 2½% on 30% of the metallic value of the ore is also a considerable concession. On this basis, taking the average grade of the ore reserves at the end of 1917, namely, 25 oz. silver, 27% lead and 19% zinc, and the average price of metals for the 10 years before the war, namely, silver 28d., lead £15, and zinc £23 16s., the royalty comes to 1s. 8d. per ton of ore. If we assume as likely prices for the next 10 years as 30d. for silver, £15 for lead, and £25 for zinc, the royalty comes to 1s. 10d. per ton.

It might be urged that, in respect to the loan, the government of India might have taken a share in the provision of capital to build the zinc works, instead of offering a loan. The government of India, however, has, in offering us a loan, gone a great deal beyond its usual practice, and such action indicates an unprecedented concession for the government to make. It means a great deal more than a mere loan, as it indicates that the proposition is one that the government of India approves of, and I feel sure we can count on every assistance it can give us to insure the successful working of the enterprise. The board has accepted the terms offered by the Secretary of State, and it hopes it will be able to persuade him that no charge shall be made for interest on the loan during construction.

RELATIONS WITH THE GOVERNMENT

At this point I should like to emphasize the extreme importance to the future success of this company that it should always have the confidence and support of the government of India and the Secretary of State. At all stages of the operations in Burma we often require government assistance and good will, and I will ask you to appreciate the position of the government of India—the landlord and owner of our mineral rights—as owning and controlling the Burma railway system and as possessing authority to deal with all local conditions. As illustrating the necessity for securing the confidence of that government, I will give you one or two instances. Although we have secured the support of the Burma Railways Co. to the construction by that company of a branch line to Namtu, this support is contingent on the approval of the government of India, which owns the Burma railways, and leases them to the company to work, sanctioning the construction of the branch and providing the railway company with money to build it.

Again, during the war, without the assistance of the

Indian government, we could not have produced lead or silver, as it was impossible to obtain coke in the quantity required, and such tonnage as we might have secured would have been at an exorbitant price. With government aid we obtained the coke we wanted at a price we could afford to pay. As illustrating the help the government can give us in local matters, I may say that the water rights in the Mansam waterfalls belong to one of the local chieftains. With the assistance of the government of Burma, we were able to make reasonable terms with the owner of these water rights, the final agreement being that for the first five years we pay nothing for the use of the rights, for the second five years we are to pay £1000 a year, and for the rest of the period £2000 a year. Incidentally I would remark that the local government of Burma is also our good friend in many matters, and is charging us half the usual rates of royalty on the timber and wood fuel we obtain from the government forests.

Mr. Addicks' Investigation of the Burma Ores

Turning again to the action taken toward the establishment of the zinc works in India: Anticipating that the government of India's reply would be satisfactory, the board, at the end of 1917, deputed Lawrence Addicks, who at the present time is our consulting engineer, to proceed to India and Burma to report specially on the proposed zinc works, as well as to investigate generally the metallurgical position at the mines. Careful inquiry was made before the selection of Mr. Addicks to undertake this important mission was decided on, and I am glad to think that his selection met the entire approval of H. C. Hoover, who was consulted in relation to the appointment.

The work Mr. Addicks did in India and Burma, and the clear and precise reports which he submitted, have fully justified the confidence of the board in his selection. His reports indicate a complete grasp of the magnitude of the problem of dealing with the Burma ores, and his recommendations were sound in every way. After careful investigation and study in India in the early part of 1918, Mr. Addicks advised the erection at once of the zinc-smelting plant at Sakchi, India, capable of dealing with 25,000 tons of zinc concentrates per annum. Sakchi, I would mention, is the place where the Tata Iron and Steel Works are situated, these works being of great magnitude. The designing of the zinc works has been intrusted to Mr. Addicks. He has had the advantage of studying, on the spot, the local conditions affecting the working of the plant. On his return from India, in the spring of 1918, he visited important zinc-smelting works in England and discussed with leading experts the features of the design of a plant which would be most applicable to Indian conditions. He further has an extensive practical knowledge of American methods of dealing with ores of a character akin to those of Burma. We believe we have in Mr. Addicks an adviser in whom full confidence can be placed, and, from my long experience in India, I have every confidence that Indian labor will be found very suitable for zinc-smelting work.

I have visited zinc-smelting works in England, and see no reason why the labor part of the work cannot be efficiently carried out by Indians, or why it should be beyond their capacity. The Indian workman of the good class obtainable can be trained to do any work required. He is apt in picking up new kinds of work if trouble and patience are taken to teach him; and, having once mastered his particular job, he works at it like a machine, however monotonous it may be. I have seen many instances of the way in which Indians learn new trades with success, and will give you one example. Previous to the installation of the Tata Steel Works, at Sakchi, the manufacture of high-class and reliable steel in large tonnage in India was unknown. When these steel works were first started, a large contingent of white trained labor was employed. Today, this white contingent has been mainly replaced by Indian labor, all trained by the steel-works staff. With raw material at no great distance, with cheap coal and reliable cheap labor, there seems to be every reason why the promotion of zinc-smelting works in India should be a financial success. There will be a ready sale to the Tata Steel Works for a great deal of the spelter and acid which the works will produce, and negotiations with the steel works for such an arrangement are well advanced.

Statistics obtained by Mr. Addicks when in India show that, in the two years before the war, imports of spelter were 7745 and 9965 tons, respectively, these figures being exclusive of the requirement of the Tata Steel Works, which is a new demand. Our anticipated output of spelter from the works of the size planned will be about 10,000 tons.

Industrial Development in India

That India is at the beginning of a period of extensive industrial development is certain. The Indian Industrial Commission has recently issued its report, and I understand that one of its recommendations is the creation of an industrial department of the government of India whose special function will be the development of Indian industries. The department will be represented by a board of three members, the president of which is to have a seat on the Viceroy's Executive Council. In this industrial development there should be a wide field for the increased use of spelter and sulphuric acid. It is therefore entirely possible that the future may justify a large expansion of zinc smelting in India, and lead to the absorption of large tonnage of our zinc concentrates, particularly when it is recollected that Indian conditions, especially labor, lead one to think that it will be possible to make spelter in India at a cheaper cost than in other countries.

We are now on the eve of a new period in the history and development of this company. The early history of the Bawdwin mines, up to the year 1914, was most disappointing, and it was not until the Burma Corporation was formed, to provide a supply of the much-needed capital, that prospects improved. Then the war ensued, with the many difficulties it created and the anxieties that it caused; and I think the progress which has been made is a matter for congratulation.

Gratitude to H. C. Hoover

This company owes a great debt of gratitude to H. C. Hoover for his work in laying the foundation of success. To him and to the technical committee we owe the bold conception of the Tiger Tunnel and the ideas on which our mining policy should be based. We also owe a great deal to our consulting engineer and to our staff in Burma, who have been working under adverse circumstances during the last four years. We start the new period before us with our finances in a sound condition, with a fuller knowledge of the metallurgy of our ore, and with the full support and sympathy of the government of India. The prospect ahead is a bright one, and although difficult problems of detail have still to be finally solved, there is no reason to apprehend that these difficulties will be insurmountable.

Mobility of Gold in Solid State*

BY EDWARD KELLER

Some years ago my attention was called to the fact that rolling-mill scales from auriferous copper do not have the gold tenor proportional to the gold contained in the copper from which they are derived. So, later, I made a few simple experiments, which are described herewith.

To test the gold movement on the changing surface of a copper plate under the influence of oxidation, plates 6 in. by 8 in. by 1 in., of converter copper, refined, of 99.29% purity, and leaded copper with a tenor of 95.65% copper, were obtained. Ten cuts were made through the thickness of the plates along the longitudinal center, and the silver and gold tenor ascertained in each of the 10 samples in both plates. The assay results showed that the gold distribution is relatively uniform in both plates, whereas silver has greater variations, especially in the leaded plate. The plates subjected to oxidation were placed in a red-hot muffle for about two hours, two small scorifiers being used as supports. Arranged alongside each other, they nearly filled the width of the muffle, and so were practically under equal conditions of heat and draft. The accurate observance of the time was not possible, however, because of other work, but the time of the exposure of each plate in a pair was identical. At the end of each period, each plate was plunged into water and completely freed of scale, which was carefully collected, dried, weighed, and analyzed. Samples of the plates had also been taken of the molten metal and duly analyzed.

The figures showed that in the oxidations of the converter copper the silver is fairly uniform, whereas the gold is highly irregular and especially low in the first layer. In the oxidations of the leaded copper plate, the silver and gold contents are variable.

What has been proved of the gold movement toward the residual plates should also be proved by the analyses of the plates themselves. However, these residual plates, which were approximately ¾ in. thick, had samples planed from the top and bottom surfaces, and these, as also a sample from the finally remaining plate, were analyzed, but the weights of the respective parts were not taken, and a proper average of the assays cannot be given.

Most of the converter copper now shipped from the smelteries in the form of anodes and bars is subjected to the so-called pickling process; that is, the red-hot castings are plunged into water, in which they shed most of the oxide scales that have formed on their surface. That these scales have by far the greater part of the gold that was contained in the copper has been conclusively proved. No data available show the commercial magnitude of this problem, but the first layer of scales in the oxidation of the experimental converter copper plate may, perhaps, be an index of what takes place on a larger scale in metallurgical practice. The original plate was not weighed, but from its dimensions, 6 in. by 8 in. by 1 in., and the assay results the following data and conclusions are obtainable:

Weight of original plate, lb.	14.4
Weight of copper in first oxide scales (365.4 oz.), lb.	0.8
Weight of remaining plate, lb.	13.6
Gold in original plate, oz. per ton	0.315
Gold in copper of first oxide scales, oz. per ton	0.046
Weight of gold in original plate, oz.	0.002268
Weight of gold in first oxide scales, oz.	0.000018
Weight of gold in remaining plate, oz.	0.002250
Gold in remaining plate, oz. per ton	0.331
Gold in original plate, oz. per ton	0.315
Enrichment of remaining plate, oz. per ton	0.016 =5.08%

This last figure, of course, will decrease with the increase of the thickness and weight of the plates or with the decrease in the thickness of the layer of oxidized copper. In the latter case, however, the scales would become poorer in gold, which would relatively increase the enrichment of the remaining plate.

It is generally known that in silver-gold alloys the silver is soluble in nitric acid when the alloy contains about 30% or less of gold, and that in the higher grade of alloys comparatively strong nitric acid may be used without disintegrating the gold. As the gold content decreases and nitric acid above a certain strength is used, disintegration will take place. However, for the whole series of alloys down to 1% or even less of gold, a proper strength of nitric acid and heat will dissolve the silver and leave the gold in such a coherent state that it represents the exact shape of the original bead, although very much reduced in size when little gold is present. Therefore it may be said that, with decreasing gold content in the silver-gold bead, the more marked will be the gold movement in the direction of the retreating surface of the silver under the solvent action of the nitric acid.

The assay silver-gold beads derived from the greater part of the converter copper now produced contain about 1% of gold. Unless the gold is obtained in coherent form in the parting operation, there are almost unavoidable losses in the decanting manipulations and there is a resultant low gold assay. For example, when such low-grade assay beads are left in cold dilute nitric acid, nine parts water to one part nitric acid (sp.gr. 1.42), until all the silver is dissolved, the gold will be completely disintegrated. The same dilute nitric acid is the best solvent for preserving the gold in the desired state, when it is brought to the temperature of boiling water as quickly as possible after the assay bead is immersed. The higher temperature evidently increases the gold mobility.

Silver-gold assay beads derived from silver chloride and metallic gold by the customary operations of scorification and cupellation have a silver fineness, after deduction of the gold, of 996 to 998.5 per thousand.

Titrations and analyses have confirmed these figures. An analysis of 30 gm. of such beads showed them to contain 0.16% lead and 0.15% bismuth, the latter metal having concentrated in the silver from the test lead, which at the time contained approximately 0.02% of that metal. Assay beads of not less than 997 silver fineness offer no difficulty in the gold assay, but when the silver falls to 990 or lower the gold cannot be obtained in any other form than powder, no matter what acid and heat combinations are employed.

---

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E., February, 1919.

Much difficulty was formerly encountered in obtaining concordant results for silver and gold in the assay of the same sample of copper-anode residues by the all-fire method. There were always disagreements, reading, "high silver, low gold" or "low silver, high gold." As the pyrometer has not been introduced in the assay muffle, it is impossible to give the terms "hot" and "cool" in degrees of temperature. By the term "hot" is meant a temperature that will keep the slag in the scorifiers thoroughly liquid and will prevent the formation of lead oxide crystals (feathers) in the cupels. By "cool" is meant a temperature that keeps the slag molten but permits the profuse formation of crystals in the cupels. Tests showed that, with the higher temperature, a considerable portion of the silver was not recoverable; that is, it was volatilized, whereas at the lower temperature impurities to the extent of 16.22 oz. were retained by the assay beads. Supposing the beads that yielded the result of 3750 oz. to be of 998 fineness, those that gave 3766 oz. should be 993.8 fine. Results showed that, in the gold assay of the beads of the latter character, considerable gold passes into the decantation liquid, owing to disintegration; and that it is three times as great as that from the beads obtained in the hotter operations, and which, therefore, are purer. This decanted gold is not visible, ordinarily, and is not recovered in commercial work. It is best collected by the precipitation of a certain quantity of silver chloride, filtration, and subsequent operations. A gradation occurs in the degree of the gold disintegration, from its almost complete cohesion, when derived from silver beads of 998 fineness, to its pulverulent form when derived from beads of, perhaps, 990 fineness.

A scientific examination of the causes of these differences has not been made. It is a generally accepted theory that the whole silver-gold alloy series form solid solutions in which the two metals are, to a certain extent, in a state of continuity, their molecules remaining within spheres of mutual attraction. It may readily be imagined that impurities forming compounds of eutectic mixtures may be so interspersed in the alloy as to disrupt the continuity of the gold and to destroy its cohesive property. Or, certain impurities may form chemical compounds with the gold itself, which would no longer have the properties of the metal, but would leave it in a finely divided metallic state upon the action of the nitric acid.

Zinc Smelting at Saltillo, Mexico

The International Zinc Ore Co. is building a zinc smeltery at Saltillo, Mexico, but owing to the great difficulty in obtaining material and machinery from the United States in 1918, construction had to be interrupted last June. The company is building two Belgian distilling furnaces of 300 retorts each, which will be fired with petroleum. It has completed an eight-grate furnace to make zinc oxide direct from ore.

At present the company is confining itself to blende roasting, shipping the product to American smelters.

Construction of the plant will be resumed this year. Some interesting photographs on pages 360 and 361 of this issue will give a good idea of what has been done already. Among other things will be noticed an experimental distilling furnace of 30 retorts. This is claimed to be the first zinc-distilling furnace built anywhere in Latin America. We have no doubt that the claim is correct.

British Imports and Exports

The following figures of British metal imports and exports have been reported by the Board of Trade, and published in the *Ironmonger*, of Jan. 11, 1919:

BRITISH IMPORTS
(In Long Tons)

Metals	1917	1918
Pig iron, basic	48,076	62,831
Pig iron, forge, foundry	75,547	29,889
Pig iron, bematite	17,863	11,642
Pig iron, other grades	13,640	24,992
Steel blooms, etc	58,402	20,046
Iron bars, angles, rods	28,270	15,082
Copper regulus	28,238	21,031
Copper, unwrought and part wrought	142,778	203,943
Lead, pig and sheet	147,124	208,932
Tin, blocks, ingots, etc	27,143	12,567
Zinc, crude	76,105	64,138
Zinc, manufactured	4,105	3,023

BRITISH EXPORTS
(In Long Tons)

Metals and Ores	1917	1918
Pig iron, total	733,758	483,140
Basic	10,570	12,319
Forge and foundry	326,994	242,406
Hematite	301,717	162,136
Other grades	94,477	66,279
Iron ore	667	160
Copper total	10,159	7,255
Ingots, etc	5,177	4,034
Yellow and mixed	464	223
Manufactures of	3,417	2,482
Lead, pigs, etc	9,364	4,910
Tin, unwrought	19,265	15,251
Zinc and spelter	7,804	1,383

Excessive Areas in Placer Claims

By A. L. H. Street*

A location of a placer claim made in good faith, but by mistake containing an excessive area, is not wholly void, holds the United States Circuit Court of Appeals, Ninth Circuit, in the recent case of Adams *vs.* Yukon Gold Co. *(251 Federal Reporter, 226)*, a suit brought to quiet title to placer properties on Otter Creek, Alaska. Such a location is invalid only as to the excess area, which may be rejected from such portion as the owner may select; and until the owner is advised that there is an excess, and has had reasonable time within which to make his selection, his possession extends to the entire claim. Anyone who goes upon it and makes another location becomes a trespasser, and such relocation is, according to the decision of the court, void.

Incidentally, it is decided by the court that, where a claim is owned by two or more persons in undivided interests, one of them is not bound by the act of his associate or associates in unauthorizedly consenting to a relocation of part of the claim by an outsider, or agreeing to any other attempted disposition of the joint property.

---

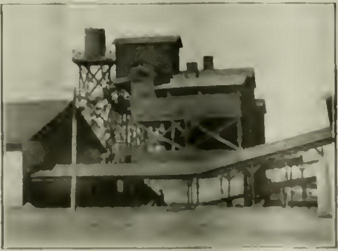
*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

International Ore Co., Saltillo, Mexico

MAIN ENTRANCE TO PLANT OF INTERNATIONAL ORE CO. AT SALTILLO, MEXICO

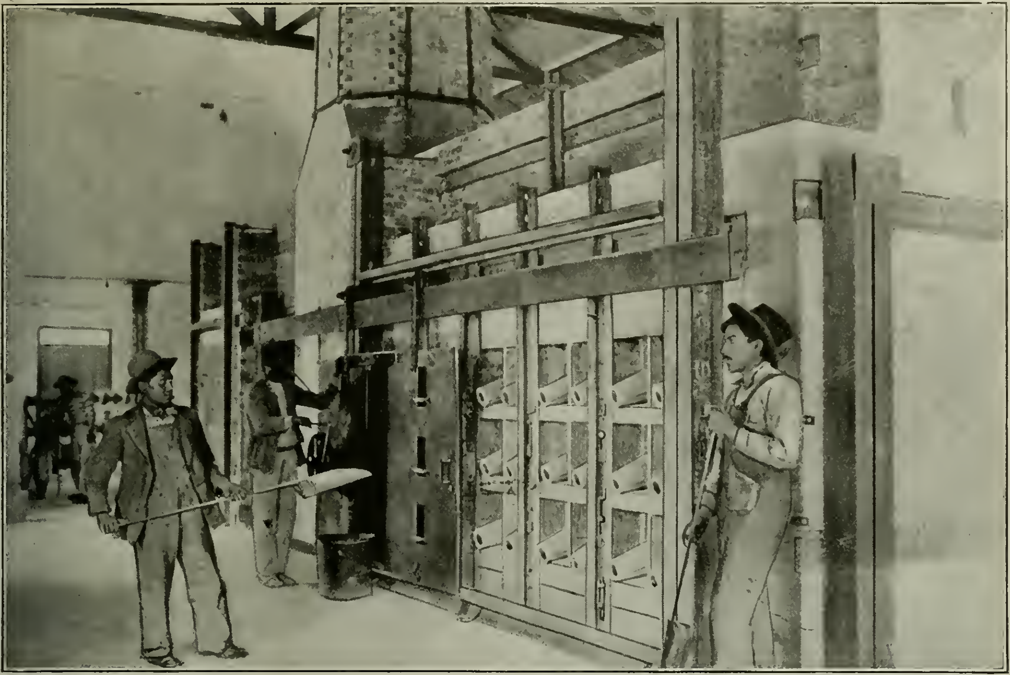
GENERAL VIEW OF CALCINING AND SMELTING PLANT OF INTERNATIONAL ORE COMPANY

SHAFT FURNACE

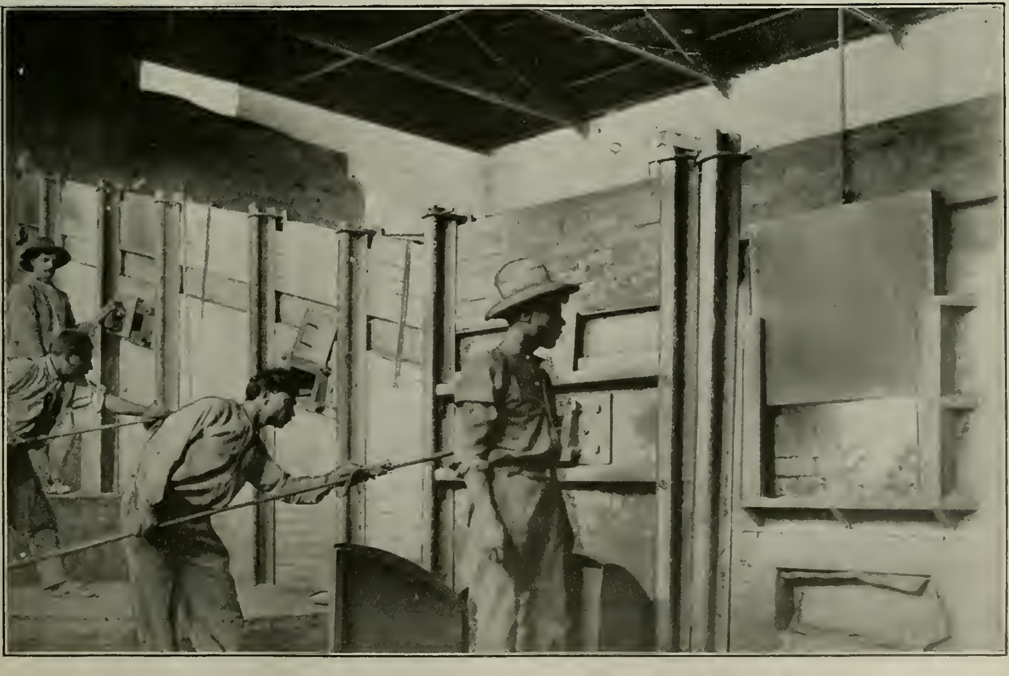


CALCINING PLANT

DISTILLING PLANT



FIRST ZINC-DISTILLATION FURNACE IN LATIN AMERICA AT PLANT OF INTERNATIONAL ORE COMPANY



REVERBERATORY FURNACES FOR CALCINING FINE ORE AT SALTILLO, MEXICO

An Appreciation of Rossiter W. Raymond

By E. S. BOALICH[*]

WHEN Clarence King laid aside his earthly cares, Raymond said "The King is dead—and there is none to take his place." Raymond now has gone, and not only is there none to take his place, but who is there to tell of his passing as he has chronicled the falling of the curtain on the lives of his friends for more than fifty years?

Raymond was an intimate of the majority of those engaged in all branches of mining almost since the beginning of that industry in the United States. He was a scientist, an engineer, an editor, a writer, a soldier, a lawyer, an orator, and a poet. His friendship must have been priceless to those who knew him. I saw him but once—at a distance—during the Pan-American Scientific Congress in Washington, D. C., in December, 1915. But I have read his obituaries—his farewells to the friends of his youth—written as these men, one by one, dropped out of the race which he continued to run, even beyond the allotted span of threescore years and ten. A volume containing these obituaries would make a "human" document unequaled in literature, and it would comprise a real and fascinating history of mining and metallurgy in America, as well.

And I have read his poems—some of them; and some of his editorials; and many of his accounts of Western travel, when the West *was* West. I have today a feeling of personal loss so strong that I am almost glad I was denied the pleasure of actually knowing him.

Whether discussing the law of the apex, or presiding at the laying of a cornerstone, his buoyancy and optimism and wit and wisdom simply seemed to bubble to the surface and permeate all the fabric of either the carefully drawn document or the extemporaneous speech. Many have viewed the great cross-section of the earth's crust which is revealed at the Grand Canyon of the Colorado: it has been "written up" by great and small; but what poet could have more aptly and reverently set down his impressions than did Dr. Raymond in the following?

THE GRAND CANON (1889)

A thought of God, on earth expressed!
The silence of His perfect rest;
The patience of eternal power;
The ceaseless change from hour to hour;
Forms in alternate gloom and flame
That bide, yet evermore the same,
And do but wear such fitful guise
Reflected in our human eyes,
Which compass only in their range
The things that change, or seem to change;
The blended hues of heavenly birth
Beyond the tenderest tints of earth,
That fill and flood her spaces wide
With surges of celestial tide;
The beauty of that awful brink
Where meaner thoughts in rapture sink,
And souls are clear, though eyes grow dim
While space and time are lost in Him!
Methinks I could not faint or flee
In any conflict yet to be,
Whatever pathway must be trod;
May I but keep this thought of God!

To what miner, or smelter, or engineer has been vouchsafed the gift of describing his chosen labor as Raymond did in the following toast "To Ourselves," written for a banquet of the American Institute of Engineers in 1880?

Beside a thousand turbid streams
We follow where the treasure gleams,
The onset of our mighty hose
Disturbs from ages of repose
The rocky guardians of the gold
Left by the refugees of old,
When rivers hastened, sore bestead,
And dropped their jewels as they fled.

Beneath the everlasting snow
Of stainless summits, blow on blow
We smite and delve; we pierce and blast
Along Earth's veins, until at last
The sleeping mountains, long at rest,
Dream troubled dreams, and tremble lest
With inward throes that shake and burn,
Old geologic pangs return.

There for a while, reluctantly
The shore surrendered to the sea,
And when, anon with sullen roar
The sea retreated from the shore,
And great fern forests lived and died
To mark the battle's changing tide—
Their tombs we spoil, to bear away
The sunshine of an elder day.

What wakes the echoes of the hills?
The clangor of our stamping-mills.
What paints the sky with midnight reds?
The flaming of our tunnel heads.
The blinking, blasting breath that slips
Through fierce converters' bellowing lips,
The fiery snakes, that to and fro,
Among the roll-trains glide and glow.

Ho! merchants in the city's din,
We find the coin you strive to win.
Ho! sturdy growers of the grain,
We help you till the fertile plain.
Ho! gallant sailors of the sea,
Staunch comrades in your toil are we;
Behold our work from mast to keel,
In iron hulls and shrouds of steel.

We hail in every rank of art
The earnest souls that do their part;
Yet not to any lower the crest
Of that we deem the worthiest:
The arts which first of arts began!
The art which most has wrought for man!
And we will greet with loudest cheers
Ourselves—the Mining Engineers!

On Feb. 22, 1868, Dr. Raymond published the following "Dog-Eat-Doggerel Ballad," which touches neither the heart not the head to any great degree, yet reveals a distinct side of the character of the young "Ph.D." (of 28), who had about four years previously founded the weekly technical magazine which was soon after named the *Engineering and Mining Journal;* and the man who was at that time U. S. Mining Commissioner and had begun the work now carried on by the U. S. Geological Survey.

---

[*] Mining engineer, California State Mining Bureau, San Francisco, California

JIM GREEN

There was a man, Jim Green by name, he struck a ledge and staked a claim;
Then came to town by the overland bus, and corraled a scientific cuss.

"Professor, I would like to sport an assay and a swell report;
I want you to crack up my rock and take your dividend in stock."
The swell report was quickly done, the ledge it was a fissure one;
Quite well defined; and the ore it run a thousand dollars to the ton.

Then Jim he got a brand new hat (the trader wouldn't take stock for that!)
And started, one of the steamer days, to sell in New York, and make a raise.

He mounted all his handsome things—two California diamond rings—
And a nugget breast pin on his shirt shed golden lustre o'er the dirt.

He landed, and to Wall Street went, and there he found a nice old gent;
So Jim laid out to do his best, and talked him till he couldn't rest.

"Your h'ain't got no notion how great," says he, "Our mineral resources be;
Jest one per cent of what we get will pay this whole damn national debt.

"There ain't a better cow to milk than a first class mine (that ain't a bilk);
She'll give you quartz"—and here he cussed—"If that ain't level then bust my crust."

The nice old gent he was no clam, he had served a while with Uncle Sam,
And what he hadn't found out yet was mighty poor tailings, now you bet.

So this old capital sharp told James that he often bought these first-class claims
And if he froze to any feller it was a mineral-property seller.

Then just to grease the bargain, Jim made out a quit claim deed to him,
And, as a matter of form, agreed to name one million in the deed.

In thirty days the thing was done, and when Jim figured what he'd won,
He felt as cheap as a Yankee clock;—Ten whiskey straights, *and the rest in stock.*

The stock he had promised not to sell—(how it happened he couldn't tell—
He signed the documents in haste) until the company's stock was placed.

There was a board of rich trustees, (a stock donation to each of these)
And they sold the shares on terms to please, to twenty widows and ten D.D.'s.

A brigadier was president, the treasurer was the Wall Street gent,
And for economy it was agreed the treasurer only should be fee'd.

When Jim Green's turn to sell came round, there was nary buyer to be found;
And the treasurer kindly did advise to hold his stock till it should rise.

"Look here," said Jim; "this thing's a sham, I'm told your stock ain't worth a damn!"
"My friend! in mining operations there always are these fluctuations."

As time eloped they failed to get the process for the sulphuret,
And ere they solved that fatal doubt the blasted ledge had petered out!

The trustees all did abdicate; the clergy preached man's lost estate;
The treasurer took a foreign tour; the widows! heaven protect the poor!

Jim Green upon a marble white his name and this "dead broke" did write;
Then lay down in an onion bed and pulled the tombstone o'er his head.

Though my knowledge of Dr. Raymond has been gained entirely through his writings, I think of him as being possessed of a soul such as that revealed, in part, at least, in the letter written at the death of Justus Adelberg, his friend and business partner, who died in 1869. This letter, dated Central City, Colorado, June 14 of that year, says in part:

> In a world which gives little credit for difficulties overcome and measures men by their success, he achieved an honorable fame. He carried a heavy weight, yet did not fall behind his competitors in the race. Such examples put to shame the indolence and indifference of those who, blest with health and strength, accomplish nothing . . . yet as I sit alone by midnight, in a strange city, and muse over this bereavement, I think not of his genius and learning, but of his noble soul. Others have lost in him the keen observer, the brilliant thinker, the pleasant acquaintance, the hospitable host; but to me he was all this and a thousand times more. He was my wise kind teacher, my upright partner; my dear, true friend.
>
> Finally, Justus Adelberg was not one of those modern philosophers who sneer at religion or coldly argue away the foundations of spiritual life. Through many conflicts from which less independent minds are exempt, he held fast his faith in God, and was not ashamed to avow it. In the same faith, looking for the resurrection of the dead and the life of the world to come, I lay upon his grave this tribute of my love. His deliverance and gain are great; my loss is not for long.

Mining Conditions in South Africa

By E. M. Weston

The South African mining industry, in the middle of 1918, was in a critical position. The factors affecting the position had been (1) the rise in cost of supplies, (2) shortage of glycerin for explosives, (3) high wages paid to white labor and allowances to dependent soldiers, (4) increased realization charges on gold, (5) increased taxation, and (6) shortage of native labor. The industry now is threatened with increased provincial taxation on profits and with still further increases of wages demanded by white and native labor. The rise in working costs is illustrated in the case of the Crown Mines, Ltd., as shown herewith:

COSTS AT CROWN MINES, LTD.

Year	Development Footage	Tons Milled	Working Costs Per Ton	
			s.	d.
1914	2,725	190,583	15	7
1915	4,025	208,083	16	1
1916	4,540	188,833	18	3
1917	3,008	175,000	19	3
1918	2,081	162,400	21	9

From August, 1914, to May, 1918, the war has caused this company an extra expenditure of £847,360, made up as follows: Increased cost of mine supplies, £387,000; increased wages to Europeans, £129,099; war bonuses,

£46,555; allowance to employees on active service, £54,644; increased gold realization charges, £124,994; war levy by South African government, £105,068. The working costs for 1918 increased 4s. per ton as compared with 1914. This has involved the mines of the Witwatersrand in an additional cost of £5.100,000 per annum, or 3s. 8d. per ton milled.

On the Crown Mines, white wages, in 1914, were 4s. per ton milled; in 1918, 5s. 8.9d. Stores, 4s. 8.8d., increased to 6s. 8.3d. Other costs, 2s. 9.5d., increased to 3s. 11.5d. The average monthly earnings of skilled laborers increased from £27 12s. to £31 15s. The Crown Mines contributed £214,745 and the whole industry spent £2,850,012 on phthisis prevention and treatment during the five years ending July 31, 1917.

In August, 1918, owing to the rapidly advancing cost of living, the Chamber of Mines agreed to increase the war bonus to mine employees to an amount that will cost the industry another £750,000 per year, or 7d. per ton milled. The native workers in the mines have been showing signs of restlessness, owing to the spread of education and the rise in prices in the stores of the mines. An abortive strike took place and a demand was made for a wage increase of 1s. a day. An increase of only 3d. would cost the industry £750,000 per year. Although the natives have been quieted by the appointment of a commissioner to inquire into their grievances, a number, especially those living near the towns, are suffering hardships. Native mine workers' wages average 2s. per shift, and food, housing, and medical treatment cost, in addition, 7d. per shift. A successful attempt to inoculate natives against pneumonia has effected a great decrease in the death rate, which, at the Crown Mines, was 7.37 per 1000 in 1910 and 2.95 in 1918. At the Premier Diamond mine, which is worked by open-cut methods, pneumonia was formerly a terrible scourge, the death rate in 1910 being 28.97. From November, 1916, to October, 1917, 10,507 newly recruited natives were inoculated, and the death rate dropped to 0.86 per 1000.

At the De Beers diamond mine the underground death rate from pneumonia was 19.27 per 1000 in 1910. From May to October, 1917, statistics indicate that 6466 natives were inoculated, and of these only one died. The total mortality rate at the mines of the Witwatersrand is now 13 per 1000. The production of gold for the first eight months ended August, 1918, was valued at £23,667,542, the corresponding period of 1917, £24,983,236. Working costs have risen £408,698 and working profits have decreased £1,623,896. Of the 49 producing companies, six show a working monthly loss, and 15 others show a small profit. Capital expenditures, debenture debt, phthisis compensation, and other charges, however, convert this into a loss. These figures show the serious position of the industry. The mines now being developed in the Far East Rand cannot be brought to a productive stage in time to take the places of those whose life is expiring, and considerable reduction in the gold output may be expected.

The report of the government mining engineer, Sir Robert Kolze, shows that for 1917 the value of the mineral output of the Union of South Africa was £52,260,190, an increase of £1,666,831, compared with 1916. Gold output amounted to £38,307,675, showing a decrease of £1,183,315 compared with 1916. The diamond, coal, silver, and lime output showed an increase. The copper output showed a decline, owing to the falling in grade of the ore mined at the Messina mine, which shows signs of exhaustion, and the lower-grade ore treated in the Namaqualand mines of the Cape Copper Company.

Nationalizing the Oil Industry

Speaking at the recent meeting of the American Mining Congress, D. M. Folson said:

"To my mind there are many good reasons why the Government should not attempt the nationalization of any industry; but I shall only mention two reasons. To begin with, I question the possibility of Government success in the actual operation of any industry as many-sided and as sensitive as the oil industry. Nothing that the Government has done, either before the war or during the war, has indicated that Uncle Sam is a good business manager or even a fair success as an industrial executive.

"America has developed as a nation of pioneers. The frontier line has never quite faded away, and the race which has grown up on this continent has acquired its character and its liberty of action and its self-reliance as a result of the free opportunity given to the individual. This is so fundamental that I emphasize it here only because of the socialistic winds which blow through the world. The will-of-the-wisp of nationalism, of paternalism, and of public ownership may tempt the dreamers and inspire the demagogue even in our own country—but in their elusive visions of a Utopia the dreamers forget that the human race has risen from the Stone Age through the acquisition of property and the human quality of selfishness. All human experience and all human wisdom point to national development through the opportunity for development given to individual initiative.

"In the past, each industry which has attempted to secure favorable legislation from Congress has had to work alone. The result has been that each industry has immediately and directly been accused of lobbying to its own interest and has been discredited before the committees of the national Congress in every attempt to obtain relief or justice from the legislative branch of the Federal Government. In turn, various groups of mining men, representing companies producing certain metals; attorneys for oil companies, and executives of power companies have appeared in Washington, and have carefully and patiently explained to various committees the need of constructive legislation, and in regular rotation bills have been introduced in one or both houses of Congress, only to die in committee or in conference. From time to time promises of legislation have been made, and Presidential messages have been written, in regard to the development of power and the release of withdrawn lands. But the temporary withdrawals still stand, and the producer of power from water and the producer of power from oil are both prevented from developing the resources of the nation. This policy of repression was inconsistent and unfair before the war. It was almost fatal to the prosecution of the war, and if continued will certainly be fatal to the development of a national constructive program for peace."

Correspondence and Discussion

Replacing Oliver-Filter Shafts

With reference to the article published in the *Journal* of Nov. 9, 1918, concerning the replacing of Oliver-filter shafts, the method described was soon improved. The pipe used was 2½ in., and the shaft (pieces of the original Oliver-filter shaft) 2 7/16 in. As there was 1/16 in. of play between shaft and the pipe, the pulp worked in between, and ground the shaft and pipe seriously, the pin acting as a pivot. After short service the pipe worked so loose that no satisfactory packing could be held in the packing boxes.

The improvements made were to use a piece of shafting about 8 in. long, with a pipe on each end, bolted together with two ⅝-in. bolts and with lock washers. The paddle blades were bolted to the pipe, and, so as to make it possible to get at them easily from the side of the filter; the manhole was enlarged to 18 x 12 in. Inside the stuffing boxes on each side next to the pulp a cast-iron bushing ¾ in. long was placed. This fits snugly inside the box and loosely (1/64 in. clearance.) on the shaft. When worn down ⅛ in. they are exchanged for new ones, and thus save the wear on the boxes, keep the shaft in the center, and are a great help in keeping the packing in the most satisfactory condition. Gland water cannot be used, but by using grease, in compression cups, the service is good. **Chas. Labbe.**

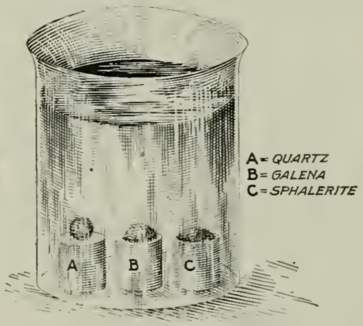
Nelson, Nev., Dec. 15, 1918.

Flocculation in Flotation

In an article which appeared in the *Journal* of Dec. 28, 1918, on "Why Minerals Float," George J. Young ventures the hypothesis "that before a froth can be formed it is necessary to have conditions present that will permit of the flocculation of the mineral particles," such conditions being brought about by the "addition of an electrolyte." He fortifies this statement with the following experiment: "Suspend 50 gm. of finely crushed galena in 5000 c.c. of water rendered alkaline with 25 gm. caustic soda, and maintain it in suspension by vigorous agitation in one part of the vessel. Now add some flotation agent. No froth will form. Gradually acidify the solution. As soon as acidity is reached, a froth will appear and rise to the surface in the quieter portions of the vessel." In describing this experiment he states that "agitation and oil failed to produce a froth, but as soon as an electrolyte was added a froth appeared."

From the above experiment it is evident that the author has overlooked the fact that sodium hydroxide is a strong electrolyte, being almost completely ionized at the dilution of the experiment. No mention is made of the kind or quantity of the frothing agent used in the experiment quoted. Some frothing agents, when used in alkaline water, possess the property of forming what might be called "permanent emulsions," in which state they are not active for froth formation. When such a condition exists, the addition of sulphuric acid will break the emulsion and free the reagent, thus bringing it into such condition that it will form a froth. It is probable that this condition existed in the experiment described by Mr. Young. Although data were lacking with which to duplicate this, we have carried out the following test along somewhat similar lines: An amount equaling 250 gm. of a mixture of 45% galena and 55% quartz was agitated with 1250 c.c. distilled water rendered alkaline with 4 gm. of sodium hydroxide. Upon the addition of 0.15 c.c. of an oil mixture (90% pine oil, 10% kerosene), a stable, mineral-bearing froth resulted. When the solution was acidified with sulphuric acid, a slightly more selective, less stable froth formed, but in smaller quantity.

It is true that acid is often beneficial in flotation, usually by the formation of a more selective froth. However, in many cases it is found to be detrimental to froth formation, and some ores give better results when an alkaline pulp is used.



POSITION TAKEN BY A DROP OF HEAVY TAR OIL WHEN PLACED ON VARIOUS MINERALS

Mr. Young's contention is to the effect that flocculation is necessary for froth formation, the floccules serving to trap and hold the globules of air with sufficient tenacity to cause a froth to form. If this condition existed, the mineral should appear as floccules in the bubble film of the froth. We have made careful microscopic examination of over 2000 mineral-bearing froths formed from a number of different ores and with a wide variety of frothing agents, and in few cases has there been noticeable any flocculation of the mineral. In practically all cases the mineral exists in the film in the form of distinct, individual particles.

The tendency of oil to displace either air or water is greater at the surface of sulphide particles than at the surface of gangue particles. When sufficient oil is used to cause cohesion of the sulphide particles, granulation will result under proper conditions. Such granulation is detrimental to froth formation. It is possible, however, to form granules or froth with the same conditions as regards frothing agent, by a slight change in other conditions of the experiment.

It has been our experience that flocculation, which is incipient granulation, is detrimental to both froth formation and the recovery of the mineral; and that, whenever mineral floccules are apparent in the pulp, any change in the conditions of the experiment which tends to decrease the flocculation results in improvement in both froth formation and metal recovery.

As to the question of obscure chemical reactions between oil and oxygen adsorbed on the surface of the sulphide particles, the most striking argument against such a possibility is that flotation is easily explained by reference to well-known physical phenomena and without the aid of hypothetical, unlikely chemical reactions.

Further, many of the reagents used in the flotation process are not easily oxidized, and some are themselves oxidizing agents. We have carried out some elementary experiments, a description of one of which follows, with a view to studying the possibility of oil oxidation in its connection with sulphide oiling, but in all cases the results have tended to discredit the probability of such behavior.

A sample of a heavy tar oil (sp.gr 1.14) was mixed for approximately one hour with a strong solution of potassium permanganate which had previously been acidified with sulphuric acid. The resulting mixture, which was rather viscous, was washed until free from permanganate. The washed viscous oil was then warmed to decrease its viscosity and dropped from a pipette onto galena, sphalerite, and quartz, which were immersed in water at approximately 60° C. The position taken by the oil are shown in the accompanying illustration. The positions taken by the non-oxidized oil were the same as those taken by the oxidized oil. That there might be additional oxidation of the treated oil by oxygen adsorbed on the surface of the sulphide is hardly to be expected, because of the strong oxidizing action of the permanganate solution.

This experiment shows that, in the presence of water, the oxidized oil is no better and no worse as a coating agent than the unoxidized oil; in other words, that oxidation, even though it might, by a large stretch of the imagination, be possible at the oil-solid contact, plays no part in the covering action. Further, the persistence of adsorbed air films at the surface of submerged sulphide particles is an assumption for which no proof is offered, and the presence of such films on the surface of particles ground under water, as is the case with flotation feeds, is even more unlikely.

C. C. Smith,
A. R. Pickett.

Hammond Laboratory, New Haven, Conn., Jan. 9, 1919

International Money

Much discussion has been published on the subject of the "Gold Question," and many remedies have been suggested for the betterment of conditions for gold producers. The simplest argument, is, "Let well enough alone"; but the contention that present conditions are well enough is a debatable one. If what is called "business" is to persist in world life, then business certainly will adjust itself automatically to conditions; and the adjustment will begin to make itself noticed as soon as there is reasonable assurance that some of the conditions will remain fixed, or will at least follow some definite and logical law of change.

For example, if the I. W. W. miners at Butte announce that they must receive $6 for six hours' work each working day during March, and that for each successive month the pay must be increased 25c. per shift and the working period shortened by 15 min., then a simple calculation will show that they have dreams of getting $9 for three hours' work during the month of March, 1920. But before the year had passed the business of mining at Butte would have automatically adjusted itself, and the pay of I. W. W. miners would be zero dollars for zero hours of work.

The idea that the value or price of gold readjusted to $40 per oz., in place of the present U. S. Government price of $20.67 or $20.6718 per oz. (I believe that I was paid at the rate of $20.67 the last time I sold gold) certainly sounds interesting to one who has not made a life study of the higher phases of currency problems. To me it sounds like the reopening of many old mines, the search for gold and the discovery of mines capable of producing gold and other metals, and—well, it sounds like the stuff that dreams of prosperity are made of. Dreams are only dreams, but the old-fashioned American spirit used to make some dreams come true.

I recall that, when a youngster, I was much interested in a poem about one Darius Green and his flying machine. It was interesting to dream about flying, but our wise teacher (who had studied physics in a serious way for many years) told us that it simply could not be done. So when economists tell us that gold must remain at $20.67, or $20.6718, we should endeavor to forget that what we call a dollar today represents currency inflation, and dismiss the $40-per-ounce idea as a heavier-than-air dream.

In my dreamy way I have advocated that the proposed League of Nations take up the study of the $40-per-ounce idea, and at the same time consider the feasibility of establishing a fixed rate of exchange or the coinage of international money on a basis of:

One pound sterling = five dollars = 25 francs.

The idea is by no means original. At this time any objections from Germany may be ignored as unworthy of consideration. It would perhaps be a constructive and instructive aid for the *Journal* to reprint an editorial published in Vol. 25, May 25, 1878, p. 356, under the caption "International Money."

William B. McKinlay.

Yonkers, N. Y., Feb. 7, 1918.

Teaching Engineers Economics

The question as to what should be taught in a collegiate course in mining engineering comes up from time to time with the protests of some engineer who feels that something was wrong with the curriculum of his alma mater. These criticisms are undoubtedly earnest and sometimes constructive, but are so widely divergent in their recommendations that it is not surprising that they have so little effect. That which seems invaluable to a man of one experience seems a waste of time to another whose work has led him into a different field. It is probably true, as has been often pointed out, that the average American mining school tries to cover too wide a course, and neglects to provide a sufficient foundation in the fundamentals of science and engineering In other words, the student, to his temporary satisfaction, is given a vast amount of information, most of which he promptly forgets, instead of being taught to *think* along the lines of his profession.

Nevertheless it seems to the writer that the point taken by "Engineer" in his letter to the *Journal* of Nov. 9 was well taken. Many of the young engineers of this generation sooner or later find that their ambitions lie in executive or administrative work, although few of them, perhaps, realize it while in college. Granting that this is to some extent true, cannot the technical school, by starting them thinking along economic lines, be of greater help in the training of the executives which the coming period will need? It is the fortunate student, rather than the average young man, who can combine the broadening influence of a liberal-arts course with his technical training. Yet we are told by one of the leaders of the profession that: "The engineer is going to have from now on such obligations as he never had before; . . . he should saturate himself with sound economic doctrine." And certainly the biggest problems confronting mining executives today are not strictly technical. They are problems which the novitiate could observe and study effectively, if his attention were called to them and were he trained to study them systematically. To make the suggestion as constructive as possible, I venture to offer the following outline for a course of study, which might be called, for lack of a better name, "mining economics":

1. The Organization and Financing of Mining Companies. Methods of Organization. Stocks. Bonds. Comparison With Industrial or Railroad Companies. Over- and Under-Capitalization. Tendency Toward Large Corporations. Duties to Stock Owners. Reports.

2. Personnel Organization. Functions of Departments and Executive Officers. Importance and Value of Definite Distribution of Authority. Education and Training of Shift Bosses. Training of Men for Executive Positions. Efficiency Work—Its Value and Limitations.

3. Problems of Labor. The Increasing Recognition and Importance of "Welfare Work." Labor Unions. Grievance Committees. The Education of the Laboring Class, Especially Against Bolshevik Doctrines. Improvement of Living Conditions. Dangers of Paternalism. Insurance and Sickness Compensation. Bonus System. Profit-sharing.

Such a course would naturally be restricted to senior or post-graduate students. It would be necessary to avoid the natural tendency of the instructor to overreach his mark by attempting to go more deeply into the subject than the status of the class warranted. In avoiding that difficulty it would be as easy to sail onto the other rock, namely, the making of the course a mere dispensation of "dope," with the thinking all done for the student, in which case the value would most certainly be small. In beginning the study of each subject, the instructor might, in a lecture, outline the problem and point out the important points. Members of the class would then be given reading assignments to books of reference, technical journals, and papers, which already constitute a considerable source of information. To these the instructor might add as suggested by the outline, the examples cited being but a few of those equally apropos. The reports on these references would be given orally to the class, the function of the instructor being merely to stimulate and direct discussion. Of course, much would depend upon the personality of the instructor, as it does, indeed, in any course. It would be obviously impossible to go deeply into all the subjects mentioned, but if the student could be given an interest and studious attitude toward these problems, surely the time would be well spent.

Miami, Ariz., Feb. 2, 1919. A. P. ALLEN.

Rocky Mountain Club To Welcome Returning Fighters

The Rocky Mountain Club has been officially designated by Hon. Robert D. Carey, Governor of Wyoming, s official representative to welcome Pershing's boys from Wyoming when they arrive in New York, thousands of miles from home. The Legislature of Wyoming has made an appropriation of $10,000 for the purpose.

Governor Stewart of Montana officially designated the club to represent Montana in welcoming Montana boys, and the Rocky Mountain Club has been advised that a bill has been presented to the Legislature calling for an appropriation of $25,000 for this purpose. The Rocky Mountain Club is further advised that Senate Bill No. 48 (Rocky Mountain Club Bonus of $10,000 Entertainment of Arizona Troops in New York City) has passed its second reading and has been referred to the Committee on Appropriations.

The Rocky Mountain Club has cabled to General Pershing that it has been designated to welcome his boys from the states mentioned.

It is a matter of regret that too many of our returning fighters have been landed here, far from their home and friends, without even a welcoming cheer. They wander about this city looking for a friendly face—too often in vain. Let us no longer permit the iron of indifference to sear their souls and make them doubt if their sacrifices were understood. Give them a real Western welcome straight from the heart, as soon as they set foot upon their home soil—a welcome that will assure them they are appreciated, and that their sacrifices for the cause of humanity have not been in vain.

Every resident and former resident and those interested in the Rocky Mountain and Pacific Coast states with which the Rocky Mountain Club is identified, men and women, who may be in New York during the period of demobilization—all are asked to help in order that the welcome their boys receive will be from the hearts of their own people. H. WALL,

Secretary Rocky Mountain Club of New York.

New York, Feb. 11, 1919.

Co-operation Among Small Mines

The article in the *Journal* of Nov. 9 is a move in the right direction. It is a matter of surprise to me that writers in the *Journal* appear to neglect the small operator. Many small operators are to a certain degree pioneers, and are dependent upon the *Journal* for technical information. They must depend upon the technical papers to bring to their attention new milling and metallurgical appliances. This in my judgment has been neglected. MINER.

San Miguel, Colombia, S. A., Dec. 15, 1918.

Details of Milling and Smelting

In a number of phases of the dressing and treatment of ores, it is found necessary to maintain a constant level of pulp in certain machines. This is especially true in the case of flotation cells, where the regulation is preferably insured by the automatic adjustment of the underflow, or tailing pulp. In the article on "Pulp-Level Control" a few simple and effective methods of maintaining a constant head in flotation cells are described; and it will be found that the suggestions embody schemes that are equally applicable to many other phases of wet metallurgical work.

Operations in connection with the repair of the arms of a roasting furnace are desirably performed with ease and without unnecessary loss of time. The note herewith published—"Furnace Arm Carriage"—describes a special type of rack and roller, by the use of which the arms may be removed expeditiously and with the minimum of handling. The detail is an improvement which has been adopted at the reduction works of one of our most prominent and progressive copper-mining companies.

One of the troubles usually encountered in the operation of the ordinary design of sliding chute gate arises from the circumstance that fine ore and grit are likely to collect in the channel in which the partition slides, thus making it extremely difficult to open or close the gate. The suggestion published herewith, and described in the short article entitled "Improved Design of Chute Gate," aims to obviate this condition by the provision of a chamber around the edges of each side of the slide, and arranged with discharge ports which permit the accumulated fines to escape.

Pulp-Level Control

By Claude T. Rice

Uniform conditions are necessary in order to obtain the best results by flotation. One of the most important points needing attention is the level of the water in the cell. On most of the Callow machines used in the Cœur d'Alene plants this is regulated by means of a float pan and a lever which opens and closes the discharge valve. A screw is generally used to vary the length of the rod carrying the taper plug which regulates the discharge of the tailings.

A more convenient method of regulating the length of the plug rod is used at the Gold Hunter plant. It consists of a notched plate *A* (Fig. 1), which slides between two guide plates *B* on the float arm *C*. The valve rod *F*, which carries a taper plug *G* (for regulating the discharge of tailings from the tank), is flattened and has two straps *D* riveted to it, which carry, near the top, the pin *E*, which in turn rests in a notch of the plate *A*. By depressing the float arm and moving the pin into another notch, the size of the discharge opening can be varied in accordance with the amount of feed the machine is treating. After this main adjustment is made, any variation in the water level is corrected by the up or down movement of the float pan.

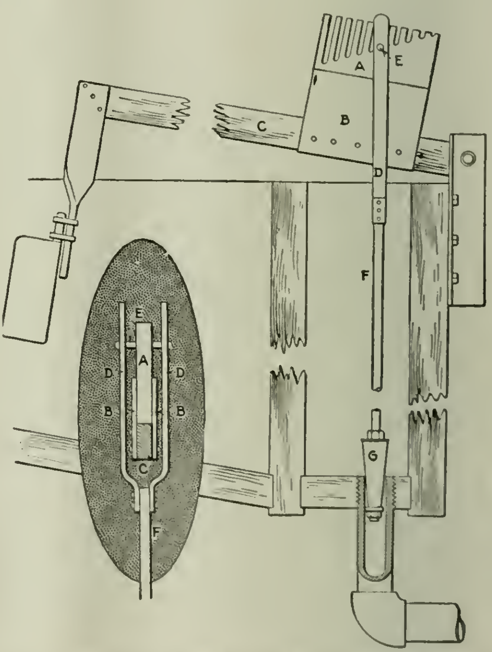


FIG. 1. REGULATOR USED AT THE GOLD HUNTER MILL

At many mills the float regulation of the water level is not favored, and more positive means are preferred. One such method consists of a gooseneck discharge devised by C. L. Hewitt and George Crerar. A pipe leads from the bottom of the cell tank (Fig. 2). A tee *A* is screwed onto this, so that the bulk of the tailings is discharged through opening *B* in a regulating plug that fits into the main discharge opening of the tee. A nipple *C* connects the tee to the gooseneck overflow pipe *D* through an elbow. The size of opening *B* is made such that though most of the tailings discharge through it, any excess rises in the gooseneck and discharges through that. By swinging the gooseneck on the nipple *C*, the water level in the flotation machine is controlled.

This gooseneck regulation of the water level is preferable to that obtained with the float and taper plugs, but it does not give a really positive regulation, and for that reason is not so good as one which has been devised at the Bunker Hill & Sullivan plant by R. S. Handy. This consists of an air lift *A* (Fig. 3) in a water box *B*, that lifts the tailings into discharge box *C*, from which they leave through pipe *E* in its bottom. The water rises in box *B* and overflows through the adjustable gate *D* into the discharge box *C*. Thus the level of the water in the flotation machine is maintained in a positive manner, as the elevation of the notch in gate *D* determines the water level throughout the whole machine. This discharge can be used on other types as well as on the Bunker Hill machine. It is the best method when air is available, as it generally is in flotation installations.

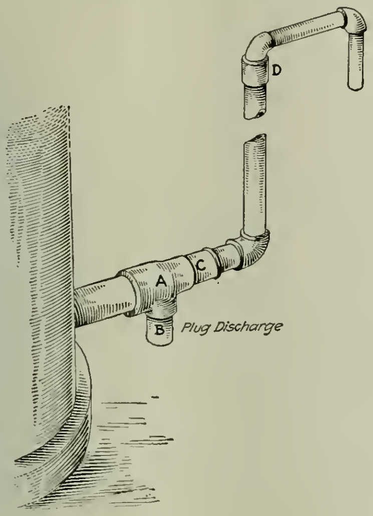


FIG. 2. GOOSENECK LEVEL REGULATOR

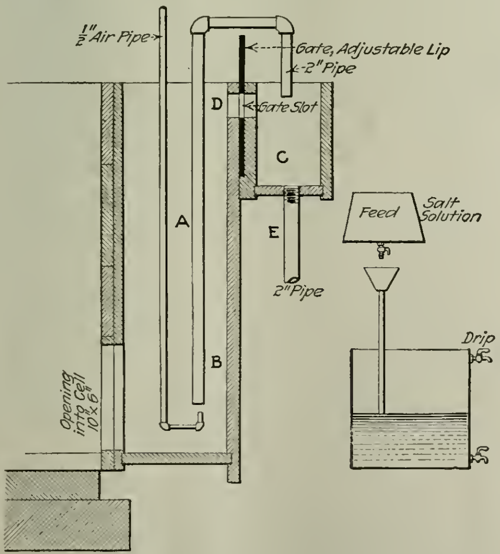
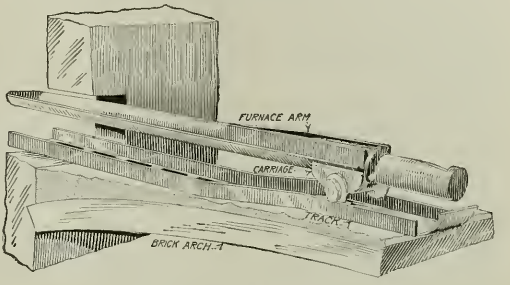


FIG. 3. AIR-LIFT REGULATOR

Furnace Arm Carriage

A special arrangement is used at the Anaconda Copper Mining Co.'s reduction works at Anaconda, Mont., in connection with the operation of removing the arms from the multiple-hearth roasting furnaces.



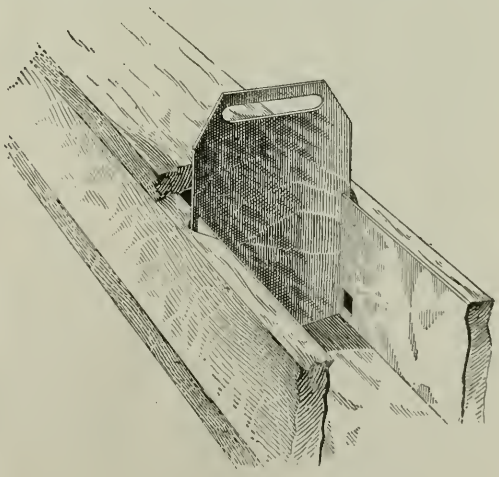
FURNACE ARM CARRIAGE

Details will be readily understood by reference to the accompanying cut, which shows the furnace arm resting on a specially designed carriage, which runs on the track, as shown. The track is placed temporarily under the arm to be removed, the arm lowered to the carriage standing to receive it, and both are drawn out onto a truck which stands outside.

Improved Design of Chute Gate

By W. L. Prouty

Loss through leakage often occurs in chutes carrying fine material; and it is sometimes impossible to close the gate tightly, or to open it after a shutdown.



CHUTE GATE OF NOVEL DESIGN

The adoption of the type of gate shown in the accompanying cut has resulted in an avoidance of trouble from such a source; and it has met requirements better than any other design in general use.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Agree on War-Minerals Relief

After prolonged discussion, the conferees on the Dent-Chamberlain bill providing for the legalization of informal contracts adopted a section intended to cover certain losses sustained in the endeavor to increase the supply of war minerals. Section 5, as finally agreed upon in conference, reads as follows:

Sec. 5. That the Secretary of the Interior be, and he is hereby, authorized to adjust, pay, or discharge any agreement, express or implied, upon a fair and equitable basis the amount or amounts of money heretofore invested or contracted to be invested and obligations incurred in good faith by any and all persons, firms, or corporations for producing or in good faith acquiring property for producing, within the United States, for the purpose of supplying the urgent needs of the nation during the war, any ores or mineral substances mentioned and enumerated in the act entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply," approved Oct. 5, 1918, the production of which was requested or demanded by the War Industries Board, the War Trade Board, the Shipping Board, the Emergency Fleet Corporation or the Department of the Interior and which has been performed in whole or in part by any such person, firm, or corporation prior to Nov. 12, 1918; and that said Secretary ascertain, determine, adjust, liquidate, and, out of the moneys provided and appropriated by said act, pay to the parties justly entitled thereto the amounts of such losses and damages as he, the said Secretary, shall find and determine to have been sustained by reason of having made said investments for said purposes, and that in each case he shall make such determination, provision, settlement, advancement, or final payment, or by agreement with claimants take such other action as he shall find and determine to be just and equitable; that the decision and action of said Secretary in each case shall be conclusive and final; that all payments shall be made, and all expenses incurred by the said Secretary shall be paid from the funds appropriated by the said act of Oct. 5, 1918, and that said funds and appropriations shall continue to be available for said purposes until such time as the said Secretary shall have fully exercised the authority hereby granted and performed and completed the duties hereby provided and imposed: Provided, however, That said Secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this act

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States.

Potash Independence Deemed Possible

Within five years the United States can be independent in the matter of potash if means are provided to safeguard the development of the domestic industry, producers told the Senate Committee on Mines and Mining at a hearing which began Feb. 13. George Otis Smith, the director of the U. S. Geological Survey, speaking in favor of the bill, which was drafted originally in the Interior Department and approved by the Secretary of the Interior, said:

Under this bill, a market is provided for domestic potash. That market, to some degree, can be competitive among the various producers, but protected against foreign competition. An import license is to be issued conditioned upon purchase or agreement to purchase, say, 30% of domestic potash. The price is not a question—the lower the better. The consumer and the producer can work that out. The producer is protected by the assurance of the market through this bill. The consumer, in turn, is safeguarded by the proviso enforcing a fair price.

Dr. Smith also explained that the Government has been endeavoring to stimulate the production of potash since 1911, when the action of the German potash monopoly had brought about a commercial war. It was stated by representatives of all domestic producers that they would make no claim for relief under the War-Minerals Relief Act provided the potash bill were passed.

Senator Jones, of New Mexico, fears that the price will be fixed at the high-cost level if the bill should be passed in its present form. He prefers that the Government purchase at varying but reasonable prices all domestic potash and resell it to the consumer at the average price. This, he admitted, would require the formation of a Government corporation with a revolving fund of several million dollars. The bill, as originally drafted in the U. S. Bureau of Mines, contained a provision for such a corporation, but it was eliminated by Secretary Lane to make administration of the bill as simple as possible.

The producers attempted to establish that they would be able promptly to reduce costs and to improve their processes to the point where they will be able to compete with many other producers. If no such steps as have been suggested are taken, they will be forced, within a very few months, to compete with German stocks, some of which were piled up by the labor of prisoners of war. If the several lines of potash development are not killed within the next six months, it is believed that a sufficient start will have been obtained to insure the country a permanent potash industry.

Arthur C. Harragin, the secretary of the American Trona Corporation, told the committee that he realized that it must be convinced that it will be possible, within a short time, to compete with foreign producers. His statement with regard to costs at Searles Lake, which is the first of the kind to be made public, is in part as follows:

Our average production costs per ton of potassium chloride in 1918 at Searles Lake were as follows: Steam plant, $19.60; labor, $6.03; cost of brine, 52c.; and plant overhead, $3.85; total, $30.

To this amount must be added $3.75 and $3.50 for general overhead and sales expense, respectively, making a total cost of $37.25 to produce one ton of 100% KCl salts. Therefore, the total cost to produce one ton of potash salts of a grade of 80% KCl, about 50% K_2O, is $31.25. The freight and war tax is a "postage-stamp rate" of $17.72 per ton of salts from Trona, Calif., to any of the market centers in the southeast. The total cost to us delivered is, therefore, $48.97 per ton of salts of 80% KCl.

The quantity of crude petroleum marketed from oil wells and field-storage tanks in the United States in 1918 reached the record-breaking total of 345,500,000 bbl., as shown by preliminary estimates made by John D. Northrup, of the U. S. Geological Survey, Department of the Interior. This output is an apparent gain of 3% over the former high record, 335,315,601 bbl., established in 1917.

Monthly Copper Production for 1918

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE-COPPER PRODUCTION, 1918

	September	October	November	December
Alaska shipments	4,216,816	4,142,744	6,607,216	16,407,461
Arizona:				
Arizona Copper	4,330,000	4,060,000	4,000,000	3,600,000
Coos. Ariz. Smelting	1,200,000	1,200,000	1,030,000	1,060,000
Inspiration	7,800,000	8,125,000	7,500,000	7,350.000
Magma	747,805	949.455	992,271	1,049,783
Miami	5,012,865	4,945.178	4,382,170	4,989.435
New Cornelia (*a*)	2,468,000	2,390,000	2,272,000	2,804,000
Old Dominion	2,292,000	2,373,000	2,101,000	2,686,000
Ray	7,250,000	7,490,000	7.020,000	5,800,000
Shannon	722.000	800,000	684,000	688,000
Shattuck Arizona	686,844	744,069	583,655	506,332
United Verde Extension	4,623,300	4,702,500	4,348,942	4,000,000
Other Arizona	25,002,934	26,604,700	24,567,938	22,765,668
California:				
Mammoth	1,140,000	910,000	1,140,000	1,660,000
Michigan:				
Calumet & Hecla	10,341,468	11,929,929	10,499,711	10,539,706
Other Lake Superior (*b*)	7,000,000	7,000,000	7,000,000	7,000,000
Montana:				
Anaconda	21,800,000	23,450,000	22,600,000	21,900,000
East Butte	2,134,700	1,823,000	2,100,000	1,929,720
Nevada:				
Mason Valley	1,682,340	1,086,200	1,073,400	1,273,176
Nevada Cons	6,670,415	6,700,000	6,601,000	5,800,000
New Mexico:				
Chino	7,936,000	7,063,000	6,464,285	5,507,635
Utah:				
Utah Copper	17,785,000	19,000,000	16.500,000	13,835,000
Eastern smelters (*b*)	1,750,000	1,750,000	1,750,000	1,750,000
Total reported	144,592,487	149,238,775	141,817,588	144,901,916
Others, estimated	13,400,000	19,400,000	17,400,000	16,900,000
Total United States	157,992,487	168,638,775	159,217,588	161,801,916
Imports: Ore and concentrates, etc	10,828,810	10,112,365	15,399,815	10,196,022
Imports in blister, etc	37,570,650	33,884,114	27,793,791	26,405,704
Grand total	206,391,947	212,635,254	202,411,194	198,403,642
British Columbia:				
Canada Copper Corpn	142,466	191,433		
Granby Cons	3,371,535	2,549,474	2,147,405	2,955,450
Mexico:				
Boleo	1,764,000	1,873,760	2,072,324	1,785,840
Cananea	4,900,000	4,300,000	5,100,000	5,100,000
Phelps Dodge, Mexican properties	4,308,845	3,791,602	3,551,418	2,023,000
Other Foreign:				
Cerro de Pasco	6,150,000	5,836,000	5,398,000	6,410,000
Chile	7,346,000	8,548,000	9,854,000	10,902,000
Katanga	4.887,598	3,306,900	551,250	2,513,244
Backus & Johnston	2,435,442	2.503,945	2,103,163	

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (*b*) Estimated.

The production of the United States by months during 1918 is as follows:

	Pounds
January	165,431,568
February	160,011,364
March	185,525,168
April	163,207,096
May	181,070,350
June	166,723,599
July	159,329,031
August	165,550,799
September	157,992,487
October	168,638,775
November	159,217,588
December	161,801,916

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce, and includes Kennecott production from its Alaskan mines.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco, and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo and Katanga companies, whose copper does not come to the United States.

By error, the figure for "Others, estimated," in October was given as 4,100,000 instead of 19,400,000. This changes the total for the United States to 168,638,775, and the grand total to 212,635,254.

Gold Committee's Report Made Public

WASHINGTON CORRESPONDENCE

No steps should be taken by the Government to stimulate or promote the production of gold. This is the judgment expressed by a committee appointed by the Secretary of the Treasury, on Nov. 2, to investigate the gold situation. The committee consists of Albert Strauss, Edwin F. Gay, Raymond T. Baker, Emmet D. Boyle and Pope Yeatman. The report was submitted to the Secretary of the Treasury on Feb. 11. After reviewing gold-mining conditions prior to the armistice and describing the change that took place when hostilities ceased, the committee draws these conclusions:

> Under these circumstances, there is in our opinion no need for artificial stimulation of gold production. Not only has any need therefor passed, but there have come into operation causes that will in due time restore all industry, including the mining of gold, to a normal basis. Gold mining will then become again normally profitable and respond automatically to normal stimuli.
>
> It is therefore the judgment of this committee that no steps should be taken by the Government to stimulate or promote the production of gold.
>
> The representatives of the gold-mining interests very properly based their suggestions for relief on the public necessity for a larger production of gold and not on the hardships suffered by them as parties interested in an industry in which the margin of profit had been rapidly shrinking, and in many cases had entirely disappeared or been turned into a loss. They recognized that such diminishing profits and such losses were inevitable under the shifting conditions of war, and that merely as producers they had no better claim to relief than any other section of the community suffering a reduction of profits or incurring losses under the changing incidence of war conditions.
>
> In the course of its consideration of the subject referred to it, this committee has conferred with a committee appointed by the American Gold Conference held at Reno in August, 1918, under the presidency of Governor Emmet D. Boyle of Nevada; it has had the benefit of the very complete survey of the conditions of the gold-mining industry contained in the report dated Oct. 30, 1918, of the committee appointed by the Secretary of the Interior to study the gold situation, of which Hennen Jennings, Esq., was chairman; and of the report dated Nov. 29, 1918, of the gold-production committee appointed by the commissioners of the British Treasury under the chairmanship of Lord Inchcape; and the committee has conferred with or secured the views of Prof. Irving Fisher and other eminent economists, besides which it has had referred to it a considerable volume of correspondence expressing widely varying views which had been received by the Secretary of the Treasury and the Director of the Mint.
>
> It is interesting to note that the British Treasury committee arrived at the same conclusion as that which we have reached.
>
> We cannot refrain from expressing gratification at the substantial unanimity of opinion among those whose position or experience entitles their views to respectful consideration against suggested measures of relief that would have had a tendency to undermine or upset our standards of value.

Foreign Notes

When the Germans, after the collapse of Russia, overran the country, one of their first objectives was the manganese mines in the Ukraine and the still larger deposits of that mineral in the Caucasus.

The new works of the Companhia Siderurgica Mineira at Sabara, Minas Geraes, Brazil, will be one of the most important iron works in South America. The company has a large stock of fuel with which to begin work as soon as the machinery is installed.

The surplus production of antimony is so considerable in France that this industry can hardly continue to exist on a paying basis unless producers come to an understanding among themselves.

Modern antimony works were established in Tonkin during the war by the firm of Schön & Rhay. Both native and Chinese ore is worked up.

Mining Regiment's Return Delayed

The 27th Engineers is still at Nantes. When the regiment entrained at Givry, early in January, it thought that it was well on its way home. It appeared, however, that transportation facilities were far short of the requirements to transport the men and that there were numerous organizations ahead of the 27th Engineers on the priority list. In the meanwhile, the time has been spent in the daily routine of drills and inspections, which are, if anything, more severe than before leaving the United States. After the excitement of life at the front, the men are heartily sick of the present stagnant existence. However, it seems likely they will surely be home in March. We understand that the regiment is destined to go to Camp Devens, at Ayer, Mass.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including Interest	$19,715.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
W. L. Strauss	10.00
Employees Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5.00
Carl J. Trauerman (second contribution)	5.00
Total	$19,959.46

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Owing to the work of administering the Comfort Fund, contributions are acknowledged only in the columns of the *Journal.*

Planning Sale of Government's Metals

The War Department's surplus stocks of copper, brass, and lead are to be marketed in a way that will have the least possible effect on the market. Before any plan is adopted for the sale of these stocks, producers will be consulted.

At a preliminary conference with representatives of the lead industry, it developed that the surplus quantity of lead in possession of the War Department is a very small proportion of a year's production. Though the figures are not yet final, on the basis of present information the department cannot have more than a few thousand tons to be disposed of ultimately. This quantity represents the surplus of lead in the possession of the War Department which was allocated by the lead producers' committee, at the instruction of the Ordnance Department, for use on cost-plus contracts. Although the details of the arrangement have not yet been worked out, it is practically agreed that some arrangement can be made between the War Department and the lead producers by which the surplus stocks of lead now in the hands of the department may be gradually fed into the market without affecting market prices and market conditions.

In regard to copper and brass, the representatives of the War Department, though anxious to prevent loss of the Government on this material, realize that it would be injurious to the industry, and especially to the workers, if the market prices were upset by throwing this surplus on the market over a short period. Such action would also tend to reduce market prices and thus defeat the desire to obtain for the Government a fair price for this surplus stock

Idaho Mining and Geology Bureau

A bill has just been passed by the House of Representatives of the State of Idaho to provide for the creation of a State Bureau of Mines and Geology. Coöperative work with the U. S. Bureau of Mines and the U. S. Geological Survey is to be provided for, as well as geological and economic investigations of the mineral resources of the state.

Under the provisions of the law the Board of Control will comprise the Governor of the State of Idaho, who shall be ex-officio chairman; the dean of the School of Mines of the University of Idaho, who shall be ex-officio secretary of the board; the State Inspector of Mines; the head of the department of geology of the University of Idaho; and the president of the Idaho Mining Association.

Foreign Trade in Lead and Zinc

Imports and exports of lead and zinc, as reported by the Department of Commerce for December, 1918, are as follows:

IMPORTS

	December, Lb.
Lead	
Ore, metal contents	689,914
Imported from	
Canada	277,200
Mexico	153,185
British South Africa	259,529
Bullion, metal contents (from Mexico)	14,946,348
Pigs, bars and old	......
Zinc:	
Ore, metal contents	2,958,281
Imported from	
Canada	932,866
Mexico	2,005,415
Blocks or pigs, and old	....

EXPORTS

Lead (foreign exports)	
Pigs, bars and old	671,227
Lead (domestic exports):	
Pigs and bars, produced from domestic ore	4,441,279
Pigs and bars, produced from foreign ore	6,411,949
Spelter:	
Produced from domestic ore (pigs)	13,131,377
Produced from foreign ore (pigs)	3,272,856
In sheets, strips, etc	3,861.04

Foreign Trade in Copper

Exports of copper from the United States in December, 1918, are reported by the Department of Commerce as follows:

	December, Lb.
Ore	10,000
Concentrates	
Unrefined, etc., in bars	672,000
Refined in bars	44,698,991
Composition metal	32,580
Old and scrap	
Pipes and tubes	160,789
Plates and sheets	4,760,412
Wire, except insulated	1,336,193
All other manufactures	974,234

The weight of ore exported in December was 47 long tons. No exports of copper concentrates or of old and scrap are reported for the month.

Imports of copper into the United States in December, 1918, are reported by the Department of Commerce as follows:

	December Lb.
Ore	6,041,176
Concentrates	3,002,775
Matte and regulus	1,152,071
Unrefined, etc., in bars	26,405,704
Refined, in bars, plates, etc	2,687,560
Old, etc., for remanufacture	647,657
Composition metal	
Copper manufactures, all others	

Material imported in December was 19,189 long tons ore, 9338 long tons concentrates, and 1172 long tons matte and regulus.

The American Institute of Mining Engineers

The annual meeting of the Institute was held at New York beginning on Feb. 17 and was concluded on Feb. 20, with a visit to the Federal shipbuilding plant at Newark, N. J. Important subjects of timely interest were discussed, dealing to a considerable extent with problems of reconstruction now confronting the mining industry. Horace V. Winchell, of Minneapolis, Minn., was elected president for the coming year.

THE 119th meeting of the American Institute of Mining Engineers convened at the Engineering Societies Building, in New York, on Monday, Feb. 17. The registration amounted to 350 on the first day, comparing favorably with that of previous years. However, the fact that some members are still engaged in war activities, prevented them from being present.

A number of interesting papers were presented, including those dealing with technical subjects, as well as others on important problems of reconstruction involving labor difficulties, and employment of discharged soldiers and men crippled either by wounds received in the service or by industrial accidents.

The social entertainment, especially arranged for the ladies accompanying the delegates, began with a sightseeing automobile trip around New York, visits being made to the American Museum of Natural History, where a special mineralogical display was arranged; to the Spanish Museum, the American Geographical Society, the American Numismatic Society, and the Cathedral of St. John the Divine. On Tuesday, visits were made to the Metropolitan Museum of Art and the art galleries of the Hon. William A. Clark. In addition, the arrangement included several receptions, the annual banquet and an all-day excursion to the Federal shipbuilding plant at Newark, N. J. The entertainment of the visiting ladies was undertaken by the Woman's Auxiliary of the Institute, which arranged a complete program. The Auxiliary held several meetings dealing with organization matters.

Horace V. Winchell, of Minneapolis, Minn., was elected president of the Institute for the coming year. Other officers elected were Edwin Ludlow, Lansford, Penn., and A. R. Ledoux, New York, as vice-presidents. The directors elected were as follows: J. V. W. Reynders, New York; George D. Barron, Rye, N. Y.; Charles F. Rand, New York; Louis S. Cates, Ray, Ariz.; Stanly A. Easton, Kellogg, Idaho.

A memorial meeting was held for the members who lost their lives in service during the war and also for Dr. Rossiter W. Raymond, who died Dec. 31, 1918.

Among the papers read at the session on Industrial Organization, which was presided over by B. F. Tillson in the absence of H. I. Young, was the "Prevention of Illness Among Employees in Mines," by A. J. Lanza, which evoked a spirited discussion. The practice of dry drilling in hard rock was criticized by Mr. Lanza, and in the discussion which followed, C. W. Goodale stated that, in overhand stoping, miners preferred the present method to working with water, because of wet ground. The discussion also confirmed the fact that dust in coal mines apparently does not produce tuberculosis to a great extent. Limestone is also not considered very injurious. However, siliceous rock was accepted as the cause of a large amount of lung diseases among miners, which evil is to some extent lessened by improved ventilation.

J. P. Monroe, vice-chairman, Federal Board for Vocational Education, told of the attempt of Bolshevist leaders to introduce a revolutionary labor movement into this country, choosing Lawrence, Mass., as the most favorable spot for a beginning. The movement was unsuccessful, the American Federation of Labor, the United Mine Workers of America, and other workmen being decidedly against it.

The paper presented by Major Robert M. Yerkes on "Mental Tests in Industry" created considerable interest. The psychological tests applied by the U. S. Army for the selection of officer material were described and methods of rating various degrees of intelligence were given.

Another paper of interest was one by T. T. Read, on "Mental Factors in Industrial Organizations," which traced many of our present labor difficulties back to the mental causes which produced them. The discussion pointed out the benefit of welfare work and social activities of the workers in an industrial organization in providing an effective remedy in overcoming the present tendency for the workman to see in his work only the unpleasant necessity of earning a living.

The session on petroleum and gas was enlivened by a discussion on the paper of Dorsey Hager and G. W. McPherson, which was read by James F. Kemp in the absence of the authors. Under the title of "Cement Plugging for Exclusion of Bottom Water in the Augusta Field, Kansas," the effectiveness of the methods for preventing the flooding of wells was discussed. The discussion brought out the fact that in various fields no successful method has been discovered, and some operators were entirely skeptical of accomplishing such an object.

A new spirit characterized the proceedings at the "smoker." A year ago war and the preparation for more war dominated the minds of everyone. On Monday night, 300 members of the Institute lifted their voices in the National hymn with a joyousness that only the realization of the termination of the world war could bring. Together with their Canadian confrères they sang the Canadian anthem. E. P. Mathewson then introduced John T. Terry, the cartoonist. Terry quickly demonstrated that many prominent members of the American Institute of Mining Engineers were known to him. George C. Stone paraded before his astonished fellow members on an Australian kangaroo. H. C. Hoover's cartoon met with emphatic approval. H. V. Winchell's "back from Russia and never going there any more" caused many chuckles. Mark L. Requa was introduced as the only man who had ever driven the automobiles off Fifth Ave. on Sunday. J. E. Johnson, Jr., smiled on everyone, and cautioned the members not to blow out the light. Sidney J. Jennings sported around "as the greatest Roman of them all" in toga and laurel wreath—and smile. E. P. Mathewson was the only member who required red chalk additions. George D. Barron was shown coming out of Mexico with the information "that cactus isn't all that grows in Mexico." Many other members proved before this part of the entertainment was over that they had met the cartoonist and their features and characteristics had been registered.

George C. Stone and B. F. Tillson saw the geological map of New Jersey as they never saw it before, and were rendered speechless by the interpretation which E. P. Mathewson gave it. Probably there is no other geological map in existence that is so liable to misinterpretation as the one issued by the Geological Survey of New Jersey. George C. Stone's activities also were not limited by his interest in the geological map, as E. P. Mathewson very proudly exhibited a cigar advertisement which left the worthy Stone with nothing to say as to his commercial affiliation outside of the New Jersey Zinc Co. J. Parke Channing was also brought before the bar of membership approval by his apparent connection with a prominent Parisian firm interested in the sale of a well-known hair restorer. The entertainment also included moving pictures, songs, and stories, which combined to make the affair a notable success.

Tuesday was Canadian Mining Institute day. The non-technical session opened with a point discussion by members of the two institutes on the principles of mine taxation. This was followed by papers on industrial democracy and education by C. V. Corless and S. J. Jennings. The former said that workers must be given a sense of personal responsibility if they are to be freed of the notion that they are being oppressed by those in authority. Unless the economic facts of production are thoroughly understood both by capital and labor, a state of mind will result which may develop into Bolshevism.

In the afternoon the sessions were continued, T. A. Rickard in an opening paper making a plea for the elimination of those minor prejudices that distinguish the English-speaking peoples, and a broader recognition of the fact that Great Britain and her colonies and possessions have much in common with the United States. He also urged the revisal of American history books, particularly those which show a lack of impartiality not in keeping with historical facts. Dr. A. R. Ledoux said that it was encouraging to note that the spirit of the congress carried with it a broader recognition of the principles of ethics and applied Christianity. He drew attention to the fact that the barriers were down between the United States and Canada except for a few lengths of barbed wire in the form of tariffs which it was hoped would soon be swept away. This freedom of intercourse, he said, had resulted in the increased development of both countries and an appreciation of the value of reciprocity. The Great Northern R.R. was constructed by Canadians. The Canadian Pacific Ry. was built by Americans. American capital and American energy had contributed to the development of Canadian industry. On the other hand, Canadians were well and honorably known in the United States, and, in mentioning Douglas and Mathewson, Dr. Leoux paid a tribute to the country's northern neighbors, in the course of which he maintained that America can learn much from Canada. Disinterested advice in Washington on mining matters from Canadians would be welcomed and would be valued on account of its impartiality. Mexico also offered a promising field for coöperation between the two nations. Dr. Ledoux finally recommended that the two institutes—the American Institute of Mining Engineers and the Canadian Mining Institute—should appoint a joint commission to study the situation. Canada's advice would be valuable, as that country is further away from the trouble than the United States. The result of the coördination of impressions and opinions would inevitably lead to influencing public opinion, and much good would follow.

In commenting on Dr. Ledoux's remarks, chairman Jennings said that he had decided to go to Mexico in the immediate future, and would hold conferences in Mexico City at which the various problems would be discussed.

The question of Canadian and particularly Ontario mining laws was ably presented by T. A. Gibson, the mining commissioner of the Province of Ontario, who drew attention to the satisfactory features of the practice of settling disputes by means of a commissioner of this sort rather than by incurring the delay and expense that seemed unavoidable if such matters are taken before a Supreme Court judge.

The question of uniformity in mining legislation in North America was discussed by H. V. Winchell, who prefaced his remarks by stating that any such plan must start with the standardization of the laws of individual countries, so that local regulations at least were uniform. In Canada the various provinces can make their own laws, but this is not true of the United States, although each state in the Union can limit the rights given to prospectors under the Federal mining law, which provides that claims shall be 600 ft. wide by 1500 ft. long. This has been deemed excessive in several states, with the result that legislation has been enacted and the lengths in some states have been reduced to 200 or 300 feet.

Mr. Winchell drew attention to the honest and fair treatment that was invariably meted out to prospectors in Canada. The mining laws were liberal as regards the citizens of other civilized countries. In the United States it was necessary to be a citizen or one who had declared his intention to become a citizen before rights would be granted. In Canada the opportunity to develop minerals was open to all, regardless as to whether they were British subjects or not. The only persons who were not allowed to acquire mineral rights were Germans and other alien enemies. The Mexican mining law as it was in pre-revolutionary days was based on sound principles and long practice, and was taken from the old Spanish code. In concluding, Mr. Winchell expressed his belief that a uniform mining law for North America was impracticable, on account of the differing conditions, in all particulars, in the countries concerned. There was an opening, in his opinion, for a closer appreciation of the advantages of international intercourse which would lead to development and greater prosperity.

Editorials

The Course of Prices

THE course of prices in all of the free markets is downward, and rapidly so. Among the metals antimony went first, then zinc, then lead, and, finally, copper, the last being quoted this week at 16c. The only metals that now remain very high (on paper) are tin, in which Government officials have perpetrated an outrageous economic crime in order to conceal the consequences of their great gamble; and iron and steel, the magnates of which industry refuse to recognize that attractive prices ever stimulate consumption. There is too much of the atmosphere of the erstwhile Gary dinners still hanging over the iron and steel industry.

So it is with other commodities. The prices of many foodstuffs have started downward, but the fixed price of wheat holds everything back. The Government must keep its agreement with the farmers, but that does not mean it should not liberate the market. Among retail dealers in all commodities there is the traditional policy of maintaining prices until they have disposed of their stocks of goods at cost. Secretary Redfield and his colleagues are gravely talking about arranging prices on the basis of cost of production. The present market situation is temporarily one in which cost of production has nothing to do with the case.

The whole commercial situation is like that of a river that has been dammed up. The dam has broken and the water has begun to run through one hole after another, but some sections still stand, impeding free flow. They are crumbling away, and will soon go also. Not even are the steel magnates able to maintain a structure strong enough to resist indefinitely the pressure of economic law. When the obstructions have all gone, and the river of commerce flows freely again, there will begin to be a revival in business. In the meanwhile there is disappointment that the great declines in zinc, lead, and copper have not yet stimulated any considerable demand. Nor will there be such demand until the whole commercial current is flowing more freely or until offers are made to sell at prices so low that speculators will be induced to buy in anticipation of the rise that will inevitably follow at some later time.

Another great obstacle to the readjustment is the attitude of labor. Workmen complain correctly that the cost of living is still high. That consideration, however, is not going to stay the course of events. There is some slack that can be taken up. Employers can forego the profits to which normally they are entitled, as they have generously done already, and workmen can philosophically sacrifice the margin that they have enjoyed, as, indeed, they have done. There will have to be contraction in the scale of living in many directions. But just as the steel magnates stand in the way of readjustment, in the commodity markets, so do the railway brotherhoods and other aristocrats in labor. Naturally they enhance the difficulties of many other classes of labor ranging down to the ditch diggers and drudges, who have the hardest time.

It is hinted that the President has become alive to there being something seriously wrong with the economic situation. Some of the recent negotiations in Paris have been concerned with opening the German market for commodities. That will be very helpful, for no doubt Germany will desire to buy copper, cotton, and other materials. However, a good deal more than that has got to be done to right the situation. One of the best things the President can do is to call the new Congress immediately into session and request it to give prompt attention to the correction of economic evils, including the matters of the price of wheat, the incidence of taxation, the case of the railways, and the elimination of all governmental interference with industry and such public services as the telegraphs and telephones.

The Railway Problem

THE *Railway Age* of Jan. 17, 1919, published a timely editorial on the solution of the railway problem which contained considerable food for thought, not only for public men and railway officials, but also for the public in general. The railway problem is not a problem of railway officials or of Congress. It is broader than that; it is a national problem, a problem of all the people—one in which all men are vitally interested and one which must be solved by public opinion guided by the facts in the case.

The editorial mentioned points out that the problem cannot be studied from the point of view of the management, the operatives, owners, shippers, or of any other class, but must be looked at almost exclusively from the standpoint of the public. There must be a harmonizing of every class interest for the greatest public benefit, and with the attainment of this condition it will be found that no class suffers at the expense of any other class, but each is obtaining its just due. For example, under-payment of operatives will tend to lower the type of men that may be employed, resulting in inefficiency which will cause the public inconvenience. Excessive payment to operatives means higher charges to the public. Under-compensation or over-compensation to owners will affect the public in the same manner.

Looking at the question from the public standpoint, one may ask: "What will be the conditions accompanying a satisfactory solution of the railway problem?" The answer can be given in one sentence—adequate transportation facilities and good service, with passenger and freight rates as low as may be consistent with these requirements.

Adequate transportation facilities and good service—that is what the public wants, that is what it demands, and that is what it can have if it is prepared to treat fairly all those classes which together furnish the service, and which it cannot have if it is not prepared to pay a fair price for the service that is rendered. It is also within the power of the public to see that it does not pay an excessive price for what it gets.

"Reason and experience," the *Railway Age* points out, "demonstrate that the desired results can be attained only through private ownership and operation," and in substance it approves of the suggestions of the Association of Railway Executives presented to the Senate Committee on Interstate Commerce, but points out that these do not go far enough. It says: "They would not insure that the average net return which the railways would be allowed to earn in the future would be any less inadequate than the average which they were allowed to earn before Government control was adopted."

Those conditions which it is necessary to bring about in order that the railways, under private ownership and management, may attain the ends which are most desirable of attainment in public interest, may be briefly stated as follows:

Reasonable competition in service and intense emulation in operating efficiency.

Coöperation and coördination in the operation of railways in the same territory, which, while not interfering with emulation and reasonable competition, will prevent the wastes caused by excessive competition.

Prompt, impartial, and expert determination of questions regarding the wages and working conditions of railway employees. The same may be said respecting freight and passenger tariffs.

The establishment of railway credit on a firm foundation. In this connection the *Railway Age* advocates the absorption of the weaker roads by the stronger companies in the same territory, because no adequate provision is made for establishment of their credit in any of the suggestions that have been offered. The reduction in the number of minor railroads would help the situation.

When the management of a mining proposition is confronted with the problem of re-locating a lost oreshoot, it sensibly calls in a geologist of experience. If the trouble is at the furnace, it calls in a metallurgist. Wherever the trouble may be, a specialist is needed. This practice has long been recognized by every successful business.

We trust that Congress will realize that it is not composed of railway men, and, like the miner, call for the specialist to assist in the solution of this intricate problem. Also that the public, in its desire for low rates, does not overlook the main point—adequate service—and in striving for a condition that may mean low rates temporarily defeat its best interest in service. It is our duty to use our judgment, but we should weigh seriously the advice of the specialist in forming our conclusions.

Whatever the answer, it will probably not come immediately as any one act of Congress. So large a matter can reach a satisfactory solution only in the course of development, where the best is kept and the mistakes are cast aside. Even then there will be no final solution, for changing national conditions must continue to change the operations of this most important of public utilities. The spirit of give-and-take must not only be invoked in trying to find a solution today—it must always prevail.

Concerning the Mine Prospect

A GREAT deal has been said regarding the prospector, his failures and his triumphs; and he has always formed a romantic character of the history of the mining industry. The article "Examining and Developing the Mine Prospect," which appears in this issue, throws an interesting sidelight on the practical consideration to which all mine prospects must be subjected, and the paper should be of timely interest, in view of the fact that increasing demands for precious metals will require extended operations by mining companies now in the field and those which will enter that branch of industry.

We believe the opportunity for legitimate enterprise is as great today as it ever was, but investors in mine properties are no longer willing to buy "a pig in a poke," and the prospector who would dispose of his holdings must have conclusive evidence that he is offering a proved proposition to his client. The element of chance in the purchasing of prospects is still present, but it can be reduced to a great extent by means of careful and analytical study. Painstaking consideration of all factors which may have a possible bearing on the determination of the status of the property under examination is urged by Mr. Curran, and the fact is emphasized that an indifferent report made by an engineer is to be avoided as much as one which attempts to overestimate conditions by means of an elaborate camouflage of geological terms frequently bewildering and misleading to the layman.

The mining engineer backed by experience and with the proper knowledge should be able to offer an opinion as to what work should be done to determine the further possibilities of the prospect, and the performance of such work should properly fall under the direction of the engineer. Many investors are prone to overlook the difference between the prospect and the producing mine. The management of the latter offers opportunity for a definite organization, the personnel of which may embrace considerable variation, depending on the magnitude of the operation. A business man with little or no technical training may, by reason of his executive ability, make an excellent producing-mine manager, but development of the mine prospect requires a versatility usually found only in the engineer.

The article on the prospect is worthy the attention of the engineer and the prospective investor alike. The comprehensive point of view taken by Mr. Curran should accomplish much in removing the misunderstanding that exists in certain quarters regarding the foretelling of prospects. Their reputable promotion is not a matter of magic or legerdemain, but the result of a careful analytical study of all local factors and conditions.

Copper Production in 1918

OUR statistics of the production of crude copper show that the output of American mines in December was 161,801,916 lb., compared with 159,217,588 lb. in November and 168,638,775 lb. in October. These monthly figures, which are the compilation of returns from all producers, are about 5% too high, owing partly to nonallowance for losses in smelting, partly to the inclusion of some foreign copper that cannot be segregated, and partly to other causes; but month by month they are strictly comparable.

The December figures show that the copper producers kept their promise to the War Industries Board to maintain production, foolish as may have been the request for such a policy and the acceding to it. During 1918 the production of the mines was remarkably uniform. It attained a maximum of 185,525,168 lb. in March and showed a minimum of 157,992,487 lb. in September, but during most of the year the monthly figures were between 160,000,000 and 165,000,000 pounds.

The total for January, 1919, will show a great decrease and that for February a greater one. About all the copper produced since October is going into stock of refined. Including the imports, the arrivals, domestic and foreign, have been about 200,000,000 lb. per month. With about 250,000,000 lb. of crude copper at the refineries to start with, 100,000,000 lb. of refined on Jan. 1, and 600,000,000 lb. for the November-December-January production, we get approximately the total that was talked about in the official statement of Feb. 1.

The Hand of Death

IN THE morning papers of Feb. 16 appeared the following dispatch from Washington under date of Feb. 15:

> Approval of the proposal to establish a Government price-adjustment board to stabilize conditions during the post-war period was cabled by President Wilson today to Secretary Redfield.
>
> The organization, to be known as the Government Price Conference Board, will be constituted immediately. As devised by Secretary Redfield and his commercial advisers, the plan calls for an investigation of the costs of production of basic commodities under conditions as they have changed since the war and the determination of prices which the Government will pay. Early adjustment of prices will be sought to avoid the period of stagnation and commercial depression, with consequent unemployment, that might intervene if the process is left to the ordinary operation of supply-and-demand laws.
>
> Secretary Redfield indicated that the personnel of the board would include a large number of men who served on the War Industries Board prior to its dissolution.
>
> The first product for which prices will be recommended, it is thought, will be steel. The board will work through a series of subcommittees in each industry, which will report findings for the approval of the general body.

The above leaves us in doubt as to just what kind of new economic crime is meditated. If the new price-fixing is to be the publication of prices that the Government will pay as a buyer, there is not much in it. The Government does not want to buy things. It wants to sell them. Perhaps, however, it is thinking of the needs of the railways and the shipbuilders.

If, however, there is contemplated any further interference with the law of supply and demand, we shudder, as with the chill of the graveyard.

C. W. Purington writes from Vladivostok that he wishes the Allies would pay a little more attention to Siberia. At present the freight congestion is such that it is hard to get even one car of goods to the interior, where the civil population is so badly in need of supplies. The American railway men, under Mr. Stevens, are there, and in Harbin, waiting to be allowed to take charge, but so far have not been asked to do so. This letter was dated Jan. 1, 1919.

If we were mere stockholders and bondholders of the railway companies, we might view with complacency the proposal of the Brotherhoods that the Government appropriate 18 or 20 billion dollars to buy the railways and turn them over to the labor unions to run. But, as taxpayers and travelers, we confess to much alarm over this lunatic proposal. Taxes are high enough now, and railway service is bad enough. What they would be if the railways were in the hands of totally inexperienced managers we shudder to think.

"There will be perfect equality in the world only when nobody knows how to read and write," a speaker at a meeting of a Russian soviet is reported to have said. This is the ideal of socialism. Only when the people of the world are reduced to that degree will there be any real equality; but at that time they will be wearing the skins of animals and making fires by rubbing stones together. There may be real equality among the natives of Borneo, but we doubt even that.

BY THE WAY

Miners from the province of Galicia, or Gallegos, as they are known, are efficient, as miners go, among Spanish labor, but they are notoriously set in their ways; so much so, in fact, that they are invariably the butt of practical jokers and are made the subjects of innumerable anecdotes in the vernacular. The Andaluz, or southern miners, are generally good workers whose motto is that "All work and no play makes Jack a dull boy." It is almost superfluous to state that whenever a trick is played, the rule is not "*cherchez la femme,*" but "which Andaluz did it?" Recently a *Journal* reader was admonishing an Andaluz, and endeavored to bring the lesson home by quoting a story of a Cornishman that had appeared in this column. When asked if he understood just what a Cornishman was, the Andaluz smiled blandly and replied in pretty good English, "Yes, all right. We had a lot of those fellows at the Rio Tinto mine. We called them the Gallegos of England."

The mineral cubanite, or *cubanita,* was named by the mineralogist Breithout in 1843. Some authorities state that the specimen of ore responsible for the christening came from "Barracanao," but the correct name for the locality is Bacuranao. The theoretical formula of the mineral is stated to be $CuS.Fe_2S_3$, the composition being about 23.3% copper and 41.3% iron. The crystallization is said to be isometric, the mineral also occurring in massive form. In different parts of Cuba enthusiastic islanders exhibit various specimens of *cubanita,* varying in color from light yellow to dark brown. The structure is almost invariably massive. The cleavage may be cubical, but some interested persons feel that the product is not divided on the square. For present-day mineralogical classification, a convenient field definition of cubanite is "any off-color bastard sulphide of iron and copper that does not come up to the chalcopyrite standard." If, on the contrary, the name cubanite is to be confined to the mineral with the definite formula as given above, cubanite is a very rare mineral.

Personals

Have You Contributed to the Association of the 27th Engineers?

J. R. Buchanan is now manager for the Homestead-Iron Dyke Mines Co. at Homestead, Oregon.

L. O. Kellogg has sailed from New York for Ecuador, to resume his position as superintendent for the South American Development Company.

O. A. Dunlap has been elected vice-president of the Hollinger Consolidated Gold Mires, Ltd., Ontario, Canada, succeeding the late John McMartin.

C. D. Kaeding, general manager of the Dome Mines, Ltd., Porcupine, Ontario, Canada, has gone to California, where he will remain about two months.

Col. R. W. Leonard, president of the Coniagas Mines, Ltd., of Cobalt, Ontario, Canada, has been elected president of the Engineering Institute of Canada.

James C. Farrant, London representative of the Hardinge Conical Mill Co., who had been a prisoner of war in Germany for four years, has returned to England.

A. E. Hodgkins, formerly general manager of the Cheever Iron Ore Co., Port Henry, N. Y., has been appointed to the newly created office of comptroller of Witherbee, Sherman & Co., at Port Henry.

R. L. Herrick, formerly assistant publicity manager of the Ingersoll-Rand Co., has resigned to accept a position as managing editor for "Raw Material," which is published by the Gage Publishing Co., New York.

Thomas H. Mathias, formerly assistant general superintendent of the Lackawanna Steel Co., has been appointed general superintendent of that company. **George A. Whitehead** is now assistant general superintendent.

E. P. Barry, formerly Governor of Massachusetts, **John E. Allen**, of Boston, and **Walter Harvey Weed**, of New York, were recently in Butte, Mont., inspecting the property of the Crystal Copper Co., situated near Basin, Mont.

Capt. Gerald L. Wendt, recently discharged from the Chemical Warfare Service, has resumed his duties as assistant professor of chemistry at the University of Chicago, and as a member of the editorial board of the bulletin of the Chicago Section of the American Chemical Society.

Errol MacBoyle, mining engineer, who recently concluded the consolidation of the Union Hill, Eureka-Idaho-Maryland mines, in Grass Valley district, Calif., and the formation of the Gold Point Mines, Inc., taken over by the Bulkeley Wells interests, has been retained as consulting engineer and a director in the company. His office is now at 1112 Hobart Bldg., San Francisco, California.

C. W. Purington writes from Vladivostok, Russia, that temporarily he has joined the staff of the War Trade Board there, under the direction of August Heid, attaché to the War Trade Board. Together with Reuben Smith, he will soon make a trip to the interior to try to ascertain the proper distributing channels for the goods which it is planned to send for the relief of the civil population.

Societies

International Mining Convention will be held in Vancouver, B. C., Canada, Mar. 17-19.

Engineers' Society of Western Pennsylvania, held its regular monthly meeting at the Union Arcade Bldg., Pittsburgh, Penn., Feb. 18. The subject for the evening was "The Camera in the War" by C. E. K. Mees.

American Institute of Electrical Engineers, Denver Section, held its regular monthly meeting on Feb. 15, at the Denver Athletic Club, Denver, Colo. The speaker of the evening was O. N. Robinson, of the General Electric Co. The subject of the address was "Electric Welding." Many interesting lantern slides were shown.

The Teknik Club of Denver, Colo., held its regular meeting and dinner at the Shirley Hotel, on Feb. 11. Following the dinner, Harry J. Wolf presented a paper on "The Manganese-Silver Problem," in which he reviewed the various efforts that have been made to solve the difficulty, and described recent developments in connection with the uses of reducing gases.

Colorado Scientific Society held its regular meeting on Feb. 15, at the Shirley Hotel, Denver, Colo. This was the first of a series of dinner meetings planned for the ensuing year. The speaker was S. A. Ionides, who addressed the meeting on "Sulphuric Acid" and presented some of the later developments in connection with the manufacture of certain chemicals and explosives. A discussion by various members of the society followed.

American Society of Civil Engineers held a meeting Feb. 19 at the Engineering Societies Bldg., 29 West 39th St., New York. Nathan C. Johnson spoke on "New Developments in Concrete." Motion pictures traced the concrete process from the earliest days, the actions of the respective materials were shown in their several phases; the processes of manufacture were minutely analyzed, and means for producing more uniform and reliable concrete was indicated. A thorough discussion of the subject followed.

Industrial News

Detroit Steel Products Co., Detroit, Mich., has reëlected John G. Rumney as president.

Choctaw Engineering Co., Poteau, Okla., has recently been organized. S. D. Callaway and J. E. Davis are the members of the company, and will engage in consulting, mining, and civil engineering.

National Conduit and Cable Co., New York, has elected Joseph C. Baldwin, Jr. as director to fill the vacancy caused by the death of Capt. J. R. de Lamar. W. S. Eckert has been elected vice-president of the company in charge of sales.

White & Brothers, Inc., smelters and refiners, Philadelphia, Penn., has opened an office at 919 Oliver Building, Boston, Mass., to take care of the large increase in the New England demand for electrolytic and casting copper, ingot and babbitt metals.

Material-Handling Machinery Manufacturers' Association has been formed, following the suggestion of the Department of Commerce and the United States Shipping Board. The suggestion was made by these two agencies because of the need for intensive study of the freight-handling methods at both railroad and ocean terminals, and the association will take up the whole field of material handling and so touch every industry. The active work will be done by the secretary and manager, Zenas W. Carter, formerly commissioner of the Associated Metal Lath Manufacturers. The officers of the association are: President, Calvin Tomkins; vice-president, J. A. Shepard; treasurer, Lucian C. Brown; directors, Mr. Shepard, Mr. Brown, R. W. Scott, F. W. Hall, William Clark, J. C. Walter, C. M. Watson, and Fred Stadelman. Four additional directors are to be chosen when the charter membership is completed.

Trade Catalogs

Dump-Bottom. W. L. Goodwin, 1516 North 40th St., Seattle, Wash. 3¾ x 8¾; illustrated. A pamphlet describing the Goodwin-Holman patent dump-bottom.

Buckets. Lakewood Engineering Co., Cleveland, Ohio. Bulletin No. 26, 8½ x 11, pp. 24, illustrated. The principal features of the design and construction of the Lakewood clam-shell buckets are described.

Gasolene Locomotives. Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis. Publication No. 110; 10 x 7; pp. 32; illustrated. General description and specifications of the different types of Milwaukee gasolene locomotives.

Simplex Ore Separators. W. O. Arzinger Machinery Co., Nashville, Tenn., pp. 8; illustrated. Descriptive of the Simplex ore separators for the treatment of ores by the flotation process. Details regarding the equipment will be furnished on request.

Steam and Electrical Equipment. F. William Stocker, Inc., 1119-1121 Clinton St., Hoboken, N. J. Pamphlet, 8 pp. A list of new and second-hand equipment used in mining, including air compressors, air receivers, boilers, wire rope, crushers, hoisting engines, and pumps.

Boiler Logic. Heine Safety Boiler Co., St. Louis, Mo. Pp. 86; 6 x 9; illustrated. A treatise covering some fundamental considerations of boiler design; practical baffling of water-tube boilers; Heine boilers for different fuels, firing, and services; overloads, the boiler as a pressure vessel; and details of the construction of the boilers.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloys Rich in Phosphorus; also Metallic Phosphides, Process of Making. Paul E. Demmler, Pittsburgh, Penn., assignor to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,287,653; Dec. 17, 1918.)

Blower, Rotary. Ira H. Spencer, West Hartford, Conn., assignor, by mesne assignments, to Spencer Turbine Co. (U. S. No. 1,288,728; Dec. 24, 1918.)

Cement, Acid-Resisting. Alfred Ewart Holley and Harry William Webb, Oldbury, England, assignors to Chance & Hunt, Ltd., Oldbury, England. (U. S. Nos. 1,287,995 and 1,288,413; Dec. 17, 1918.)

Coke, Manufacture of. Arthur McDougall Duckham, Ashstead, England. (U. S. No. 1,289,045; Dec. 24, 1918.)

Conical Mill. Harry W. Hardinge, New York, N. Y., assignor to Hardinge Conical Mill Co., New York, N. Y. (U. S. No. 1,288,573; Dec. 24, 1918.)

Copper From Its Ores by Leaching and Flotation, Process of Extracting. Harry W. Morse, Los Angeles, Calif., assignor to Chino Copper Co., Hurley, N. M. (U. S. No. 1,288,121; Dec. 17, 1918.)

Filtering, Process and Apparatus for Continuous Pressure. Jasper A. McCaskell, Salt Lake City, Utah. (U. S. No. 1,288,433; Dec. 17, 1918.)

Flotation—Concentration of Ores. Oba Wiser, Hurley, N. M., assignor to Chino Copper Co., Hurley, N. Mex. (U. S. No. 1,288,350; Dec. 17, 1918.)

Furnace, Annealing. William A. Wood, Dunellen, N. J., and Walter S. Rockwell, New York, N. Y., assignors to W. S. Rockwell Co., New York, N. Y. (U. S. No. 1,288,353; Dec. 17, 1918.)

Furnace, Electric. Leo L. Simpson, Seattle, Wash., assignor to Adrian H. Sroufe, Seattle, Wash. (U. S. No. 1,288,240; Dec. 17, 1918.)

Furnace, Electric. Lewis G. Rowand, Brooklyn, N. Y., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,289,055-6; Dec. 24, 1918.)

Furnace, Electric. William K. Booth, Chicago, Ill., assignor to Booth-Hall Co., Chicago, Ill. (U. S. No. 1,287,849; Dec. 17, 1918.)

Furnace, Metal Heating. Walter S. Rockwell, New York, N. Y., assignor to W. S. Rockwell Co., New York, N. Y. (U. S. No. 1,288,202; Dec. 17, 1918.)

Gases, Process and Apparatus for Electric Arc Treatment of. Frans Henrik Aubert Wielgolaski, Christiania, Norway. (U. S. No. 1,287,807; Dec. 17, 1918.)

Refractory. Louis P. Kraus, Jr., New York, N. Y. (U. S. No. 1,289,049; Dec. 24, 1918.)

Rope and Cable Thimble. Edward O. Keator, Dayton, Ohio. (U. S. No. 1,288,021; Dec. 17, 1918.)

Rope Clamp. Reinhold Loos, Newark, N. J. (U. S. No. 1,288,943; Dec. 24, 1918.)

Slag Pocket. William M. Whalen, Erie, Penn. (U. S. No. 1,288,328; Dec. 17, 1918.)

Steel, Chrome. Child Harold Wills, Detroit, Mich. (U. S. No. 1,288,344; Dec. 17, 1918.)

Steel. Ingot Stripper. David Kendall, Alliance, Ohio, assignor to Alliance Machine Co., Alliance, Ohio. (U. S. No. 1,288,023; Dec. 17, 1918.)

Steel. Manufacture of Openhearth. Herbert C. Ryding and Anson W. Allen, Birmingham, Ala. (U. S. No. 1,289,057; Dec. 24, 1918.)

Steel (Spring). Containing C, Mn, Cr, Si and Mo. Child Harold Wills, Detroit, Mich. (U. S. No. 1,288,345; Dec. 17, 1918.)

Steel and Iron, Solution for Rust-Proofing. William H. Allen, Detroit, Mich., assignor to Parker Rust-Proof Co. of America, Detroit, Mich. (U. S. No. 1,287,605; Dec. 17, 1918.)

Sulphur Mining. Robert E. Carmichael, Damon, Tex., assignor of one-half to George Hamman, Houston, Tex. (U. S. No. 1,287,878-9; Dec. 17, 1918.)

Well-Drilling Machine. George R. Watson, Waterloo, Iowa. (U. S. No. 1,288,319; Dec. 17, 1918.)

Well-Drilling Machines, Ram Attachment for. Harry E. Brown, Augusta, Kan. (U. S. No. 1,287,865; Dec. 17, 1918.)

Editorial Correspondence

SAN FRANCISCO—Feb. 12

The Summary of Oil-Well Development and production in California in December, 1918, reported by the Standard Oil Co., embraces all fields and shows a total of 46 new rigs, 331 wells in process of being drilled, 41 completed, and seven abandoned. The total number of wells producing was 8606. The total average daily production in all fields for December was 275,596 bbl. or a total production for the month of 8,543,476 bbl. The crude-oil stocks on Dec. 31 amounted to 32,042,923 bbl., total shipments being 8,434,463 bbl. The summary for November, 1918, which is the last summary to be compiled and issued by the Pacific Coast Petroleum War Service Bureau, showed 34 new rigs, 348 wells in process of being drilled, 47 completed, and one abandoned. The total number of wells producing was 8473 in November, the daily initial production of completed wells totaling 6293 bbl. in that month. The total average daily production in November in all fields was 277,618 bbl., or a total production in the month of 8,328,540 bbl. Total crude stocks Nov. 30 were 32,265,746 bbl., total shipments not being recorded. The crude-oil prices at the well, posted by the Standard Oil Co. on Jan. 15, 1919, are the same as posted and effective May 1, 1918, without change during that period.

Supervision of Oil Wells in California in the last four years, under a state law, has been carried out in such a practical way and been so generally beneficial to operators and conservative of oil measures that it is rather surprising that it should be necessary now to amend the law. The amendment sought by the State Mining Bureau, a department of which exercises supervision over oil and gas, provides for the enforcement of a section requiring all operators to protect the petroleum and gas deposits. The authors of the original measure believed it was sufficient to provide for recourse to the courts by operators who might object to the demands of the oil and gas supervisor. But it appears this provision was not sufficient. There have been few, but notable, failures to obey the law strictly. So it is now necessary to provide by legislative amendment that, if on or before 10 days after the date of service of notice of any order of the supervisor which has become final and absolute, or in case of action in court to enjoin the enforcement of an order, the owner or operator has not in good faith begun the work, the supervisor may apply to the court to enforce such final order or decree and appoint agents necessary to enter the premises and perform the work. The amount expended by the supervisor for the performance of the work shall constitute a lien against the property. In any such foreclosure action, the court shall authorize a personal judgment against the person whose duty primarily it was to perform the work done by the supervisor, for any deficiency in the amount resultant from the foreclosure and necessary to meet the judgment. There are other amendments respecting the regulation of drilling, keeping of logs, and similar matters, all of which are essential if the law is to operate wholly to the benefit of the oil industry, and oil measures of the state are to be conserved. The law, as so far enforced under state supervision, has never worked a hardship upon owner or operator, and has resulted in such regulation that water infiltration has been greatly diminished and the life of the wells extended without damage to or infringement upon neighboring or adjoining wells. R. P. McLaughlin is the present oil and gas supervisor.

PHOENIX, ARIZ.—Feb. 13

A Strike at Jerome, begun early on Feb. 10, when the copper companies put into effect a cut of 75c. per day in men's wages, affected about 4000 men. The union miners, affiliated with the International Union of Mine, Mill and Smelter Workers, obeyed instructions from leaders to remain at work pending the arrival of Federal Mediator Hywell H. Davies, who, Secretary of Labor Wilson telegraphed, would start immediately. The United Verde and United Verde Extension companies issued a joint ultimatum to employees on Feb. 11, that both properties would shut down indefinitely unless enough men returned to work to keep smelteries supplied with ore. Miners at Jerome had voted to accept the new scale under protest, but were intimidated and kept away from the shafts. The new rate of pay is 75c. higher than under the old Miami sliding scale. The United Verde made the following announcement: "We wish to state, in all frankness, that we are discriminating against the I. W. W. and Bolshevik element, where we know that such men are in our employ." The labor troubles must be most inopportune from a labor viewpoint, for the condition of the copper market is causing general curtailment of output at the larger properties, and scores of shipping properties are closing down entirely. The Sasco smeltery of the American Smelting and Refining Co. has shut down. The Swansea lease is stopping operations at Swansea, in northern Yuma County, although it is completing a 250-ton mill. Great Western, at Courtland, has suspended, largely because of water, and the Johnson camp has about ceased to ship. The Bush and other shipping properties near Tucson are also closed. Several shafts at Bisbee have been abandoned for the time being, and the miners transferred elsewhere or discharged. Most of the many development properties at Jerome are waiting until costs become lower.

MORENCI, ARIZ.—Feb. 10

Reduction of Wages in the Clifton-Morenci-Metcalf district went into effect on Feb. 10, in accordance with the following excerpts from notices posted on Feb. 8: "The present wage rates will be adopted as standard with copper selling at 26c. per lb., and the differentials on the existing wage scale will apply with copper selling above or below 26c. per lb. and down to 18c. per lb., which will be taken as a minimum for the present, whether copper sells below 18c. or not. In making the above adjustment consideration has been given to the present high cost of living, and the bonus of $1 per day to underground and 75c. per day to surface employees will be continued for the present." This changes the rate of miners from $5.01 per day to $4.41; of muckers from $4.30 per day to $3.70; and of craftsmen from $6.35 per day to $5.63.

SALT LAKE CITY, UTAH—Feb. 13

The Matter of Mine Taxation is still in the air. A meeting between various committees of the Legislature, the Governor, the State Treasurer, and representatives of the legal staff of the state has been held, and it is reported that a bill is to be placed before the Legislature fixing the rate of mine taxation at three times the net proceeds, allowance to be made for all actual and necessary expenses of production, with the exception of all Federal taxes and legal expenditures, salaries of corporate officers, and of officers and employees not resident within the state. With the passage of the law in this form, it is stated the occupation tax law would be repealed; and it is expected that the protesting companies above mentioned would then pay the million dollar assessment, dropping their present suit.

Apex Rights are once more the cause of a suit between the Utah Consolidated and Utah Apex mining companies, Utah Consolidated in the present instance being the complainant, as was the Utah Apex company in the suit instituted last October, and later compromised. The same point as in the former case is at issue, namely the right of title to fissure veins apexing, according to the complaint, in the Keepapitchinin and Rattlesnake claims in Bingham. These veins dip to the north, passing through Utah Apex ground, and the complaint alleges that they have been entered at depth by the Utah Apex, that company, it is stated, having mined ore to the value of $500,000 from each vein. The Utah Consolidated asks that title to the veins in dispute be established, and that an accounting be made for the ore alleged to have been illegally extracted.

Reductions in Wages by Mining and Smelting Companies generally are being made. The reduction by Utah Copper Co. was noted in the last issue of the *Journal*, Other mines in Bingham have followed, and it is likely that reductions will be made by Park City and Tintic mines. The three smelting companies operating in the Salt Lake Valley have made reductions. The copper plant of the A. S. & R. at Garfield reduces employees receiving more than $3.90 per day by 75c. a day and those receiving $3.90 or less by 65c. The lead smeltery of this company at Murray, Utah, reduces employees receiving more than $3.80 a day by 65c. and those receiving $3.80 or less by 55c. The scale of wages at the Garfield plant varies from $7.10 per day to $3.65, and the scale in force at Murray is somewhat lower. The lead smeltery of the United States Company at Midvale makes reductions corresponding to those made at the Murray plant of the A. S. & R. The International, operating at Tooele, with a wage scale somewhat higher than the Garfield scale, makes reductions amounting to 75c. a day for employees receiving over $4.15 daily and a 65c. reduction for employees receiving $4.15 or less. The new scale of wages at the various plants became operative February 10.

Legal Proceedings Brought by Metal-Mining Companies against payment of occupation tax, fixed at 3% of net proceeds for 1918 (in addition to regular tax on physical valuation), have been dropped and nine companies have paid the amounts assessed against them plus 12% interest from the date when the tax became due. It is understood that, after this payment, the tax will be dropped and the matter of mine taxation in general cleared up. A law will probably be passed by the state Legislature fixing mine taxation at the rate of three times the value of the net proceeds (the amendment favorably voted on last fall called for taxation at some multiple of the net proceeds, setting no limit) and on surface values. It goes without saying that it will be of distinct benefit to the mining industry to be finally in the clear as to what is expected of it in the matter of taxation. Mining companies which have already paid the occupation tax above mentioned are the Utah Copper, Silver King Coalition, Grand Central, Eagle & Blue Bell, Bingham Mines, Cardiff, Victoria Gold Chain, and Ophir Hill, representing together, about $765,000. The Utah Copper paid $680,000. It is expected that the mining industry in general will make payment without protest. Funds from these sources will, it is stated, be used for the support of the schools of the state, particularly of the district schools. Coal-mining companies have thus far taken no action as to payment, and their assessment would, if paid, amount to about $100,000.

Analysis of the Copper Situation, as particularly affecting the Utah Copper Co., is made by R. C. Gemmell, general manager. Referring to the statement by the Federal Government on Feb. 4, 1919, Mr. Gemmell calls attention to the large surplus of copper stocks on hand, produced on the maximum basis of cost and with the expectation of realizing 26c. per lb., and to the present lack of market. Keeping these conditions in view, and with the absolute necessity of curtailment of output, the entire effort of the Utah Copper management is to maintain a going concern and keep the largest possible number of men employed. Although economy would be in the direction of the cessation of stripping operations, which are always kept several years ahead of production, these are being continued with a view to offering employment. Also, the Magna mill is operating at 50% capacity, when one mill would be able to care for the output. The closing of the Magna plant would mean either no work for the entire Magna force or half time at the Arthur for the consolidated forces. This will not be done unless absolutely necessary. An interesting point is that wages at the Utah Copper, in spite of the recent reduction, are higher than they were, after being raised four times in succession, on Dec. 1, 1916, the date of the fourth increase, based then on copper at 27½c. per lb. With the price of copper fixed at 26c. per lb., voluntary increases were made by the company three times subsequently in view of the high cost of living. In making the present necessary reductions in wages, the company has again taken the cost of living into consideration.

Radical Changes in the Utah Workmen's Compensation Act are proposed. This has been operative in its present form since July, 1917, and is the first statute of its kind in the state. The danger to the mining industry from the changes proposed, before the law as now in force has had a try-out, are pointed out in a pamphlet prepared by the Utah Chapter of the American Mining Congress. A dangerous feature of the proposed amendment is the almost arbitrary power given to the commission in fixing the amounts of compensation, the commission's acts being subject to review only by the state supreme court and then in a very limited degree, and not by the district courts, which have jurisdiction under the law at present operative. The amendment also undertakes to eliminate private insurance companies, which assume responsibility in case of death, in favor of state insurance, which assumes no such responsibility. The scope of the law would be widened to include workers engaged in non-hazardous undertakings, though excluding domestic servants and farm laborers, the latter, it is pointed out, being at times certainly subject to danger. The amount of compensation would be materially raised. The present rate of compensation is 55% of the average weekly wage, not to exceed a maximum of $18 a week or a minimum of $7, and in no case to continue more than six years or to exceed $4500. It is now proposed to fix compensation at 66⅔%, with a maximum of $18 a week. There is also to be added compensation for especial injury, such as the loss of an arm at or near the shoulder, so that from the wording of the proposed amendment, which appears somewhat in doubt, and which it is pointed out a court might construe otherwise, a compensation equal to four-thirds of the actual weekly wage (or $36 for at least 200 weeks) would seem possible. The law will also be burdened with definitions as to dependents and children, the matter of minimum wage, hours for women and children and similar matters, which appear somewhat foreign to the question in hand.

BUTTE, MONT.—Feb. 17

The Philipsburg District is still producing a small quantity of manganese, and, according to one operator recently in Butte, a couple of mines will be operated up to about May 1, when contracts with steel companies expire. An effort will be made to develop some of the old silver properties.

The Butte Metal Mine Workers' Union called off its strike on the afternoon of Feb. 17 after a nine-days' struggle and the miners hastened to get their jobs back. More men presented themselves than could be taken care of. The strike was promoted by I. W. W. agitators in Butte, who were aided by reinforcements from Seattle and other points, causing much confusion in the city. It was conducted, according to the publications of the strikers, by the Soldiers', Sailors' and Workers' Council. The council, according to the secretary of the Metal Mine Workers' Union (independent), is composed of representatives from 15 labor unions, discharged soldiers and sailors, Industrial Workers of the World, the Pearse-Connolly Club (an Irish patriotic society), Socialists and others. Taking advantage of the reduction in wages to start trouble, the agitators soon enlisted in their ranks thousands of persons not in sympathy with I W W teachings. Going several thousand strong to the roads leading to the various mines, they drove the miners back from work with sticks and guns until every mine in the district closed down, as well as the smeltery of the East Butte Mining Co (shut down Feb. 10) and the Elm Orlu mill. Butte was early placed under martial law Additional soldiers were brought into the city, but no sooner had they begun to deal with the strikers with a firm hand than the mayor of Butte stepped in and begged the commanding officer to call in his patrols, assuring him that the police would afford all necessary protection The request naturally went unheeded The I W W element openly defied the authorities and distributed about the city circulars containing most seditious articles It is commonly believed by citizens that profiteering by tradesmen is in large part responsible for the high prices prevailing in Butte, and this circumstance was made much of by the agitators to stir the people up It was argued that the miners could not stand a wage reduction and support their families at the prevailing prices. With the mines down, plants dependent on them for ore followed the Anaconda concentrator closed on Feb 11, and the acid plant on Feb 12 The backbone of the strike was said to be broken on Feb. 15 when the hoisting engineers of the mines voted by a majority of two to one not to join the walkout. The streetcars resumed operations in Butte on the same day. Thomas Campbell, president of the miners' union, said that the metal-mine workers had never declared a strike, despite the fact that some members, acting individually, joined with the I. W. W.

DENVER, COLO.—Feb. 12

Manganese Producers of Colorado hold that the Government should reimburse them for losses incurred in good faith in preparing for production, or at least give them time to extract ores blocked out and available for immediate shipment, before allowing imports of crude ore or ferromanganese. The Leadville district mines have available 150,000 to 200,000 tons of manganiferous ore running from 15% to 43% manganese, and low in silica and phosphorus; some also carrying up to 50% iron. Such ores have been shipped to Eastern markets, and used in making ferromanganese carrying 35 to 45% manganese. Much of this ore may be classed as blocked out, and under normal conditions could be shipped within about a year. The producers in the district have endeavored to increase production wherever possible, and through the sudden ending of the war have incurred a loss of about $200,000. Large bodies of ore have also been developed in the Gunnison district, and much money has been expended, but the operators have not had a chance to ship a carload. It is estimated that from 75,000 to 100,000 tons of ore suitable for ferromanganese has thus been made available there. One remedy suggested is that the Government announce that no licenses be issued for importing either manganese ore or ferromanganese during the first half of 1919. Such action would not enable the domestic producers to avoid all loss, but would help them to dispose of ore supplies now on hand at their properties, and might enable manufacturers to unload their supplies of finished product. Operators who go so far as to expect Congress to impose a protective tariff, think that it should amount to at least $10 a ton on crude ore and $25 a ton on ferromanganese.

DULUTH, MINN.—Feb. 13

Capt. Alexander McDougall's Patent for Washing Iron Ores is an adaptation from an old process and the principle involved therein invalid, it is claimed by attorneys of the U. S. Steel Corporation in the answer filed by them in the $40,000,000 suit brought by Captain McDougall against the corporation in the U. S. District Court in Duluth. The Oliver Iron Mining Co., the corporation's subsidiary affected, denies that McDougall's alleged invention is the first one for separating sand from iron ores on a commercially profitable basis. The Oliver company claims that the Greenway patent that it employs is based on apparatus successfully used for the purpose long before McDougall obtained his patent

HOUGHTON, MICH.—Feb. 11

The Activities of the I. W. W. and other labor elements which are causing apprehension in the iron districts of northern Michigan will not affect the Lake Superior copper mines, it is believed by mine managers and labor authorities in the copper country, although the copper mines are operating, in general, on three-quarter time. The circulation of printed posters at Iron River, threatening the blowing up of public buildings and the homes of leading mining men and other prominent people, has resulted in that community appealing, through its legislative representative, for a guard of the state constabulary, and state authorities are making an investigation. Threatening posters of this sort have also been distributed at other iron country points, including Crystal Falls, since partial suspension of iron mining occurred at those places owing to the sudden termination of hostilities Employees of the copper companies are apparently satisfied to accept temporary curtailment of output until a demand for the metal builds up. Pay has been lessened, also the number of working hours, and at some of the smaller mines total suspension of work has resulted I W W activities in the copper district soon after the United States entered the war were checked by the miners themselves, when thousands of men were out of work for eight months, the 1913 strike still being fresh in their memories

JUALIN, ALASKA—Feb. 10

The Jualin Alaska Mines Co. will resume work at once on its property at Jualin, Alaska. This property was taken over by the Alguncian Development Co., a Belgian and French corporation with head office at 16 Rue de Turin, Brussels, Belgium. A 7800-ft. tunnel was started, intended to crosscut the vein system at a lower level and also to drain the mine water. This tunnel, which had advanced 2000 ft., was discontinued when the war broke out, and attention confined to actual production. All work was suspended in November, 1917, owing to labor shortage and extreme operating conditions. During the last operating year the mine produced nearly $200,000 in gold from a 10-stamp mill. It is now planned to complete the tunnel and at the same time to carry out an active program of development from the present workings. Until the completion of the tunnel, no ore will be milled except that coming from development work. Jean Vanophem, Brussels, Belgium, is president. Charles G. Titus, Juneau, Alaska, is general manager.

VICTORIA, B. C.—Feb. 15

The Committee Investigating Smelting Rates charged for treating custom ores at Trail has visited the management of the Consolidated Mining and Smelting Co. of Canada at the Trail smeltery, where a full discussion took place regarding the inquiry to be made and its scope. The committee is now engaged in making preparations for the securing of evidence from all who are interested. In this connection a circular has been issued and is being distributed among all shippers independent of the company It reads as follows: "This committee has begun its work. Though it has extensively advertised its wish to receive either oral evidence as to facts or opinions of shippers of ore to Trail concerning their relations to the smeltery, it feels that further opportunity should be afforded for hearing from any who have thus far failed to make their position known to the committee. For this reason a copy of this letter is being sent to all shippers to ask their wider coöperation toward making our investigation completely successful and satisfactory to all concerned Appreciating the fact that some shippers may naturally not desire to make statements in any public way, we wish to impress on you and them the fact that we are quite prepared to afford every reasonable opportunity for private hearing and discussion and that we will endeavor to make arrangements for this if necessary after hearing from you. We wish particularly to have it known that it is not only the matter of rates and charges as such that come within the purview of our work, but the collateral matter of sampling, settlement, or anything else which may, and often does, cause dissatisfaction. We shall be glad to receive any communication or complaints touching these matters, and trust that such will be sent to the secretary not later than Feb. 12 next."

Referring to Spanish Influenza and the difficulties which some mining operators have experienced because of it, an interesting account is given of the method adopted by a mining man with extensive interests around Sandon and Silverton, B. C. He has an understanding with his men that during the epidemic none of his men are to leave his employ, nor to come down from the mines for a "lay-off" On his part he undertakes to send no new men to work The particular properties that he has in charge are thus rigidly quarantined, and he, himself according to the arrangement, cannot go up to them, even on a trip of inspection. Consequently he is forced to direct operations by telephone Though this is awkward, it is thought better than to take the chance of the influenza gaining a foothold in any of the camps in question, as judging by other experiences, once established at such centers it does not leave until the lives of many are seriously jeopardized and the work completely disrupted

The Vancouver Chamber of Mines has decided to change its title to that of the "British Columbia Chamber of Mines" This step has been agreed upon in order that the influence of the organization may be extended to include the whole province. At the last election of officers, a selection was made of some representative mining men outside of Vancouver, it being felt that, if the Chamber of Mines is to make its work beneficial to the industry of British Columbia, it must be understood to be a body belonging, not to any particular locality or community, but to the whole of the province and pledged to advance, wherever possible, the interest of all or any of its districts. Progress is being made in preparing for the International Mining Convention to be held in March, the effect of which, it is hoped, will be the creating of a complete understanding between the mining men of Western Canada and of the Western States and, generally, the engendering of a spirit of healthy optimism

The Mining News

ALASKA

INFLUENZA reported at Copper Center; 42 cases on Jan. 19, with five deaths to that date.

SEWARD-ANCHORAGE BRANCH of Government railroad impassable between Mile 49 and Mile 71, owing to snow and ice. Freight and passengers carried across gap by dog and horse sleds.

ALASKA GOLD (Juneau)—In January milled 151.515 tons ore, averaging $0.787 per ton. Extraction 76.87%; tailings loss, 18.2c. per ton.

KENNECOTT (Kennecott) — January production of copper was 10,040,000 lb., including output of Braden Copper Co. December output, 14,114,000 pounds.

ARIZONA

Cochise County

DENN-ARIZONA (Bisbee)—Shaft sump being completed below 1800 level. Stations to be cut and exploration work begun on 1700 and 1800 levels.

SHATTUCK-ARIZONA (Bisbee)—January production was 622,226 lb. copper; 470,168 lb. lead; 32,204 oz. silver; and 101 oz. gold. Copper output in December was 506,332 pounds.

COMMONWEALTH DEVELOPMENT (Pearce)—Shipping 750 tons a month of siliceous ore to Douglas, for converter flux, Surface ores being mined by lessees. A. Y. Smith manager.

MIDDLEMARCH (Pearce)—Sinking for development and in hope of striking water supply for mill. E. L. Elson in charge.

Gila County

GILA COPPER SULPHIDE (Christmas) —Lease of American S. and R. Co. lapsed, and receiver again in direct charge. George Morris manager.

COLE-GOODWIN (Globe) — Formerly operated by Cole Development Co. and recently examined by Dr. G. M. Butler, dean of the College of Mines, at Tucson; being equipped for extensive development of large bodies of low-grade copper ores disclosed by investigation of Dr. Butler.

LONDON-ARIZONA (Chilito)—Reported preparing for operation, after settling financial difficulties; planning to ship ore eight miles to Hayden smeltery.

Greenlee County

ARIZONA COPPER (Clifton)—January production of copper was 4,032,000 lb.; December, 3,600,000 pounds.

Pima County

SULLIVAN (Ajo)—High-grade gold ore struck in claim near Gunsight. First claims, staked by J. J. Sullivan, now surrounded by 150 locations. Ore carries some silver.

SASCO (Silverbell)—Smeltery closed during week ended Feb. 15. Ore from Silverbell mines will be shipped to Hayden and El Paso plants of American S. and R. Company.

Santa Cruz County

HARDSHELL (Patagonia)—Grading for surface works and for sinking 350-ft. shaft.

HENRY FORD (Patagonia)—Name to be changed to "Victory" by owners.

IVANHOE (Patagonia)—Option taken by E. E. Bethel, of Washington Trading Company.

TRENCH (Patagonia)—Crosscut on 750 level nearing main ledge. Several stringers of ore found.

Yavapai County

PHILADELPHIA (Crown King)—Half of 100 ft. tunnel completed; to cut at 960-ft. depth orebody already explored 200 ft. by shaft. Property then will have 3600 ft. of tunnel development, mainly along main vein.

GADSDEN (Jerome)—Northwest crosscut on 1200 level 40 ft. into porphyritic schist speckled and seamed with native copper, chalcopyrite, and bornite. Crosscut headed to cut main fault, about 500 ft. further on.

JEROME-BISBEE (Jerome) — Formal transfer being made here of property of former Jerome-Portland company, under court order discharging receiver of old corporation.

JEROME-VERDE (Jerome)—High-grade shoot of copper glance cut in stoping about 100 ft. above 900 level of Maintop workings. Company has been shipping 600 tons a month of 8% ore to Humboldt. J. B. Harper, superintendent, will determine extent of new body, with expectation of shipping.

UNITED VERDE (Jerome)—Twelve-mile broad-gage line up hillside from portal of 1100-level tunnel will be finished early in summer; maximum grade 2¾%; rise 700 ft., and air-line distance three miles. New road will handle freight business of camp, including that coming from new steam-shovel work at crest of United Verde orebody. Shovel work will add northern extension to townsite on mine ground; two gulches to be filled in and leveled. Will run part of large slag dump below old smeltery site through Clarkdale furnaces.

UNITED VERDE EXTENSION (Jerome) —Tunnel near completion.

VERDE COMBINATION (Jerome) — Sump being finished below 1300 station. Drifts to be started both ways on contact, with occasional exploratory crosscuts.

PECK (Prescott)—This and other Bradshaw Mountain mines stopped by heavy snow; roads impassable.

Yuma County

ARIZONA DESERT M. AND M. (Bouse) —Planning to increase mill capacity from 20 to 60 tons daily by adding two ball-mill units. Ten men employed.

ARKANSAS

Independence County

BIG CAVE (Batesville)—Manganese production begun by Big Cave Manganese Co., operating near Penters Bluff. Property discovered in December, bottom of shallow shaft opening into natural cave which contained manganese veins in both walls, and nugget ore in clay in bottom. One car shipped.

POLK-SOUTHARD (Batesville)—Work begun with small force at manganese property by Independence Mining Co. Idle several weeks.

ROGERS (Cushman)—Manganese mining recently begun on Rogers tract by Stanley Hanford, operator, with two small crews.

ROUMINER-ROUGH (Cushman)—John Barksdale has small force mining manganese.

Marion County

BEARDEN (Rush)—Blytheville Mining Co., recent purchaser of Bearden land, has let contracts for drilling to prospect lower levels.

LONNIE BOY (Rush)—Zinc mine taken over by Stanley Hanford and associates, of Batesville. New owners will start operations at once.

MATTIE MAY (Rush)—New mill will be completed by April 1.

PAT BAKER (Rush)—Operated by Oklahoma Oil and Gas Co. Tunnel heading driven into old underground water course in which three runs of ore have been found. Two cars of hand-cobbed ore on dump ready for shipment. Strike made at 75-ft. depth.

SHEPHERD GROUP (Rush) — Zinc mines of J. C. Shepherd Mining Co., idle for last year, will start up soon. Largest producing group in north Arkansas field.

MONTEZUMA (Yellville)—Tract owned in fee and lease by Lucky Duke Mining Co. showing good ore. Prospect work to date entirely. Fifty discoveries of lead and zinc thus far. Tunnel now in 150 ft. displaying run of ore 40 ft. wide and 12 ft. thick.

NORTH STAR (Yellville)—New aërial tram tested and found satisfactory. Mill running and making good production of zinc carbonate.

CALIFORNIA

Amador County

MINES ON MOTHER LODE, including Kennedy, Argonaut, Central Eureka, Keystone, and Plymouth Consolidated, have increased working crews and are advancing development on largest scale since war began. Labor situation greatly improved.

Butte County

TRIUMPH (Lumpkin)—Ledge disclosed in new development in raise above old workings. M. B. Sears, manager.

DENVER (Forbestown)—H. R. Rountree reports surface buildings and other improvements will be ready for reopening mine early in spring.

Riverside County

TAHQUITZ (Riverside)—Newly incorporated by Charles DeLady, William Brandon and H. M. Anthony, of San Francisco.

San Bernardino County

GOLDEN WEST (Needles)—At annual election A. Rossiter made general manager; Charles P. Blanton, president, and Joseph Onetta, director. Property in Ibex district 26 miles northwest of Needles and west of Oatman, Arizona.

Shasta County

BOARDMAN ADDITION, comprising 720 acres, mostly within city limits of Redding, leased by Isaac Grant, of San Francisco, to J. B. Graves and L. Albach for mining purposes.

AFTERTHOUGHT (Ingot)—Death of John T. Milliken, of St. Louis, one of the owners, will not affect operation. John Tait Milliken, manager of Afterthought, no relation to deceased

Tuolumne County

TUOLUMNE SUPERIOR (Sonora)—To operate National group of mines near Priest Station. Initial payment made on purchase. Will deepen 300-ft. shaft to 500 ft. and begin drifting.

COLORADO

San Miguel County

TOMBOY (Telluride)—Considering substitution of oil flotation for cyanide treatment. Details of equipment not fully decided upon.

IDAHO

Shoshone County

OLD HICKORY (Mullan)—You Like vein cut at 500-ft. depth. Will drift 800 ft. to east end line.

INTERSTATE CALLAHAN (Wallace)—January shipments were 3,418,000 lb. zinc; 1,215,000 lb. lead; and 20,320 oz. silver. Lead-silver output for month largest in company's history.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—January production of copper by company and subsidiaries was 11,758,500 lb.; December, 11,399,036 lb. Ahmeek produced 1,928,305 lb.; Allouez, 486,708; Calumet & Hecla, 5,588,051; Centennial, 199,478; Isle Royale, 1,514,220; La Salle, 155,230; Osceola, 1,405,898; Superior, 76,610; and White Pine, 404,000 lb. Operations suspended in No. 2 shaft, Calumet; rails and other equipment removed. Shaft pillars removed from bottom and as near to surface as safety permits.

SENECA (Calumet)—Retiring directors reëlected.

ISLE ROYALE (Houghton)—January yield increased one-half pound refined copper per ton.

MICHIGAN (Rockland)—Shipping 100 to 150 tons rock daily to Baltic mill.

MISSOURI

Jefferson County

ST. JOSEPH LEAD (Herculaneum)—Smeltery at Herculaneum closed down. Concentrates being shipped to other smelteries. Result of excessive labor demands.

Joplin District

FREEHOLD OIL AND GAS (Waco)—Erection of new concentrator begun on No. 2 lease at Waco. Part of machinery used taken from Smart & Crain mill at Lawton, Kan.; rest to be purchased new. Erection of third mill on another lease planned. Development on No. 2 property promising. Senator William Flynn, of Pittsburgh, Penn., owner o. Freehold properties; W. S. Marquiss, of Webb City, Mo., manager.

MONTANA

Silver Bow County

BOSTON & MONTANA (Butte)—George Gallup and Samuel Usher, of Boston, elected directors at annual meeting.

BUTTE MAIN RANGE (Butte)—Deepening of shaft begun from 800 level to 1200-ft. depth. Will cut station and crosscut at 1000 level. Shipped 150 tons ore daily until Washoe smeltery shut down. Operated by Tuolumne company.

BUTTE & SUPERIOR (Butte)—January production was 9,450,000 lb. zinc; December, 10,600,000 lb. Ore mined in January was 33,000 tons; December, 36,500. Mill recovery in January 94%; January silver output was 178,000 oz.; December, 225,000 ounces.

DAVIS DALY (Butte)—January production 1,018,889 lb. copper from 6022 tons ore, averaging 8.4% copper. Total development for last quarter of 1918 was 3135 ft., comprising 1277 ft. of drifts, 1696 ft. of crosscuts, and 162 ft. of raises. Shipments of ore during quarter totaled 15,191 tons, averaging 7.8% copper. Production during quarter was 2,432,010 lb. copper and 100,050 oz. silver.

POTOMAC COPPER (Butte)—Recently organized company expects to start operations around May 1. To complete three-mile wagon road and install compressor plant. W. P. Jahn, of Milwaukee, president.

NEVADA

Lincoln County

PIOCHE SHIPMENTS for week ended Feb. 6 were: Prince Consolidated, 29 cars ore; Virginia-Louise, 10; Consolidated Nevada-Utah, one.

Lyon County

NEVADA DOUGLAS (Ludwig)—Assessment levied of 10c. per share, payable by Feb. 20; delinquent sale, March 20.

Nye County

KANSAS CITY-NEVADA CONSOLIDATED (Bruner)—Has completed purchase of cyanide mill from Denver Engineering Works Co., which is erecting same; mill to be in operation in four months. Will pipe water for milling and domestic use 11 miles over Ione Valley; pipe bought from Pacific Tank and Pipe Co., San Francisco. About 1½ miles of underground work done on Phonolite Paymaster property, most of it in ore, since acquisition by company. Holdings include over 25 claims patented and paid for. Statement by R. E. Bruner, secretary.

TONOPAH SHIPMENTS for week ended Feb. 1 were 7389 tons, having gross milling value of $125,613. Shippers were: Tonopah Belmont, 2357 tons; Tonopah Mining 1100; Tonopah Extension, 1911; West End, 947; Jim Butler, 282; Montana, 232, Tonopah Divide, 175; MacNamara, 210; Midway, 54; Halifax, 43; North Star, 55, and miscellaneous, 23.

MAC NAMARA (Tonopah) — Reported planning to double mill capacity. Necessary construction work under way.

TONOPAH EXTENSION (Tonopah)—West drift on 1760 level recovered Merger vein recently; drifting on vein resumed. Mill operation interrupted by broken tube mill.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—December production of copper was 1,637,997 lb., making total for 1918, 15,730,164 pounds.

OKLAHOMA

Joplin District

LA CLEDE (Picher)—Recently opened lead cave attracting attention. Large tonnage lead ore exposed in walls.

UTAH

Beaver County

HORN SILVER (Frisco)—Strike reported on 600 level Company shipping crude ore and lessees working over old mill dumps.

Juab County

TINTIC SHIPMENTS week ended Feb. 7 totaled 118 cars

CHIEF CONSOLIDATED (Eureka)—Additional pumping units ordered to help in handling flow below 1800 level

GEMINI (Eureka)—Deep mining progressing in this and adjoining Ridge & Valley under same management. Pumps handling about 200 gal. per minute, making work possible at 1800 ft. Installation of equipment considered to permit work below this depth, where large tonnage is expected. Output curtailed somewhat owing to lead market.

MAMMOTH (Mammoth) — Company work suspended pending stabilization of copper market. Some lessees working and shipping.

TINTIC MILLING (Silver City)—Car of bullion shipped week ended Feb. 7.

Piute County

PITTSBURG-UTAH (Marysvale) — Last payment due on American Flag group potash claims stated to have been made, amounting to $5000. Purchase price $25,000. Company owns large acreage, in two groups.

Salt Lake County

AMERICAN S. AND R. CO. reduced wages 65 to 75c. per day on or about Feb. 11. Similar reduction made by International and by United States smelting companies.

ALTA SHIPMENTS during winter season held back by lack of snow, making sledding difficult. Situation improving.

MICHIGAN-UTAH (Alta)—Stockholders' meeting Feb. 10. Old board re-elected.

OLD EMMA (Alta) — Receiver's reorganization plan approved; includes consolidation of Old Emma, Emma Consolidated, and Emma Copper. Capital to be ample.

SELLS (Alta)—Maintaining production.

SOUTH HECLA (Alta)—During 1918 mined and marketed on company account 13,823,722 lb. crude ore, dry weight, at net stoping profit of $69,818. Lessees produced 4,641,982 lb. crude ore, dry weight, yielding company net profit of $3855. Combined metal content of ore produced was: 163,232 oz. gold; 112,920 oz. silver; 230,985 lb. lead; 577,773 lb. copper; 137,556 lb. zinc, and 4,261,888 lb. iron.

MONTANA-BINGHAM (Bingham-Canyon)—Closed down to await settling of metal market, according to official statement.

SILVER SHIELD (Bingham Canyon)—Car of ore ready for shipment.

Summit County

PARK CITY SHIPMENTS in January totaled 10,636 tons Shippers were: Judge Mining and Smelting, 2880 tons; Ontario Silver, 2779; Silver King Coalition, 2220; Daly West, 1012; Daly Mining, 700; Naildriver, 360; Silver King Consolidated, 185, and miscellaneous, 500 tons.

GLEN-ALLEN (Park City) — Building mill. Expects to begin production in spring or early summer.

SILVER KING COALITION (Park City)—Upper workings to be worked on leasing system advantageous to stockholders. S. A. Knowles, superintendent, to succeed James Humes. W. W. Armstrong, of National Copper Bank, president.

SILVER KING CONSOLIDATED (Park City)—Third car concentrates shipped from new mill, which is still in experimental stage. Spiro tunnel advanced 250 ft in January; to develop Thaynes Canyon section and connect with California-Comstock workings.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Mill at Salt Springs to treat tungsten-copper ore from Yellowhammer group. In January treated about 400 tons ore carrying 3% tungsten and about 4% copper. Enough of this ore developed to warrant enlargement of mill, to be moved to more convenient site. Gold Hill mine shipped about 3000 tons during January

WEST MERCUR (Mercur)—Suit filed against company to collect principal and interest on money loaned in last three years, amounting to $30,603 Company resumed work 1916. Camp in general inactive for several years

Utah County

PACIFIC (American Fork)—Received during year just ended $10,842 in royalties on 60 cars shipped by Fissures Exploration from silver-lead property Mill operated by Fissures Exploration

WASHINGTON

Ferry County

NOB HILL (Republic)—Following officers elected at recent meeting John Byrne, Spokane, president; Chester Shoudy, vice-president; O. A. Broyles, secretary-treasurer; John Byrne, Chester Shoudy, Thomas A. White, H. C. Kreysler, A. V. Chamberlain, Mrs. John Byrne, and J. E. Daley, directors.

Stevens County

UNITED COPPER (Chewelah)—To increase mill capacity. Work begun on winze from 1300 to 1400 level. Mill running three shifts.

LOON LAKE BLUE BIRD (Loon Lake)—Large flow of water struck in 70-ft. crosscut on 300 level; thought to indicate proximity of vein.

LOON LAKE COPPER (Loon Lake)—W. L. Zeigler supervising construction of new mill. Union Iron Works, Spokane, supplying equipment, including crusher, rolls, two 4 x 4 Union Iron Works ball mills, and flotation machines. Completion expected within four months. Will install new 50 hp. Ottumwa steam hoist.

CANADA

British Columbia

CONSOLIDATED M. AND S. (Fort Steele)—Work completed on main tunnel at Sullivan mine; over two miles long and will accommodate two standard tracks. Cost approximates $4,000,000. Sullivan group at present employs about 400 men; expected number will be increased soon to 1000. Preparation under way for new building to treat increased output of ore.

ROSEBERRY SURPRISE (Sandon) — Mill closed. Roseberry mill will handle ore hereafter.

RAMBLER CARIBOO (Slocan)—Milling hindered by snowslide, which stopped water supply.

GRANBY CONSOLIDATED (Vancouver)—January production of copper was 3,156,486 lb.; December, 2,955,450 lb. Anyox plant contributed 2,520,106 lb.; Grand Forks plant 636,380 pounds.

Ontario

JANUARY SHIPMENTS of silver ore over Temiskaming & Northern Ontario Ry. were: Beaver, 43 tons of 2000 lb.; Buffalo, 198; Dominion Reduction, 42; Hudson Bay, 33; La Rose, 127; McKinley-Darragh, 216; O'Brien, 37; Trethewey, 32; Miller Lake O'Brien, 26; and Casey Cobalt, 78; total, 832 tons. Above was shipped to following companies: Deloro S. and R., 303; Campbell & Deyell, 17; Cobalt Reduction, 43; and American S. and R., 469 tons; total, 832 tons. Alexo shipped 335 tons nickel ore.

MILLER INDEPENDENCE (Boston Creek)—Planning installation of mill and roasting plant of 100-ton daily capacity. Large tonnage of high-grade ore is being opened up.

ADANAC (Cobalt) — Annual report states company has two separate bodies of high-grade ore from 3 to 12 in. wide. Recently 60 tons of 48-oz. ore shipped to mill.

CROWN RESERVE (Cobalt)—Another vein cut at 200 level.

NIPISSING (Cobalt)—Shaft No. 128 on east side of lake completed and exploration work started in adjacent territory.

RELIANCE (Cobalt)—Shaft down to 100 level and ore being taken out. John Shaw, lessee

DOME EXTENSION (Porcupine)—Special meeting of shareholders called for Mar. 10 to ratify agreement giving Dome Mines working option until Mar 15, 1920.

DOME LAKE (Porcupine) — Treated about 12,000 tons ore during 1918, millheads running about $9.65 per ton. Costs reported $8.27 per ton.

SOVEREIGN (Porcupine) — Extensive program of diamond drilling will be carried out.

ALEXO (Porquois Junction)—During first week in February four carloads nickel ore, or approximately 400,000 lb., shipped to smeltery at Coniston.

MEXICO

Sonora

GREENE CANANEA (La Cananea)—January production was 3,000,000 lb. copper; 106,480 oz silver, and 780 oz. gold Copper output in December, 5,100,000 pounds.

PERU

Junin

CERRO DE PASCO (La Fundicion)—January production of copper was 5,836,000 lb.; December, 6,410,000 pounds.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—January clean-up yielded $102,000.

The Market Report

SILVER AND STERLING EXCHANGE

eb.	Sterling Exchange	Silver		Feb.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
3	4 7575	101⅛	47⅞	17	4 7575	101⅛	47⅞
4	4 7580	101⅛	47⅞	18	4 7575	101⅛	47⅞
5	4 7580	101⅛	47⅞	19	4 7575	101⅛	47⅞

New York quotations are as reported by Handy Harman and are in cents per troy ounce of bar ver, 999 fine. London quotations are in pence per y ounce of sterling silver, 925 fine.

AILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
eb.	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
13	17	66¾	4.95 @5.00	4.60 @4.65	6.20 @6.25
14	16¾	66¾	5	4.60 @4.65	6.25 @6.30
15	16¾	66¾	5	4.65 @4.70	6.30 @6.35
17	16¾	66¾	5	4.65 @4.70	6.30 @6.35
18	16½ @16¾	66¾	5	4.67½ @4.72½	6.25 @6.30
19	16 @16⅜	66¾	5	4.70 @4.75	6.25

The above quotations are our appraisal of the erage of the major markets based generally on les as made and reported by producers and agencies, d represent to the best of our judgment the preiling values of the metals for the deliveries conituting the major markets, reduced to basis of New ork, cash, except where St. Louis is the normal sing point.

Quotations for copper are for ordinary forms of re bars, ingot bars and cakes. Special shapes mmand a premium and cathodes sell at a discount. Quotations for spelter are for ordinary Prime estern brands. We quote New York price at 35c. r 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
Feb.	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
13	79½	72½	100	224½	223	29	25	48
14	78	74	100	225	223½	29	25	48
15	....	....	....	....	....	....	....	....
17	75½	72½	90	212	210	28½	25	45
18	74½	69½	90	203½	200	28½	25	45
19	74	69	(a)	206½	203½	28	25	45

(a) No quotations.

The above table gives the closing quotations on ondon Metal Exchange. All prices are in pounds erling per ton of 2240 lb.

Metal Markets

NEW YORK—Feb. 19, 1919

The chief feature of this week was the xhibition of real pressure to sell copper, and s a consequence thereof a further sharp ecline in the price. The markets for lead nd zinc were stagnant and substantially nchanged.

Copper—Small sales were made from day day at steadily declining prices, although he market held up pretty well until today, spite of sharp competition in which the ig producers participated freely along ith the small ones. This morning one producer succeeded in selling a round lot at 6⅜c., after which it was offered ineffecively at 16¼c. and then at 16c., the offerngs at the latter figure being made by ore than one seller.

London cut the price for electrolytic coper to £90 on Feb. 17.

Copper Sheets—The base price of copper sheets is 24½c. per lb. Copper wire is quoted at 19½@20c. per lb. f.o.b. mill, carload lots.

Tin—The War Trade Board has decided to refuse licenses for the importation of tin ore by American smelters. This is one more step in the rake's progress, wherein it is classic that one bad step leads to another. However, the smelters are supplied with stocks of ore that will enable them to maintain production for several months to come. We understand that of the 10,000 tons of tin held by the U. S. Steel Products Co., from 5000 to 6000 tons has now been allocated.

Lead—The major part of the domestic consumption is now being filled on average-price contracts, wherefore open sales are relatively light. A fair volume of business was done this week, and during the latter part the market seemed to have a little firmer tone. The present rate of domestic production is probably about 30,000 tons per month, and domestic consumption is probably at or near the same rate. The disposition of the Mexican production, which is now estimated at about 6000 tons per month, is a problem.

Zinc—The market was very dull. After a slight rally, large offers by producers were met, causing a slight recession. Galvanizers bought a little spelter. Curtailment of production has now been begun, much belated.

High grade zinc has been sold at 7½ cents.

The liquidation of the spelter stocks in France has been put in the hands of the Vielle Montagne company.

Zinc Sheets—Unchanged at $13 per 100 pounds.

Other Metals

Aluminum—31@32c. per lb. Unchanged.

Antimony—Dull at 7@7½c. for spot.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Weak at $90. San Francisco reports, by telegraph, $90; weak.

Silver and Platinum

Silver—Silver bullion market continues quiet, with no change in the New York official price. The London fixed price has declined from 48$\frac{7}{16}$d. to 47⅞d., owing to a reduction in transatlantic freight rates, so as to be on a parity with the New York price. No shipments of bar silver were reported last week for London; only 69,000 oz. foreign coin.

Mexican dollars at New York: Feb. 13. 77½; Feb. 14, 77½; Feb. 15, 77½; Feb. 17. 77½; Feb. 18, 77½; Feb. 19, 77½.

The general stock of money in the United States on Feb. 1, 1919, totaled $7,611,628,810; of this, $3,085,459,209 was in gold coin and bullion, $373,685,930 in standard silver dollars, and $242,203,752 in subsidiary silver. The money in circulation on Feb. 1 was $5,726,261,029, or $53 58 per capita. On Feb. 1, 1918, the percapita circulation was $47.23.

Platinum—Refined ingot, $100.

Palladium—Quoted at $115.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 15—Blende, per ton, high, $48.10; basis 60% zinc, premium, $45; Class B, $42.50; Prime Western, $42@41; sludge, $40@38; calamine, 40% zinc, $25@27. Average selling prices: Blende, $41; calamine, $30; all zinc ores, $40.66.

Lead, high, $60; basis 80% lead, $56@50; average selling price, all grades of lead, $55.60 per ton.

Shipments the week: Blende, 10,153; calamine, 347; lead, 1325 tons. Value, all ores the week, $500,570.

Sellers are holding firm for higher zinc prices, several buyers failing to fill orders for amount needed this week, after advancing the price $1 to $2 per ton. Very bad weather prevails here, the district experiencing thoroughly wintry snows and blizzards. Some mines have ceased operations awaiting a higher zinc market. Shipments are in excess of production.

Platteville, Wis., Feb. 15—Blende, basis 60% zinc, $45 base for premium grade and $40 base for high-lead blende.

Lead ore, basis 80% lead, $50@55 per ton.

Shipments reported for the week are 2038 tons blende, 35 tons galena, and 73 tons sulphur ore. For the year to date the totals are 11,406 tons blende, 498 tons galena, and 73 tons sulphur ore. During the week 2392 ton blende was shipped to separating plants.

Other Ores

Chrome Ore—No inquiry.

Molybdenum Ore—Small business reported at 80@85c.

Tungsten Ore—No buyers.

Other Minerals

Pyrites—Unchanged. Ocean freights are obtainable at 22s. 6d. per ton.

Iron Trade Review

NEW YORK—Feb. 19

Business has been maintained at the rate of recent weeks. It is almost wholly, says "The Iron Age," for necessities, though the response to the public agitation for municipal improvement work has assumed some proportions. The situation is better than a month ago in that there will be 30 days less to wait for revived buying.

By the end of the week the machinery of the Government price-investigating board, which is to start with the steel trade, will be under motion. Doubts are expressed that proclamations naming what are officially regarded as fair prices will be convincing. The Government sitting in as a buyer is for the moment actually a would-be seller of all the war material and supplies no longer needed, and the investment project will wait for a paring of war wage rates as well as of war commodity prices.

Some time will likely be consumed in arriving at the new proposed stabilizing prices, and meanwhile the business world may have passed far enough along the road of convalescence from war shock to get active on its own account without Government intervention. What the trade regards as of far more importance is settlement of the railroad question and the many unpaid war contracts.

Export inquiry is in good volume, but high ocean freight charges are still a deterrent. For China 3000 tons of low-phosphorus copper-bearing pig iron has been sold. England lost a tin-plate order to the United States, which named $18.55, c.i.f. Lisbon. This, seeing that the Pittsburgh price is $7.35 per box, shows how much the buyer has to pay beyond the mill price. Seaboard prices for export are now about domestic prices.

A central selling organization has been established for French makers of rolled-steel products. It is a sign that the amount of American finished material exported to that country will be easily measured. American entry into European trade is marked in another way. A group of the steel trade is reported negotiating for the Differdingen mines and works, in Luxemburg.

The rehabilitation of the French collieries will cost, it is now estimated, $400,000,000, but part of it will necessarily be spread over ten years.

PITTSBURGH—Feb. 18

Rumors in circulation for the last two or three weeks that some steel producers are considering reducing prices in the immediate future are evidently without foundation, as nothing has transpired in that direction. Ever since the reductions of last December there has been a theory in the trade that the question of prices would, if possible, be made a matter of quarterly adjustment, in accordance with the habit followed by the War Industries Board during the period of Government control, and there was therefore expectation that, if any further reductions in steel prices were in order, the mills would be disposed to time them for April 1. Lately this view has been strengthened, for mills make no secret of the fact that, in some lines at least, further reductions are imperative if there is to be any hope of buying being stimulated, and the common view is that if there are further reductions they should be more substantial than those of last December, so that mills would feel free to make a stand upon them and insist to their customers that no additional reductions could be looked for.

Most of the Steel Corporation subsidiaries are operating at good rates. The American Sheet and Tin Plate Co. is operating at 99% of capacity in tin plate and at 80% in sheets, and is not stocking any material to speak of; the National Tube Co. is operating nearly at capacity and is building up stocks, which within two or three weeks will again be of normal proportions. The Illinois Steel Co. has a good run on rails, against old orders, but the Carnegie Steel Co. has practically no rail business. Plate mills generally are operating 50 to 60% of capacity, though bar and structural mills are hardly doing as well. The independents are not running as well as the Steel Corporation, and the industry as a whole is doing about 70% of capacity, against 85% in January, as shown by the monthly report of ignot production.

From nearly all quarters demand for steel products is very light, and present mill operations are predicated chiefly upon old orders, which will not last much longer. An exception to the general rule is the automobile industry, which is calling for fully normal tonnages of steel, and the demand for oil-country goods is practically normal. Several large orders for line pipe are definitely offered if relatively small price concessions are made, and in time the business will probably be put through. The matter is significant in that it is the first important case of regular investment buyers making a declaration as to the prices for steel at which they would be willing to act. In the matter of hotel and office buildings, bridges, and the like there are no such offers by investors.

Pig Iron—Two pig-iron meetings were held today at the William Penn Hotel, Pittsburgh, one in the morning of the Associated Manufacturers of Merchant Pig Iron and one in the afternoon of the American Pig Iron Association. No action of consequence was taken. Trade conditions were discussed. Greatly increased labor efficiency was reported, and it was learned that without any confusion, three merchant furnaces in the Valleys had discontinued paying overtime for hours worked in excess of eight. It was stated that it was practically impossible to sell pig iron in any tonnage. Prices are firmly maintained at former levels: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—There is practically no demand for ordinary soft steel in unfinished form. Quotations are reported as being firmly maintained all along the line, but there is a theory that a keen buyer with a round tonnage to place might be able to secure a concession. Regular prices remain: Billets, $43.50; sheet bars and small billets, $47; slabs, $46; rods, $57. Shell steel and discard steel continue a drug on the market, and are available at prices nearer to scrap figures than figures quoted on regular soft steel.

Ferromanganese—Not much resale ferromanganese is heard of in the market, probably because holders know they could not dispose of it. Furnaces report their asking price at $200, delivered, for 70%, but there is no interest in the figure. Imported 80% could possibly be obtained at less than $175. We quote the market nominal at $175 to $200. Spiegeleisen is quotable nominally at $57@$60, furnace, for 16%.

Coke—Less demurrage coke is pressing the market, and to that extent the market is not as weak, but it possesses no real strength. Odd lots of furnace coke can be picked up at $4.50@$4.75, depending on quality, but for a regular supply operators would hardly quote below $5. Standard brands of foundry coke are held at $6, and a few sales are being made. Prices are per net ton at ovens, Connellsville region.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	......	37.742	42.792	......
Mar.	73.861	88.082	......	36.410	43.620	......
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125		50.920	49.500	...
Oct.	87.332	101.125		44.324	49.500	....
Nov.	85.891	101.125		43.584	48.969	....
Dec.	85.960	101.125	.	43.052	48.492	....
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500		110.000		125.000	
Mar.	23.500		110.000	.	125.000	.
April	23.500	..	110.000	.	125.000	....
May	23.500	.	110.000		125.000	......
June	23.500	..	110.000	.	125.000	.....
July	25.904	.	119.913	...	134.913	......
Aug.	26.000		122.000	.	137.000	......
Sept.	26.000		122.000	.	137.000	.....
Oct.	26.000		122.000		137.000	.
Nov.	26.000		122.000	.	137.000	.
Dec.	(a)	.	118.447		133.167	......
Year	24.628	.	115.530	.....	130.507	.

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85.500	67.702	293.227	248.557
February	92.000		311.525	..
March	(a)	.	318.875	.
April	(a)	.	329.905	.
May	(a)	.	364.217	...
June	(a)	.	331.925	...
July	(a)	.	360.347	.
August	(a)		380.900	
September	(a)	......	343.905	....
October	(a)	....	335.543	....
November	(a)	......	323.550	....
December	(a)	......	267.736	....
Av. year	(a)	....	330.138	....

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973		6.899		29.00	
March	7.201		7.091		29.00	
April	6.772		6.701		29.00	
May	6.818		6.704		29.00	
June	7.611		7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.664		6.324	.	40.00	
Year	7.413		7.222		30.10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814		7.639		54.000	
March	7.461		7.286		54.000	
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.412		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25		33.95		33.95	
March	37.25		33.95		33.95	
April	36.15		32.95		33.95	
May	36.20		33.00		34.00	
June	36.36		33.16	.	34.16	
July	36.60		33.40		34.40	
August	36.60	.	33.40	.	34.40	
September	36.60		33.40		34.40	
October	36.60	.	34.40		35.40	
November	36.60	.	34.40		35.40	..
December	36.60		34.40		35.40	
Year	$36.07	..	$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Feb. 18
Alaska Gold M	4
Alaska Juneau	2
Am.Sm.&Ref.,com.	65
Am.Sm. & Ref., pf.	103
Am.Sm.Sec., pf., A.	92
Am. Zinc	11
Am. Zinc, pf.	41
Anaconda	68
Batopilas Min	1
Bethlehem Steel	61
Butte & Superior	17
Butte Cop. & Zinc	5
Cerro de Pasco	32
Chile Cop.	18
Chino	33
Colo. Fuel & Iron	36
Crucible Steel	67
Crucible Steel, pf.	92
Dome Mines	13
Federal M. & S.	9
Federal M. & S., pf.	36
Great Nor., ore ctf.	38
Greene Cananea	41
Gulf States Steel	53
Homestake	98
Inspiration Con	43
International Nickel	27
Kennecott	29
Lackawanna Steel	66
Mexican Petrol	175
Miami Copper	21
Nat'l Lead, com	67
National Lead, pf.	108
Nev. Consol	16
Ontario Min	7
Ray Con	20
Republic I &S.,com.	74
Republic I &S., pf	102
Sloss-Sheffield	50
Tennessee C. & C.	12
U. S. Steel, com	91
U. S. Steel, pf	114
Utah Copper	67
Va. Iron C. & C.	55

BOSTON CURB*	Feb. 18
Alaska Mines Corp.	‡.12
Boston Ely	95
Boston & Mont.	.43
Butte & Lon'n Dev.	.12
Calaveras	1
Chief Con	3
Contact	‡.05
Corbin	‡.25
Cortez	.13
Crown Reserve	.53
Crystal Cop	20
Eagle & Blue Bell	2
First Nat. Cop.	‡1
Houghton Copper	30
Intermountain	‡.05
Iron Blossom	.47
Iron Cap	13
Majestic	.20
Mexican Metals	.28
Mines of America	‡.06
Mojave Tungsten	.04
Nat. Zinc & Lead	.08
Nevada-Douglas	.12
New Baltic	‡.75
Oneco	20
Pacific Mines	‡.35
Rex Cons	06
Yukon Gold	75

SAN FRAN.*	Feb. 4
Alta	.02
Andes	.03
Best & Belcher	.02
Caledonia	.03
Challenge Con	‡.03
Confidence	.04
Con Virginia	‡.05
Gould & Curry	.02
Hale & Norcross	.11
Jacket-Cr. Pt	.03
Mexican	.08
Occidental	.40
Ophir	.09
Overman	.01
Savage	.07
Sierra Nevada	.03
Union Con	.08
Utah Con	‡.01
Belmont	3.50
Jim Butler	.39
MacNamara	.25
Midway	.27
Mont.-Tonopah	.15
North Star	.08
Rescue Eula	.09
West End Con	1.20
Atlanta	.04
Booth	.13
Comb. Frac	‡.02
Florence	.12
Jumbo Extension	.12
Kewanas	.04
Nevada Hills	.03
Nevada Packard	.25
Round Mountain	.32
Silver Pick	.04
White Caps	.16

COLO. SPRINGS*	Feb. 4
Cresson Con	4.87
Doctor Jack Pot	.04
Elkton Con	.04
El Paso	.14
Gold Sovereign	‡.02
Golden Cycle	.74
Granite	.11
Isabella	.06
Mary McKinney	.07
Portland	1.00
United Gold M	.14
Vindicator	.44

BOSTON EXCH.†	Feb. 18
Adventure	‡.60
Ahmeek	‡70
Algomah	.30
Allouez	‡43
Ariz. Com.	‡11
Arnold	‡.20
Bingham Mines	8
Bonanza	‡.10
Butte-Balaklava	.22
Calumet & Ariz	60
Calumet & Hecla	426
Centennial	‡13
Copper Range	41
Daly West	3
Davis-Daly	5
East Butte	‡9
Franklin	3
Granby	‡79
Hancock	‡4
Hedley	‡12
Helvetia	‡.20
Indiana	.75
Isle Royale	25
Keweenaw	‡1
Lake	3
La Salle	‡2
Mason Valley	2
Mass	4
Mayflower	3
Michigan	‡2
Mohawk	50
New Arcadian	‡1
New Cornelia	15
New Idria	‡8
North Butte	10
North Lake	‡.40
Ojibway	‡1
Old Dominion	31
Osceola	‡52
Quincy	‡57
St. Mary's M. L.	‡43
Santa Fe	‡.25
Seneca	14
Shannon	2
Shattuck-Ariz	‡14
So. Lake	1
So. Utah	‡.14
Superior	‡4
Superior & Bost.	2
Trinity	2
Tuolumne	.85
U. S. Smelting	45
U. S. Smelting, pf.	46
Utah Apex	‡2
Utah Con	7
Utah Metal	1
Victoria	‡2
Winona	‡.90
Wolverine	17

N. Y. CURB†	Feb. 18
Big Ledge	.75
Butte & N. Y.	.50
Butte Detroit	‡.01
Caledonia	.29
Calumet & Jerome	
Can. Cop. Corpn.	2
Carlisle	‡2
Cashboy	06
Con. Ariz. Sm	1
Con. Coppermines	5
Goldfield Con	20
Goldfield Merger	‡.05
Greenmonster	‡
Hecla Min	4
Howe Sound	‡3
Jerome Verde	‡.50
Louisiana	‡
Magma	25
Marsh	‡.03
McKinley-Dar-Sa.	.45
Milford	‡.75
Mother Lode	.29
Nixon Nevada	.36
Ohio Cop.	50
Rawley	‡2
Ray Hercules	2
Richmond	‡.56
Rochester Mines	32
St. Joseph Lead	11
Standard S. L.	
Stewart	16
Success	5
Tonopah	3
Tonopah Ex.	2
Tribullion	‡
Troy Arizona	‡.10
United Eastern	4
United Verde Ext.	30
United Zinc	‡1
Utica Mines	‡.08

TORONTO*	Feb. 18
Adanac	.22
Bailey	.03
Beaver Con	.40
Chambers Ferland	‡.09
Coniagas	2.00
Hargraves	.03
Kerr Lake	15.37
La Rose	.31
Lake Shore	.90
Min. Corp. of Can	2.00
Nipissing	18.75
Peterson Lake	.09
Temiskaming	.34
Wettlaufer-Lor.	.04
Davidson	.55
Dome Exten	.27
Dome Lake	.20
Hollinger	6.12
McIntyre	1.62
Newray	.12
Porcu. Crown	1.28
Teck-Hughes	.27
Vipond	.19
West Dome	.15

* Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

March 1, 1919

Volume 107 Number 9

A SCENE ON THE CHILEAN NITRATE PAMPA—A POTENTIAL SOURCE OF SALTPETER AND AN ACTUAL SOURCE OF A PRODUCT WHICH IS LARGELY USED IN ITS MANUFACTURE

Production and Uses of Saltpeter

BY HOYT S. GALE*

A comprehensive study of the history, uses, and sources of potash saltpeter, and notes as to its availability for more extensive application as a fertilizer. Reference is made to the important method recently adopted in Chile for isolating a comparatively high-grade potassium nitrate from the mother liquor which circulates in the Chilean nitrate plants. Data are given indicating the prevailing methods of pricing nitrate products on the basis of the units of nitrogen content.

SALTPETER, otherwise known as nitrate of potassium, was first recognized because of its difference from common salt and its usefulness for various purposes. Its value as a fertilizer seems to have been known for a considerable time, and as the principal ingredient of gunpowder its importance in warfare dates from about the sixteenth century. Only in late years—since the American Civil War—has black powder made from saltpeter been superseded largely by modern explosives in the composition of which the potassium salt does not enter. The supply of nitrates has been discussed as one of vital importance to the nations engaged in the Great War, and it is not strange that attention should be directed to saltpeter because of its former use as the nitrate salt in the making of gunpowder.

Interesting data on the subject of saltpeter are to be found among old publications. One volume published in London in 1670, dedicated to "The Right Honorable Sir Thomas Chicheley, Knight, Master General of His Majesties Ordnance," purports to be a complete review of what was then known of the nature and uses of saltpeter, or niter, as it was then termed. According to this account: "The place famous for nitre among the Ancients was chiefly Egypt, where were the Nitrariæ or nitre-works. But now East-India . . . are the chief places, in many parts of which countries it is artificially extracted and transported to us."

---

*3802 Jocelyn St., N. W., Washington, D. C.

Saltpeter is produced in earth when animal and vegetable matters containing nitrogen decay in the presence of lime or wood ashes or some substance that renders the soils alkaline, and especially in warm, moist climates. Earths rich in saltpeter have been worked in many countries, and various accounts are found of the production from this source in Egypt, India, Turkey, Burma, Tibet, Turkistan, Sumatra, Italy, Ceylon, Hungary, Poland, Spain, Brazil, on the seacoast of Peru, and in various parts of Central America and Mexico. In countries of more temperate climate, saltpeter has been produced in times of emergency from the earths of caves, cellars, and other protected places where it naturally accumulates. It is well known that supplies of saltpeter obtained in this way were used in the Revolutionary War, the War of 1812, and the Civil War in the United States.

Nitrate of potassium is now obtained for use in the United States from two principal sources. The chief of these consists of a process of manufacture in which nitrate of sodium from Chile is combined with chloride of potassium which was formerly obtained from Germany as the "muriate of potash," the interaction of these two substances resulting in nitrate of potassium, which is purified and recovered by crystallization. According to the available statistics for 1905, nitrate of potassium to the amount of 7234 short tons was manufactured during that year from Chilean nitrate and German muriate. A later report indicates that the production from these sources was over 14,000 tons in 1913, an increase which was probably due, in considerable part, to contracts for blasting powder for use in the Panama Canal zone, specifications for which required the use of black "potash" powder, made from nitrate of potassium.

SALTPETER FROM INDIA USED IN THE UNITED STATES

The other principal source of saltpeter in the United States is the crude nitrate of potassium known as Indian, Bengal, or Calcutta saltpeter, which has long been a regular article of import to the United States, as well as to many countries of the Old World. This is obtained chiefly from the great alluvial plain of the Ganges in India and the upper part of the Indus River. It is a product derived from leachings of the soil, and is made in native workings commonly referred to in English publications as "saltpeter plantations." This material comes to the United States direct from India or by way of England. Records of imports of saltpeter from all sources, but chiefly direct from India or transshipped from India by way of England to the United States, are as follows:

IMPORTS OF SALTPETER IN THE UNITED STATES, 1911-1918
(In Short Tons)

Calendar Year	Crude (Short Tons)	Refined (Short Tons)
1911	3,972	369
1912	3,256	142
1913	4,826	203
1914	1,115	135
1915	3	
1916	5,769	2
1917	4,606	368
(a) 1918	1,825	2

(a) For six months, January-June, 1918

The ordinary grade of the saltpeter received in the United States from India is nitrate of potassium about 90% pure, the remaining 10% consisting of chlorides and sulphates of sodium and potassium, with moisture and some insoluble matter. It usually comes to this country in coarse granular form, and to make it suitable for most purposes it is put through a refining process that eliminates the chlorides, sulphates, and other impurities. Before the war the market quotation for this crude saltpeter ranged from 3½ to 4c. per lb. in carload lots, or from $65 to $80 a short ton. In 1915, the import of saltpeter from India was cut off, but later, by arrangement, imports for use in munitions were resumed, although the wholesale cost of the product later increased to about 11c. a pound.

CHILE A POTENTIAL SOURCE OF POTASH SALTPETER

The most noteworthy announcement during 1918 in connection with saltpeter was made by one of the officials of the Du Pont Powder Co., who reported the recovery in quantity of nitrate of potassium as a byproduct from the company's oficinas in Chile. Practically all the Chilean nitrate exported contains an appreciable percentage of nitrate of potassium; and in some parts of the pampa the caliche is richer in potassium than in others. The nitrate ordinarily made at the Du Pont company's oficina Delaware is said to average about 5% nitrate of potassium. This refers to the product made by the usual process, in which a concentrated solution derived from boiling the raw caliche is cooled, and the usual crop of nitrate crystals is obtained from it. Ordinarily the cool mother liquor is returned to the tanks to be reheated, this being the solution in which more raw caliche is boiled, and the crystallizing process repeated. However, the Du Pont company found that, by evaporation of the mother liquor that comes from the crystallizing pans, and by cooling a second time, another crop of nitrate is obtained that is much richer in potassium nitrate than the first. This is said to average about 25% nitrate of potassium. It is reported that, from October, 1914, to October, 1917, about 20,000 tons of high potash nitrate had been produced, of which one-fourth was the potassium salt. Information concerning the innovation has been generously shared with other companies, so that the Chilean fields may become an important source of potash saltpeter, if there continues to be a demand sufficient to encourage its production.

The import records show 1750 short tons of nitrate of potassium received from Chile in 1917, doubtless referring to shipment of the mixed salts in which nitrate of sodium predominated. In 1918, the import of the so-called potassium salt from Chile was prohibited by one of the war boards, as it was considered that the need for the ordinary Chilean nitrate for munition use outweighed the possible agricultural value of the potash-enriched salt, but it is possible that much of the potash salt came under the ordinary designation of nitrate of soda. This action implied that the military need for additional nitrate of potassium was not great.

About 115 tons of crude nitrate of potassium, similar in grade to the saltpeter that comes from India, was brought from Mexico to the United States in 1917. In 1918, shipments totaling 62 tons and possibly more came from the same source. Production by means of the same methods as are employed in India has been carried on for many years in various parts of Mexico, and consideration has been given to the possibility of stimulating the output to supply requirements for the material in this country.

About 33 short tons of nitrate of potassium was received during 1917 from Japan. Information as to the source of this supply is not at hand. Recently, the principal demand has been for the manufacture of explosives, that is, for making the relatively small amount of black powder that is still used in modern warfare. Some black powder is made with nitrate of sodium, but that made with the potassium salt is considered more reliable, and, consequently, is preferred where dependence must be placed on uniformly good quality. Lately the principal uses of black powder have been as a loading charge in shrapnel, where, because of the fact that the bursting force of black powder is slower than that of the high explosives, it is better suited to scattering the fragments. Black powder is also used as a primer or igniting charge with other less easily ignited explosives. It forms a constituent of military fireworks, including signal lights, rockets, and colored lights.

Saltpeter was formerly used in considerable quantities by meat packers; and it is understood that the crude material received from India was satisfactory for this purpose. Its function in the packing industry consisted in preserving and intensifying the red color of salted meats, such as corned beef, dried beef, pork, bacon, hams, and sausage. Nitrate of sodium serves as well as the potassium salt; in fact, weight for weight, it is more effective than nitrate of potassium. Formerly the use of nitrate of sodium in this way was discouraged by the meat inspection authorities, because of small amounts of certain impurities generally found in the nitrate of sodium from Chile, which have been considered objectionable for use with meat. Now, however, because of the scarcity and high price of potash salts, a specially refined grade of nitrate of sodium has been produced by a number of manufacturers, which has found ready acceptance by the meat packers as well as by the inspectors. It is stated on good authority that it is doubtful if there will be a resumption of the use of nitrate of potassium by the packers unless the potassium salt should become so much cheaper that it would compete with the specially refined grade of nitrate of sodium now used for the purpose.

COMPARATIVE VALUE OF CHILEAN AND POTASH SALTPETER AS FERTILIZERS

Under normal conditions a large amount of the nitrate of sodium from Chile is used as fertilizer, and, where properly used, the benefit derived therefrom in increased crop yields is well recognized. Chilean nitrate is rated for fertilizer use on a basis of its nitrogen content, this element being one of the fertilizer constituents essential to plant growth. The nitrate is considered the most directly available or assimilable form of nitrogen for plants. However, saltpeter, or the nitrate of potassium, contains not only the desirable nitrate fertilizer constituent, but potassium, another of the important fertilizer elements. The potassium of saltpeter, of course, is also in readily water-soluble form, and this salt is therefore apparently a most effective fertilizing agent to afford a supply of both of those important constituents.

Saltpeter and saltpeter-bearing earths have long been used as manure by cultivators in India and Egypt where there is an available local supply. Records from experimental stations in India show remarkable increases of yield from the use of saltpeter for manure for various crops, including tobacco, millets, garden truck, wheat, potatoes, jute, rice, and sugar cane. Extensive use of saltpeter as fertilizer is supposed to have been prevented by the relatively higher price of nitrogen in the form of this salt, and because both nitrogen and potash can ordinarily be obtained cheaper in the form of other compounds.

THE PRICING AND VALUATION OF NITRATE SALTS

Chilean nitrate of soda, when used as fertilizer, is priced on a basis of its nitrogen content. The ordinary commercial grade, which is about 95% pure, is usually designated in fertilizer terminology as carrying about 15.6 units of available nitrogen. Before the war this salt retailed for about $40 a short ton, so that the nitrogen it contained may be assumed to have had a normal fertilizer value of about $2.50 a unit. These factors may be used to determine the corresponding fertilizer price of the nitrogen in nitrate of potassium.

Pure nitrate of potassium contains 13.85% of the element nitrogen, and saltpeter containing 90% of nitrate of potassium may be said to carry 12.5 units of nitrogen. At $2.50 a unit, this nitrogen may be considered to have a fertilizer price equivalent to $31.25 a short ton, or about 1½c. per lb. The fertilizer price of potash is usually estimated in a similar way, the retail sale of potash salts before the war showing a normal price of about 75c. a unit for potash (K_2O). Nitrate of potassium, 90% pure, is equivalent to about 42 units of potash, which, at 75c. a unit, would be worth $31.50 a short ton. This is about 1½c., per lb. for the potash at pre-war prices, although potash would undoubtedly bring much more than this now. Thus, stated in terms ordinarily used in the fertilizer industry, saltpeter 90% pure should be worth at least 3c. per lb. for fertilizer. As nitrate of potassium usually is not obtainable at this price, it has not been extensively used for fertilizer in the United States.

The refined nitrate of potassium known as "technical" is quoted in current price lists of chemicals at much higher prices than those mentioned. During the 10 years 1903-1913, prices for refined nitrate of potassium, 99% pure or better, ranged from 4½ to 5½c. per lb., although price lists for general chemicals issued recently have quoted potassium nitrate at 30c. or more a pound.

SUMMARY

In summary, therefore, it may be stated that saltpeter—meaning nitrate of potassium—is not now so important a commodity in warfare as it formerly was, for although it still forms an essential ingredient of black potash powder, the use of this as a propellant or bursting charge in ammunition has been largely displaced by other forms of explosives that do not require nitrate of potassium in their manufacture.

The saltpeter referred to should not be confused with the nitrate of sodium that comes from Chile, which is still a very essential constituent in the manufacture of nitric acid, and thus of explosives. The market for nitrate of potassium is small as compared with that for nitrate of sodium; and, although the prices quoted for the potassium salt are higher than those of the corresponding sodium salt, there may be difficulty in disposing of very much larger quantities of nitrate of potassium than are now used, even though the price be somewhat reduced.

Potassium nitrate is undoubtedly an efficient fertilizing agent, both on account of the potash and the nitrate it contains. If saltpeter could be obtained regularly at a price that would compete with established fertilizer prices, it is entirely probable that a much greater amount would be used than has ever yet been consumed in this country.

The Alunite Problem

By W. F. Downs*

The recovery of potash and alumina from alunite is, apparently, feasible, if merely the recorded composition of the mineral is considered. The alumina present in excess of that needed to satisfy the sulphur oxide radical present should yield readily to the solvent action of mineral acid, to form aluminum salts of the acid employed; and, by lixiviation, the potash and aluminum salts of the acid used, together with the released sulphates originally present, should be freed from acid-insoluble impurities. This would give an aqueous solution of potash and aluminum salts; and the problems of their preparation for market are well known.

Alunite of the composition 11.4% K_2O, 37% Al_2O_3, 38.6% SO_3, and 13% H_2O (Dana) is not found in quantity. It carries silica in varying quantities up to 50%, and iron oxides, phosphoric acid, lime, and magnesia are frequently present in appreciable amounts; also, the potash is often partly replaced by soda, as in feldspars. The presence of impurities adds to the complexity of the problem, and, so far as is known, none of the attempts to treat alunite by the solvent action of acids has recorded a success.

The geological reports of the U. S. Government and of several Western states record occurrences of alunite, and many private mining reports describe particular deposits. Nearly all these reports show wonderful potential values of the potash and alumina contents, but none of them indicate how to recover these materials. They are right as to the value of the contents of the deposits, but until a practicable method of recovery is available to the owners, the reports might as well compare the value with that of gold in sea water. Alunite deposits are known to be extensive, and the value of the component parts is so great that it is natural that their recovery should invite much research investigation.

Active work on the problem was begun before the war; and the prices then obtaining for both potash and alumina were sufficient to make investigation appear worth while. The conditions produced by the war greatly enhanced the value of both substances, and added still further to the attractiveness of the project. In view of the difficulty of securing an abundant supply of high-grade alumina for the manufacture of aluminum, the use of which is expanding so enormously, this question becomes of considerable economic importance.

Many years ago, in the north of Italy, alunite, or alunitized rock, was roasted for the purpose of obtaining "Roman alum," or some uncertain form of mixed sulphates. This practice indicated an important fact, which helps in the solution of the alunite problem: the action of heat breaks the bond of insolubility of this alunite, and permits, by leaching, the recovery of most of the sulphates which have not been lost by volatilization during the heating operation.

One large operation has been commercially successful in its treatment of alunite by using patented processes which have recovered solely the potash. The alumina residues of these operations are still potential in value, as well as refractory to treatment. Some operators have tried to use the calcined alunite to carry potash into fertilizers by mixing with acid phosphate. This is fraught with danger, on account of the subsequent reaction.

All of the various methods which have been proposed have received patent protection, and some of them are now being or are about to be exploited. None of these new processes, as yet, has a record of production, but enough has been done under one of them to warrant the modification of the initial statement of this article into: "The recovery of potash and alumina from alunite is easy and feasible." The technology, rationality, and operation of this method have been approved by experts of the highest character; and underlying the operation are certain fundamental features which will help to solve other problems.

Alunite carries, if pure, 87% of valuable components, viz.: 38.6% SO_3, 37% Al_2O_3, 11.4% K_2O. To obtain all these would be ideal. In practice one can profitably use grades which carry from 70% to 75% of these materials and recover most of two of their ingredients. The SO_3 is not sufficient to satisfy all the bases present, but is more than enough for the alkalis. The excess of SO_3 present over alkali needs is easily evolved at low temperature. Its evolution would make the operation troublesome, on account of the great difficulty of maintaining satisfactory heat conditions throughout large quantities of such substances. This SO_3 can be changed from its alliance with Al_2SO_3 at low temperature, by mixing with the alunite some base which has a controlling affinity for SO_3. When the resultant salts are thus formed, the alumina and silicates and silica in the mass can be separated from all soluble sulphates by lixiviation, and the potash recovered from the solution. The alumina can then be separated by any one of several methods.

The special features are, recovery of nearly all of the potash, recovery of 90% or more of the alumina, and the high grade of the alumina produced. The last named is recovered as hydrate, and a standard of 99.5% in maintained.

Chats, or Tailings From the Zinc Mines in Missouri and Kansas, and chert, slag and waste from iron mines, are now used for road metal, railroad ballast, concrete, roofing gravel, and for other purposes for which ordinary crushed stone was usually considered preferable. According to H. A. Buehler, State Geologist of Missouri, the quantity of chats shipped from the zinc mines in 1917 amounted to 1,426,716 short tons, a decrease of 1,464,254 short tons (50%). The quantity sold for railroad ballast (1,010,620 short tons) decreased 55%, and that sold for other purposes (416,096 short tons) 33 per cent.

---

*Mining engineer, 26 Cortlandt St., New York.

Sanitary Engineering in a Tropic Mining Camp*

BY HARRY N. JENKS†

MOSQUITO control and camp sanitation are effectively preserving the health of Europeans and natives in the jungles of India. Intensive clearing and drainage—utilizing cheap labor rather than oiling, on account of the expense of the latter—are the principal methods used by the Burma Mines, Ltd., at the frontier town of Namtu, in the Northern Shan States, Burma. Sanitation problems also include water supply, sewage and refuse disposal (conservancy) and general sanitation. The camp is on the Namtu River, 550 miles from Rangoon, in a region of irregular topography varying from 1755 to 2100 ft. above sea level. Until 1911, when the smeltery was moved from Mandalay to Namtu, nothing was done in the way of sanitation beyond the barest necessities. However, with the establishment of the smelting works and refinery, together with the accessory plant and shops, this village was made the center of the company's activities, and the attendant rapid growth of the camp made it necessary to provide a satisfactory water supply and adopt a system of conservancy. A few house and street sweepers were employed to care for the bungalows and compounds, and a small force was engaged in removing and burying in trenches the night soil from the camp. By this time, also, the jungle had been cleared of the larger trees, for use as timber and firewood, thus affording relief from the previous almost nightly maraudings of tigers and cheetahs, diminishing greatly the danger from snakes, and making it more convenient to get from one part of the camp to another.

By 1913 Namtu had grown to be the most important mining camp in the country. Native labor from distant provinces and from China began to appear in great numbers; and, next to Rangoon and Mandalay, Namtu contained the largest group of European residents in Burma. Realizing the importance of greater sanitary vigilance, in view of the increasing population, the company established a sanitary department to work in coöperation with the medical department, in guarding the health of the community.

The personnel of the medical and sanitary staff consists of one European sanitary engineer, two Indian sanitary inspectors, six compounders and dressers, two overseers, one sanitary sweeper, 30 hospital sweepers, eight conservancy sweepers and 20 coolies on jungle cutting and drainage.

AN OLD MINING CAMP IN INDIA

Sanitary conditions in this mining camp may be taken as typical of the rural or jungle districts. In general the fight in the Indian municipality is mainly against plague, cholera, and smallpox, and in the jungle one is face to face with malaria. Plague and cholera are more to be dreaded than malaria, but it is questionable whether there is any other single disease in the tropics that causes a greater sum total of misery and human waste than malaria and malarial cachexia. Malaria is to the resident in the tropics what colds and grippe are to those in America, especially in the New England states. In spite of the drainage afforded by the steep slopes of the hillsides of this region, the inevitable small collections of water in paddy fields and along the banks of the more sluggish streams have always furnished breed-

---

*Abstracted from *Eng. News-Rec.*, Jan. 23, 1919, p. 172.

†Sanitary engineer, Burma Mines, Ltd., Namtu, Burma.

ing places for mosquitoes. Malaria may abound in the hills, because the rank growth of jungle impedes the surface run-off, and thus allows mosquitoes to breed in every available hollow, as well as in the accumulations of water found in the stalks and among the leaves of the undergrowth. Many coolies coming from the jungle stations along the railway act as malaria carriers, so that in interpreting malaria statistics a careful distinction must be made between local and imported cases.

Freedom From Typhoid Insured by Protected Water Supply

Water for the European side of the camp is derived from springs in a swampy area. It is collected in open ditches leading to an earth-lined reservoir 30 ft. square, in which it is impounded to a depth of 8 ft. by a concrete dam. The water is carried down the hillside in a 4-in. pipe, passing through two pressure-break reservoirs on the way, and is then distributed throughout the camp by pipes of various sizes. The source of supply is protected naturally by its remoteness from human habitations and by its position near the top of the slope. In this connection it should be noted that typhoid fever is practically unknown in this region.

For conservancy purposes the latrine-trenching method of the disposal of excreta has been adopted. Sanitary practice in India has, in general, favored the latrine in its various modifications as a solution of this problem. In justice to a system which in America has been practically abandoned in favor of the water-carriage system, it must be admitted that here in India it serves its purpose surprisingly well. The people are disposed to use the latrines, and a plentiful supply of labor is at hand to attend to them. In Namtu the wet-pail system is used, the night-soil being removed twice daily by bullock carts to the trenching grounds a mile away from camp, and there buried.

THE NAMTU RAILWAY STATION

On the smeltery side, owing to the absence of cart roads, the pails must be carried to the trenches near at hand, though far enough away to avoid local nuisance. To obviate further expense in this respect, sanitary privies are now being built instead of pail latrines. In the bungalows themselves, the use of commodes, which are emptied and cleaned twice a day by the house sweeper, is found to be entirely satisfactory.

Of many limitations to the applicability of the latrine-trenching system to the problem of conservancy, one of the most obvious is that it does not provide for the disposal of waste water from house baths and kitchen sinks. In Namtu this waste water is discharged onto the ground and flows away from the house through small ditches running down the hillside. This involves expense and trouble in keeping the water from collecting in small depressions under the houses and thereby allowing mosquitoes abundant opportunity to breed on the premises. To overcome at one stroke the disadvantages of the existing method, the sanitary department has prepared a design for a comprehensive water-carriage sewerage system to serve 60 bungalows on the European side of the camp, with a new European hospital now being completed.

TYPICAL VIEW OF DISTRICT

The sanitary department maintains a squad of street sweepers in the neighboring village of Pang Hai to coöperate with the local authorities in keeping the town clean. This is an important consideration, in view of the fact that about a third of the 3000 coolies employed by the company live in Pang Hai and Ih Aung villages.

Prevalence of malaria throughout the region is the greatest detriment to health in Namtu. The extent to which it contributes to sickness among the company's workmen and staff is shown in the accompanying table.

ANALYSIS OF MALARIA INCIDENCE, BASED UPON NAMTU HOSPITAL RECORDS

	1915		1916	
Number of Cases	Europeans and Anglo-Indians	Asiatics	Europeans and Anglo-Indians	Asiatics
Malaria	238	4,589	145	5,533
All causes	706	12,243	828	13,236
Ratio malaria to all causes	0.34	0.38	0.18	0.42

In 1916 the total number of cases among the Europeans and Anglo-Indians decreased by 39%, as compared with 1915. It was in 1916 that jungle clearing and drainage work was maintained with a thoroughness not attempted theretofore. The returns for the first ten months of 1917 indicated that the total number of malarial cases for that year would be about 50% that of 1915. The increase in the number of Asiatic cases noted in the table is only apparent, and is due to the greater number of imported cases and patients who avail themselves of treatment at the company's hospital.

In the jungle itself the bamboo is regarded as the plant most responsible for the breeding of mosquito larvæ. Especially in this the case when the bamboos are cut, thus leaving a cup in each shoot, in which the larvæ thrive. After the bamboos and larger jungle growth have been removed, the weeds and grass that spring up favor the development of larvæ by arresting the surface run-off of rain water. It seems probable that in Namtu the incubation period of the mosquito egg may, under favorable conditions, be as short as one day. That no small collection of water shall remain for more than a day after a rain, the grass on the hillsides throughout the camp is kept as low as possible, so that the surface drainage and evaporation may be materially hastened.

JUNGLE CLEARING AN IMPORTANT FACTOR

Prior to 1917 jungle cutting was done by a gang of about 12 coolies by day labor. This was found to be unsatisfactory as regards both expense and quantity of work done, so that during 1917 the work was let out on contract, with a great improvement in rapidity and thoroughness. The tool with which the cutting is done is known in Burma as the dah, and is similar to the Cuban machete. The dahs vary in weight and form according to the character of the brush to be cut. For the grass-cutting work we use the Kachin pattern, which is long and light. The ground is too uneven for the use of scythes, but short sickles are employed to advantage on the tough wire grass that grows near the streams.

COOLIES USED IN CLEARING JUNGLE

The usual method of oiling mosquito-breeding collections of water finds little application in Namtu. Aside from the almost prohibitive expense, there are no ponds of importance that do not receive a thorough flushing with every tropical rainstorm, so that in any case the oil would be promptly washed away.

Open ditches drain the few low-lying places, but these require constant cleaning to keep them free from a rank growth of weeds. It is intended eventually to underdrain the swampy areas by the use of open-jointed tile. The drawback to this is the expense, as in Burma all drain tile and sewer pipe are made on the potter's wheel.

Quinine prophylaxsis is not generally practiced here. It seems to be the opinion among the company's staff that the possible injurious physiological effects of the drug when taken in the doses required to secure more or less complete immunity are more to be feared than the chances of getting malaria. The recommended dosage is five grains every other day during the monsoon season, or from the end of May to November. It is given in the sulphate form, in solution acidulated with citric acid. At the hospital quinine is dispensed in pill form to the natives.

POETS AND ENGINEERS HAVE DIFFERENT VIEWS ON INDIA

Those persons in America whose acquaintance with India has been gleaned from the fiction of poets and writers who have sung the praises of India's mysteious charms, from the lovely vale of Kashmir to the golden Irawadi shore, will, if they chance to come to this country, feel under the necessity of applying a large correction factor to the sum total. The sanitarian is confronted with the problem of making what he *can* do measure up reasonably well to what he sees on every hand *ought* to be done. As sanitary and public health work is essentially a personal problem, the habits and customs of the people whom such work is to benefit are the chief factors with which the worker has to concern himself.

It is axiomatic in the East that the native "workman" never does as much as he is paid to do. He is generally a living example of that otherwise highly useful theory in structural design known as "least work." To get more work out of him requires as much, if not more, energy from the outside in the form of active supervision than is obtained from him in return. Climate undoubtedly has been the most potent factor in arresting the development of the capacity for work on the part of the indigenous population. Namtu is more fortunate than many other places in India in possessing a climate that is about midway between temperate and tropical, although during the summer months the combination of 80° temperature, 80% relative humidity and 60 in. of rainfall approaches sufficiently close to tropical conditions.

INFLUENCE OF THE CASTE SYSTEM

Perhaps the most important of all the influences that govern the character and effect of the work done among the natives of India is the influence of habit. Habit is practically the sole arbiter in the lives of the entire population, in all that they do and will not do; and this ingrained force of habit attains its most far-reaching development in the caste system. This fact furnishes many novel problems to the sanitarian. The effect of the sanitarian's work upon the people of India is at one and the same time his chief reason for enthusiasm and despair. Considering the almost limitless field for his efforts and the beneficial results that appear when unsanitary conditions are relieved ever so slightly, he is bound to be enthusiastic. On the other hand, it appears at times an almost hopeless undertaking to attempt to make any real progress, in view of the magnitude and the difficulties of the task which confronts him.

The Production of Gold in Rhodesia, South Africa, in December, 1918, was 46,014 fine ounces, valued at £192,870. Output in November was 34,714 fine ounces, valued at £145,458.

Lubrication of Air Compressors

By H. V. CONRAD*

SATISFACTORY lubrication of air-compressor cylinders is attained by securing the reduction of friction to a minimum and the elimination of carbonization of the oil as far as possible. For the proper reduction of friction, the oil chosen should have sufficient body to sustain the weight of the moving parts and so form a seal between the piston rings and the cylinder walls, and still not absorb excessive power in the overcoming of the viscosity of the oil itself.

The objections to air-cylinder oils which allow more than the slight amount of carbonization which appears unavoidable are, of course, well known, but may be briefly stated for the purpose of clarifying what follows:

1. Carbonization of the oil allows the accumulation of deposits of carbon which are sticky in the early stages of their formation, but hard and flinty later. Such deposits accumulate on the cylinder valves, in the cylinder passages, in the pipes and eventually in the air receiver.

2. Sticking or incomplete closing of the valves, and their consequent failure to act properly, is probably the chief objection to this action from the standpoint of the efficient operation of the compressor.

The formation of excessive carbon deposits is likely to be due to any one or more of the following causes:

1. The ill-advised use of an oil, such as a steam-cylinder oil, which easily decomposes in the heat of the air cylinder.

2. The use of oils of too great a viscosity—commonly referred to as "too heavy oils." These do not atomize readily, and, therefore, remain too long upon the hot cylinder walls, thus baking down to sticky carbon deposits.

3. The use of too great quantities of oil, which has the same effect as the use of too heavy an oil as far as the carbonization is concerned.

4. The failure to provide a proper screen over the air intake of the compressor, thus allowing free entrance of dust.

The objections to this carbonization, aside from the sticking of air valves and choking of the air passages, is the menace of fire entailed by carbon deposits. Carbon particles torn loose from them may become incandescent from causes which could not be anticipated by the compressor manufacturer. If such incandescent carbon particles should happen to come in contact with "oil vapor" given off by the lubricating oil, a fire might possibly be started whose menace would be small or large, depending upon how much carbon had been allowed to accumulate in the compressor and piping to the receiver. If these are kept properly cleansed at all times, there should never be any danger. This oil vapor is given off from a lubricating oil at a certain temperature called its "flash point," just a steam arises from water at a certain point.

The selection of an air-cylinder lubricant, is of course, governed to a large extent by a knowledge of the cylinder temperature it must withstand. Knowing their air pressures, the corresponding temperatures are ascertained fairly accurately, as shown in Table I, which gives the final temperature in the cylinder at the end of the compression stroke, for single-stage, and also for two-stage (or compound) compression, when free air entering the cylinder is 60° Fahrenheit:

TABLE I. CYLINDER TEMPERATURES AT END OF PISTON STROKE

Air Compressed to a Gage Pressure, Lb.	Final Temperature, Single Stage, F.°	Final Temperature, Two Stage, F.°
10	145	.
20	207	.
30	255	.
40	302	
50	339	188
60	375	203
70	405	214
80	432	224
90	459	234
100	485	243
110	507	250
120	529	257
130	550	265
140	570	272
150	589	279
200	672	309
250	749	331

Variations from these temperatures will occur in actual practice, owing to water-jacketed air cylinders and radiation, tending to lower the temperature at the higher pressures. But at, say, 50 lb. pressure and lower the heat is likely to be somewhat greater than that given by the table, particularly if the compressor is run at high speed and also if it is not water-jacketed.

RELATION OF OIL FLASH POINT TO CYLINDER TEMPERATURE

The natural inference of the reader, after noting the temperatures in Table I, is that he must select an air-cylinder oil of a flash point higher than the maximum temperature commonly to be encountered within the air cylinder. As a matter of fact, this is not the case, and it need only be carefully noted that the study of the air-cylinder temperatures is useful mainly for such purposes as the testing of lubricating oils to determine their resistance against breaking down into carbon. But such temperatures cannot be taken as limits establishing the highest allowable flash point for a lubricant safe to use in the air cylinders.

For average normal conditions, the oil should be a medium-bodied, pure mineral oil of the highest quality, not compounded with fixed oils such as those of animal or vegetable origin, and should be carefully filtered in the final process of manufacture. A range of oil composition is permissible for lubricants approved for this work which are manufactured under the above-mentioned conditions. Primarily a distinction must be made between those oils having a paraffin base, as distinguished from those having an asphaltic base.

From a strictly operating standpoint—so it is claimed by some lubricant manufacturers—there is no distinction between these two classes of lubricants as to their desirability as compressor-cylinder oils, provided that both have been properly filtered in the process of manufacture to remove the carbon-forming elements. If any carbon should be formed, however, such carbon deposited by the asphaltic base oils is of a light fluffy nature and easily cleaned out, whereas that deposited by the paraffin-base oil is adhesive, hard and flinty.

---

*Secretary, Compressed Air Society, 30 Church St., New York.

As a guide to aid the operator in specifying the qualities to be possessed by an air-cylinder lubricant recommended for average duty, Table II is given.

TABLE II. PHYSICAL TESTS OF PARAFFIN-BASE OILS

	Minimum	Average	Maximum
Gravity, B.	28 to 32°	25 to 30°	25 to 27°
Flash point, open cup	375 to 400° F	400 to 425° F.	425 to 500° F.
Fire	425 to 450° F.	450 to 475° F.	475 to 575° F.
Viscosity (Saybolt) at 100° F	120 to 180 sec.	230 to 315 sec.	to 1500 sec.
Color	Yellowish	Reddish	Dark red to green
Congealing point (pour test deg. F.)	20 to 25° F.	30° F.	35 to 45° F

It is suggested that those oils within the range expressed by the minimum figures be used for light duty of low pressures and temperatures, whereas those expressed by maximum figures should be used for high pressures and temperatures. It is recommended that any paraffin-base lubricant intended for use in "standard air compressors" should meet the physical tests imposed by the average range of figures given in the middle column of the table. "Standard air compressors" include the following types of machines:

1. Low-pressure up to 100-lb. compressors, which may be either small-sized single-stage units, or larger-sized compound machines.
2. High-pressure compressors which are constructed with the proper number of stages, so that no excessive temperatures are ever reached.

In other words, this lubricant of average test figures is always recommended unless a compressor manufacturer specifies in his literature that a high flash-point oil should be used to meet the conditions peculiar to his machine. It is thus obvious that it is never necessary that a lubricant should possess a flash point as high as 500° unless abnormal conditions of high temperature prevail. Such high flash-point oils have an unusual tendency to produce carbon deposits.

Asphaltic-Base Lubricating Oils

The asphaltic-base lubricating oils are considered separately for the reason that the lower limit of gravity stated in the above table, namely, 25° B., eliminates this entire group from consideration—which is not the intention of this article. As a guide for the selection of suitable oil, Table III is given.

TABLE III. PHYSICAL TESTS OF ASPHALTIC-BASE OILS

	Minimum	Average	Maximum
Gravity, B.	20 to 22°	19.8 to 21°	19 5 to 20.5°
Flash point, open cup	305 to 325° F.	315 to 335° F.	330 to 375° F.
Fire	360 to 380° F.	370 to 400° F.	385 to 440° F.
Viscosity (Saybolt) at 100° F	175 to 225 sec.	275 to 325 sec.	475 to 750 sec.
Color	Pale yellow	Pale yellow	Pale yellow
Congealing point (pour test)	0° F.	—0° F.	—0° F.

For general use it is conceded that the recommendations given in Tables II and III cover the situation as well as possible, special cases, of course, requiring investigation and special consideration before making recommendations.

Proper Quantity of Lubricating Oils

The quantity of lubricating oil to feed to the air cylinders of compressors cannot be stated in exact terms. This is because of the varying viscosity of different oils, the heat of compression, and the size of cylinder. It may be stated in general, however, that, after the cylinders have acquired smooth and polished surfaces, the quantity should be reduced to the lowest limit, to avoid the possibility of the accumulation of carbon and sooty deposits. The basis of quantity given in Table IV is recommended, subect to modifications.

It will, of course, be carefully noted and clearly understood that the results in the last column of Table IV are based on the assumption that, under average conditions of temperature and usual range of oil viscosities, a pint of oil will contain an average of about 16,000 drops.

TABLE IV. QUANTITY OF AIR-CYLINDER LUBRICANT REQUIRED. PER 10-HOUR DAY

Diam. of Cylinder, In.	Size of Cylinder, In.	Displacement per Min., Cu.Ft.	Piston Speed, Ft. per Min.	Sq.Ft. of Cylinder Wall Swept by Piston	Drops Oil per Min.	Drops Oil per 10 Hr.	Sq.Ft. Oiled per Drop	Number Pints Oil Required per 10 Hr. (a)
8	8x 8	120	344	718	1	600	718	0.0375
12	12x12	320	408	1230	2	1200	613	0.0750
18	18x18	880	496	2340	4	2400	585	0 1500
24	24x24	1730	550	3450	6	3600	575	0 2250
30	30x30	2940	600	4700	8	4800	590	0.3000
36	36x36	4550	644	6070	10	6000	607	0 3750
42	42x42	6700	696	7600	12	7200	633	0.4500

(a) Figures of last column are based upon an estimated 16,000 drops per pint of oil at 75° F.

The figures are offered merely as an approximate guide. Every individual must exercise his own judgment in modifying them wherever his own particular set of working conditions is unusual.

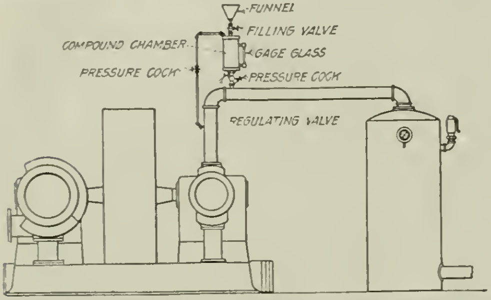
A leading authority on compressor engineering contributes the following: "The best way to determine the proper amount of lubrication is to take out the valves from time to time and examine the cylinder. All parts should feel that there is oil thereon. If they feel dry, the lubricators should be adjusted to feed a little more oil, whereas if oil lies in the cylinder and its parts show excessive oil thereon, the quantity fed by the lubricators should be reduced. By thus examining the machine a few times, the proper amount of oil can be determined to suit the characteristics of the particular lubricant used and the conditions under which the machine operates." This is a better way to finally determine the quantity of oil required than by adopting, without this experimenting, any predetermined number of drops.

Periodical Cleansing of System

The best of lubricating oils will cause the deposit of enough carbon in the compressor system to necessitate periodical cleansing. For the removal of carbon, the machine operator should confine his efforts to the use of soapsuds. A good cleansing solution is made of 1 part soft soap to 15 parts water. The suds should take the place of oil for a few hours, and be fed into the air cylinders about once a week, either by means of a hand pump or through the regular lubricator, at a rate about 10 times as rapidly as that of the oil. The cleanliness of the air valves when inspected, as they should be periodically, will indicate whether greater or lesser applications of the soapsuds should be made. After using soapsuds, open the drain cock of the air receiver, and of the inter-cooler in the case of compound machines, to draw off any accumulated liquid. Oil should be used again for a half hour before shutting down the machine, to prevent rusting the cylinder and its fittings. Never use kerosene, gasoline, or lighter oils in an air cylinder for any purpose whatever, because of their volatile nature under heated conditions.

Cleaning Air Receiver and Piping

It often happens that oil, carbon, and other foreign matters are deposited in the air-discharge lines and air receiver. A practical method of cleaning these is shown in cut attached, where a receptacle made of 6-in. pipe is shown set on top of the discharge pipe. The cut shows plainly the construction and what the different parts represent. If a mixture of 1 lb. of lye and 18 lb. of water is passed into the discharge line at the rate of 60 or 70 drops per min. while the compressor is running, this will eat out all the accumulation on the surface of the pipe and in the receiver; and if the blow-off valve on receiver is open, all this foreign matter will be discharged therefrom. This cleaning solution can be used every month or two, depending on how much accumulation there may be in the receiver.



DEVICE FOR CLEANING CARBON IN AIR-DISCHARGE LINE AND RECEIVER OF AIR COMPRESSORS

STEAM-CYLINDER LUBRICATION

The proper quantity of oil to be fed to steam cylinders is much greater than to air cylinders, on account of the constant washing away of the oil by the steam. Approximately four times as much oil will be needed in the steam cylinders as in those for air, subject, of course, to variable local conditions.

Depending on its viscosity, a pint of steam-cylinder oil will furnish from 5000 to 8000 drops, and taking an average of about 6500 drops, and four times as much oil as air cylinders of same size, and working at same piston speeds, as given in Table III, the recommended amounts to feed the steam cylinders or their equivalents are given in the following table:

TABLE V QUANTITY OF OIL FOR STEAM-CYLINDER LUBRICATION

No. Drops per Min.	Size of Cylinder, In.	Number Pints Oil Required per 10 Hr.
4	8x 8	0.4
8	12x12	0.75
16	18x18	1.5
24	24x24	2.25
32	30x30	3.0
40	36x36	3.75
48	42x42	4.5

These figures are approximate only, and will vary with the steam conditions, the kind of oil used, and its method of introduction into the steam; also with the boiler compound carried by the steam into the cylinder.

When the operator of an air compressor succeeds in obtaining lubricating oils that are giving satisfactory results, he should be cautious about making a change to other grades, particularly if cheapening the cost is advocated by purchasing and sales agents. But if a change is decided on, the performance of the new lubricants should be most carefully checked up before damage can occur to the rubbing surfaces of the compressors, and to see that no increased amount of deposit collects on the inside walls of the air receiver.

The most satisfactory way to get the quickest results is to submit the problem of lubrications to the local experts of any reputable lubricating companies, and to be governed by the recommendations, which, however, should be based on the considerations mentioned in the foregoing statement.

Manganese in South Africa

An important discovery of manganese has been made near Pretoria, Transvaal, states the *South African Mining Review*. The lode is 4 ft. wide, and has been traced so far for 300 yards, outcropping. The content is 80% manganese. Rights over the property have been secured by influential Johannesburg interests.

U. S. Employment Service

The professional and special section of the U. S. Employment Service, formerly situated at 290 South LaSalle St., has removed to 63 East Adams St., Chicago.

Engineers and professional men and women desiring the services of the professional section are requested to write to the above address for registration blanks. To secure quick service, applicants are advised to communicate with the branch which has jurisdiction over their zone district. Persons living in Illinois, Indiana, Iowa, and surrounding territory should register with the Chicago office.

State Reconstruction Committees

This letter has been sent to the Governors of all states:

ENGINEERING COUNCIL
29 West 39th St., New York

SIR: February 11, 1919.

In many parts of our country during these winter months industry is halting because of uncertainties in governmental policies and financial conditions. Private enterprise is therefore restrained from entering upon new projects, especially undertakings requiring construction. Owing to this circumstance, and to the rapid releasing from Government service of large numbers of civil, mechanical, electrical and other technical engineers, there are now available many engineers of unusual ability and able assistants whose talents might well be utilized upon state, Federal, and municipal public works. It is an unusual opportunity to create engineering organizations composed of men above the average ability. It is important for the public welfare that these trained professional men and their assistants, as well as skilled artisans and unskilled laborers, should be usefully employed so as to prevent unrest and economic waste to the community. Even if it is wise to defer actual construction till prices are more favorable, there is a wonderful opportunity now to make plans for the future.

Engineering Council, representing the leading national engineering societies of America, therefore urges upon your consideration the appointment at once of a Reconstruction Committee, a proper proportion of whose members shall be engineers of prominence in your state; or, if you have already appointed such a committee which lacks a suitable number of engineers, that carefully selected engineers be added to its membership. Highways, school houses, and other public buildings, waterworks, sewerage systems, and public utilities are among the public improvements which may be planned, according to the needs of your state and its communities. Engineers are especially fitted to advise on projects of these designations.

It is suggested that even if at the present time lowest prices for materials and minimum wages may not prevail, it will in the long run be an economy to the state to utilize now the professional talent and labor available, in making plans for the future, and in executing work which may be urgent.

If Engineering Council can be of assistance along the lines suggested, its services are at your command. Immediate action appears to be the necessity of the day.

Very respectfully,
(*Signed*) J. PARKE CHANNING,
Chairman

Sampling of Dust in Mine Air*

The reduction of dust in mine air has been, and still is, the subject of considerable study. As a means of determining the quantity of dust present, a systematic method of sampling has been evolved on the Rand, and the results, together with data of a physical nature, offer a basis for preventive measures. An air-suction pump is provided with special attachments, and great care is exercised in the sampling operations.

IN THE course of such mining operations as drilling and blasting, a large amount of fine dust is produced, and, being infinitely small in size and of little weight, it remains in suspension in the air of the mine for a long time. Examinations of the lungs of miners who have died from miners' phthisis show that the lung tissue has been converted, to greater or less degree, into a mass of siliceous tissue, in which is embedded a large number of small, sharp, angular pieces of quartz. This condition is due to the constant breathing of the fine particles of dust present in the mine air.

Nature has provided means of rejecting a certain amount of the dust present in the air breathed, but when the quantity is so large and the particles are so small as in mine air, the natural filter becomes choked and allows the dust to enter the lungs.

PRECAUTIONS TO REDUCE DUST IN MINE AIR

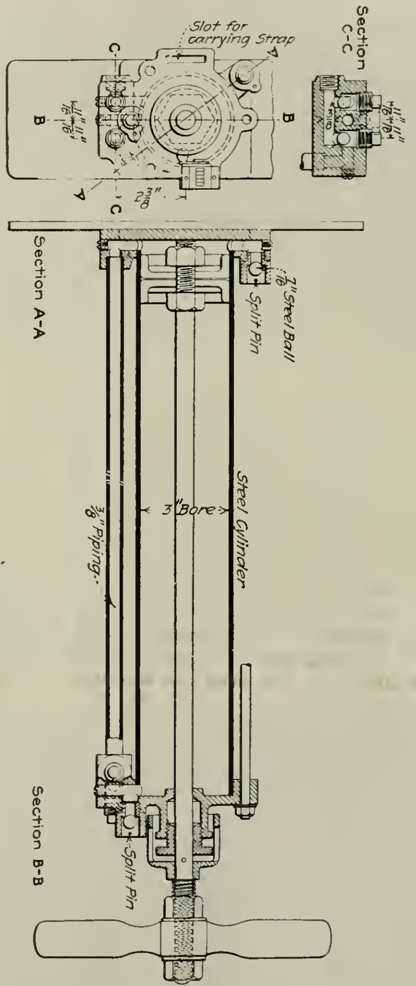
The use of water to allay the dust produced in mining operations reduces the danger to a great extent. Directing a spray on the hole in all drilling operations with machines; insisting on all hammer boys using water, even in collaring a hole, and on the use of a wet swab when the hole has been started; sprays in drives, water blasts at blasting time, and other precautions effectively carried out have so reduced the amount of dust in suspension in the air that the danger of contracting silicosis, or miners' phthisis, is being materially lessened.

PERIODICAL SAMPLING DETERMINES EFFECTIVENESS OF PRECAUTIONS

To assure precautions to keep down the dust and to prevent carelessness in regard to the use of dust-allaying appliances, a system of sampling the mine air for dust has been adopted, and periodical tests are made throughout each mine to see that dust is being allayed to the lowest possible amount. The method consists of passing a known quantity of air through a known weight of pure sugar. The sugar, dampened with the moisture present in the mine air, becomes sticky and catches all of the dust in the air passed through it. The sugar is then dissolved in hot water and the residue of dust filtered off and weighed. Because of the minute size of the dust particles and also of their light weight, special precautions against contamination must be observed in all dust-sampling operations, and it is necessary to exercise great care in taking the samples so that the results may be dependable.

An air suction pump consisting of a metal cylinder 22 in. high and of 3-in. diameter, double acting and fitted with ball valves, is the principal part of the sampling apparatus and is shown in an accompanying cut. The pump requires constant attention, and the piston rod and ball valves should be oiled daily before being taken underground. A small quantity of medium oil should be poured into the inlet tube, and several strokes of the pump taken to introduce the oil into the cylinder. The gasket and nut at the top of the piston should be screwed down tight, and the pump tested by closing the inlet pipe and trying to pull out the piston. If the pump leaks, the piston will come up easily, which it should not do.

The pump should be calibrated from time to time, and at least once a month against the standard air meter in the Chamber of Mines laboratory. This will give the



DETAIL OF AIR-TESTING SUCTION PUMP AS USED FOR DUST SAMPLING BY THE CHAMBER OF MINES ON THE WITWATERSRAND number of strokes required to aspirate the required quantity of air.

---

*Abstract of a report by J. Boyd, chief sampler, Transvaal Chamber of Mines, Johannesburg.

The sugar containers for collecting the dust are simple in construction, consisting of a glass tube (5 in. x 1¼ in.) fitted at the top with a solid rubber cork and at the bottom with a rubber cork through which passes a piece of glass tubing. On top of the latter cork is placed a small pad of cotton wool, which prevents the sugar from being sucked down the tube into the pump. Forty grams of coffee crystal sugar, ground to pass a 10-mesh and remain on a 20-mesh sieve, are placed in the tube and the solid rubber cork is fitted into the top of the tube.

A 6-ft. length of ½-in. rubber tubing is used as the connection between the sugar tube and the pump. One end of the rubber tube is attached to the inlet pipe in the pump and the other to the ½-in. glass tube which projects from the bottom of the sugar tube. It is necessary that the rubber connection be examined frequently to see that there are no leaks, and care must be taken that it is properly fastened to the pump and to the sugar tube.

The sugar tubes should be carried in a wooden box, lined with felt, of a size convenient for underground tests. A useful box is one 19 in. long, 11 in. high and 3 in. deep (outside measurement). A Fahrenheit thermometer should be carried in the box, together with a small note book.

Manner of Procuring the Dust Sample

The method of taking the sample is as follows: Having tested the pump, see that a full stroke is taken each time that the pumping is done. This must be done at a slow, regular rate—10 strokes per minute being the maximum rate—as the successful working of the pump depends on a slow, regular rate of pumping. If the pump is worked too fast, the resistance offered by the damp sugar is so great that the ball valves will leak and the quantity of air passing through the sugar will be greatly reduced. A good indication as to whether the rate of pumping is too fast or not is to watch the rubber connecting tube, and if this collapses during pumping the rate is too fast.

The quantity of air to be tested should be a fraction of 1 cu.m., and it usually requires from 100 to 120 strokes of the pump to secure ⅓ cu.m. and from 150 to 200 for ½ cu.m. The time consumed in taking the sample should never be less than 10 minutes, and usually should be 15 minutes.

One end of the rubber tube is then attached to the inlet of the pump and the other end to the ½-in. glass tube of one of the sugar tubes. The sugar tube should be held about 5 ft. from the ground and the rubber cork removed from the top of the tube. As a precautionary measure, care should be taken to see that the sugar tube is not under wet hanging, so that drops of dirty water or material fall into it. It is well to remember the small quantity of dust that is to be collected and weighed and that the greatest care must be exercised by the sampler. When the sample is complete, the rubber cork is replaced in the tube, which should be cleaned with a dry, clean rag.

The dust sample should be, as far as possible, representative of the air being breathed by the men at work, and it has been found by experiment that the best place to take a sample in a drive, a raise, or a winze is about 10 ft. from the face. In a stope, the sample should be taken near the machines.

The object of dust sampling is to ascertain the amount of dust present in the air being breathed by the men working in the mine, to trace that dust to its point of production, and, if the amount is excessive, to adopt measures to abate it. After taking the sample, notes on the following should be secured: Number of the tube; place where sample was taken; time of sampling; temperature; type of machine; nature of work in progress; nature of holes being drilled; water appliances and how used; number of men and boys at face of the working; appearance of hanging; appearance of air (hazy, foggy, or other appearance) and the sampler's impression of place and work, i.e. if care is being taken and water used. The sampler should make careful observations of the dust conditions of the mine and note the number of sprays and water blasts erected and in use; see that connections to water blasts and to water jets are installed and in order, and be prepared to give an opinion of the dust conditions of the mine and of the dust-allaying appliances.

The work calls for the exercise of great care and patience; it must not be hurried and must be carried out in a careful manner.

Report of Coniagas Mines, Ltd.

The annual report for the year ended Oct. 31, 1918, of Coniagas Mines, Ltd., shows an output from the mine at Cobalt, Ontario, of 974,264 oz. of silver, comparing with 1,344,267 oz. during the preceding year. The cost of mining and concentrating in 1918 was 33.87c. per oz., comparing with 21.36c. per oz. during the previous year. The cost of smelting, refining, shipping, and marketing was 7.98c. per oz., as compared with 4.31c. for the preceding year.

The average price realized for silver sold during 1918 was 94.14c. per oz., as compared with 79.89c. per oz. in 1917. The combined sales of ore from the mine and products of the Coniagas Reduction Co. amounted to $4,099,490.

The tonnage of ore milled in 1918 was 68,597, as compared with 60,928 tons during the previous year. High-grade concentrates totaling 529 tons and 866 tons of low-grade slime concentrates were shipped, the former averaging 1164 oz. per ton and the latter 244 oz. per ton.

The cyanide plant was shut down on Nov. 20, 1917, on account of discarding the canvas tables and installing the Callow flotation process. This latter, to which another unit was added during 1918, treated all tailings from the concentrating mill, assaying 1.75 oz. per ton, as compared with 2.98 oz. per ton for the previous year.

Re-treatment of the sand tailings pile was begun in May and discontinued in November on account of the non-delivery of necessary machinery to make possible continuance of operations during the winter. A total of 21,887 tons was treated, leaving 155,113 tons of sand tailings, averaging 3.5 oz. per ton, and 40,000 tons of slime tailings, averaging 6 oz. per ton, still to be treated. Development work showed a large tonnage of low-grade milling ore, upon which the future output will mainly depend. Work done during the year included drifting, 1075; crosscutting, 383, raising, 142 feet.

A New Lead-Zinc Mill in Colorado

ANOTHER source of supply of lead and zinc has been developed at the property of the Colorado Central Mining Co., near the famous old town of Georgetown, Colo., which in former days was a rich silver-mining camp. This town is situated about 50 miles west of Denver, at the foot of some of the highest peaks of the continental divide, at an elevation of 8500 ft. above sea level.

The mill site is on a moraine placer about four miles above the town, and is reached by means of an automobile road. Its actual elevation is 9300 ft. The plant consists of a rock crusher building and the mill building, with the necessary equipment. It is designed to handle 500 tons of rock in the crusher house and 200 tons of milling ore per 24 hours. All rock is brought to the crusher house in trains by electric locomotive, and discharged into three 250-ton storage bins. The crude ore delivers from the first bin into a flight conveyor, 19-ft. centers, 24 in. wide, running at a speed of 60 ft. per min. This conveyor discharges to a 10 x 20-in. crusher, which delivers to a horizontal belt conveyor 14 in. wide and 37 ft. long.

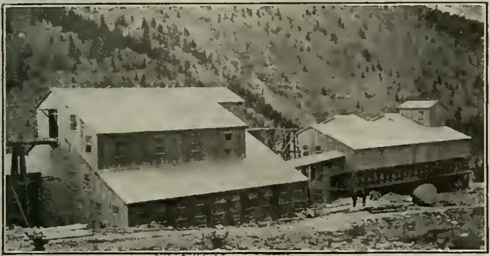


FIG. 1. MILL OF COLORADO CENTRAL MINING COMPANY

The belt conveyor carries the crushed ore to a 40-ft. center 14-in. belt elevator, fitted with 14 x 6-in. buckets, where it is elevated sufficiently to discharge by gravity into two 3-ft. 6-in. x 6-ft. trommel screens. The oversize is diverted by chutes to a set of 16 x 36-in. rolls for crushing, and the product from the rolls is discharged directly to the horizontal belt conveyor mentioned.

The fine ore from the first trommel screens passes to another set of two trommels, of the same size. The oversize from the second screen is diverted to a second set of 16 x 36-in. rolls, and is kept in the closed circuit described until sufficiently reduced. The fine ore passing through the second set of trommels is delivered directly to a 3-pulley 14-in. belt conveyor connected with the main mill building.

The second storage bin receives stope rock of higher grade for wet treatment. The ore is drawn from the bins by special feeders and passed through a disintegrating vat 4 in. deep by 12 ft. long, from which the washed material is drawn by a double-strand flight conveyor with 24 x 8-in. scrapers, and the product is dropped onto a shaking grizzly for sizing. The fine ore passing through the grizzly is fed directly to a belt elevator, made up of 14 x 6-in. buckets at 28-ft. centers and discharged into a 3-ft. 6-in. x 6-ft. trommel screen. The oversize from the trommel screen passes to double five-compartment jigs, and the tailings from these go to waste bins. The undersize from the trommel screens is diverted to roughing tables, from which the tailings are carried out to the waste bins by means of a belt conveyor, which also handles the tailings from the jigs. The conveying equipment of this part of the plant was furnished by the Jeffrey Manufacturing Company.

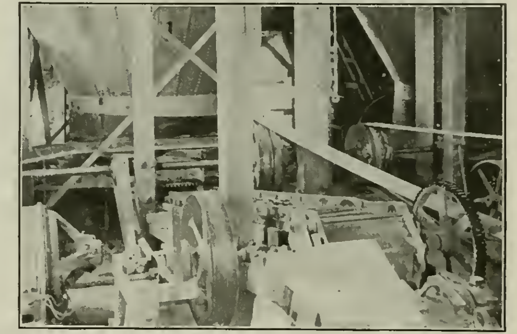


FIG. 2. STORAGE BINS AND FLIGHT CONVEYOR AT THE COLORADO CENTRAL MINING CO. PLANT

All the crushed ore is conveyed from the rock house to the mill on a Jeffrey 3-pulley 14-in. belt conveyor. The receiving end of this conveyor is in the rock house, where the undersize from the trommels is discharged onto the belt and carried up an incline of about 13° for a distance of 86 ft., then horizontally over large storage bins shown on the extreme right of Fig. 1. The conveyor is equipped with a Jeffrey automatic self-propelling, self-reversing, belt tripper for bedding the ore.

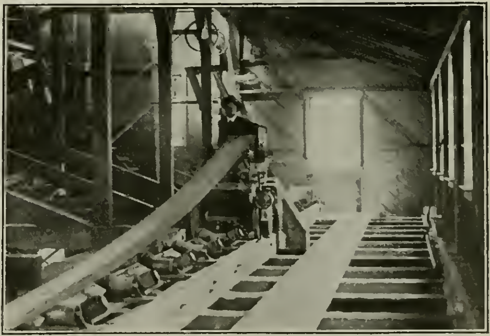


FIG. 3. BELT CONVEYOR IN THE CRUSHING PLANT

The ore is drawn from the storage bins by means of seven short Jeffrey belt-feeder conveyors and discharged onto a horizontal 3-pulley conveyor passing in front of all the storage pockets. From this conveyor the ore is elevated to a height of 45 ft. by an elevator fitted with 14 x 6-in. buckets, and discharged to 3-ft.

6-in. trommel screens. The undersize is then passed to a sloughing-off cone and distributed to classifiers and concentrating tables. The oversize of the trommels is passed to roughing tables. The product from the tables is flumed to additional classifiers and fed to five 6-ft. ball mills, where it is ground to requisite fineness for flotation treatment.

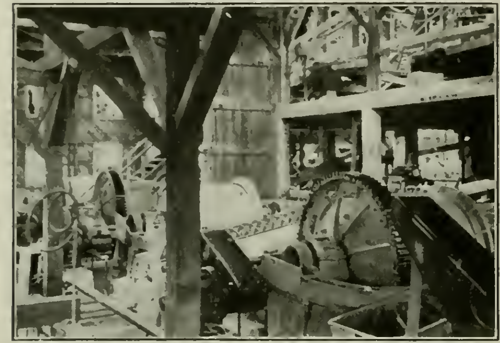


FIG. 4. COLORADO CONVERTIBLE-DISCHARGE BALL MILLS WITH AKINS CLASSIFIERS

The scheme of treatment was devised by E. S. Wiard and was based on the results of a series of tests. The detail work for the plant was designed by A. W. Pick, of Denver.

New Cornelia Copper Co.

Steam shovels at the property of the New Cornelia Copper Co. at Ajo, Ariz., are now being operated in carbonate ore suitable for leaching. The reserves of this ore have proved to be beyond the amount originally estimated when the big leaching plant now in operation was planned. Below and beyond the carbonate and oxide ores is the sulphide ore that will later be treated in the concentration mill to be erected and equipped when requirements shall have been fully determined. From the company's Ajo Consolidated shaft a long drift is being driven through sulphide ore averaging about 4% copper. Three steam shovels, operating 16 hours a day, are loading 5000 tons of ore daily, and this is hauled in trains of six 50-ton cars to the crusher plant one and one-half miles from the mine. At the coarse-crushing plant the ore is dumped directly into a Gates No. 24 gyratory crusher, and from there it passes to four Gates No. 8 gyratory crushers, which reduce the size to 3½ inches. Then by means of two belt conveyors it is carried to storage bins of 10,000 tons' capacity.

The ore is taken from the storage bins on belt conveyors to the fine-crushing plant, which comprises four units of Symons vertical-shaft disk crushers. Each of these units consists of three crushers, one crushing the ore to about ¾-in. size and the two others to about ¼ in. The daily output of 5000 tons of ore is put through these crushers in about 16 hours.

Belt conveyors take the crushed ore from the fine-crushing plant to 12 leaching tanks, each of a capacity of 5000 tons. The ore is leached by a sulphuric-acid solution, and the manipulation of the tanks is such that there are always nine in operation; one of the remaining three is being filled, one excavated, and one washed. Each tank remains in circuit from six to eight days, at the end of which period the tailings are removed by a Hulett excavator and hauled to the dump in a train of twelve 50-ton cars.

The solution from the leaching tanks, containing the dissolved copper, also holds considerable ferric iron, the reduction of which is required so that there will be no interference with the deposition of copper. The solution is therefore passed through towers where it comes in contact with SO_2 gas, which reduces the ferric to ferrous iron. After leaving the towers the solution goes to the electrolytic tank house, where cathode copper is made, and the solution is returned to the leaching tanks after about 3% of sulphuric acid has been added to it.

About 900 men are employed in mining, handling, and treating the ore. The plant has been operated at a maximum capacity of 5000 tons a day. That this capacity may be maintained without interruption, additions are being made, not with a view to increasing the ordinary operating capacity, but that there may be a reserve plant for any emergency. New additions include a fifth unit of Symons disk crushers, which was added to the fine-crushing plant and completed early in January; a fourth motor-generator set, which is being added to the power plant, and a second 800-gal. Prescott pump, which is being placed in the well for a reserve water supply.

The New Cornelia company began the construction of a 500-ton experimental mill in December, 1918, and this is to be used in conducting experiments to determine the most economical method of grinding ores.

Safety Devices in Mines

By A. L. H. STREET[*]

In the case of Haney *vs.* St. Regis Mining and Smelting Co., (*205 Federal Reporter, 93*), which arose in the Joplin mining district, the Springfield, Mo., Court of Appeals lately upheld a judgment for damages in favor of plaintiff, who was injured through a fall of rock down a shaft, at the bottom of which he was working as a tub hoister. The suit was brought on the theory that the defendant company had been negligent in failing to maintain a "skidoo bell"—an electric bell by which a hoisting engineer apprises men at the bottom of a shaft that rock is falling.

The court holds that omission to install and maintain such a warning device might be found to have been negligent on the part of the company, in view of evidence tending to show common use of such devices in similar mines in the same district, yet it is decided that the company could not be charged with liability for failing to maintain the "skidoo bell," unless evidence indicated that its use would have prevented the accident.

The court lays down this rule: "In occupations attended with danger to the employees, the master must use such methods and appliances as are practical and readily obtainable and in common use in doing similar work, or show that other means or appliances equally efficient are being used by him; and a failure to do so when the methods and appliances used are not reasonably safe is a basis for actionable negligence."

---

[*] Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Iron Ore in 1918

PRODUCTION of iron ore in 1918, as estimated by Ernest F. Burchard, of the U. S. Geological Survey, decreased 7.4% from that of 1917. During 1918 there was mined 69,712,000 tons, against 75,288,851 tons the preceding year. Estimated shipments in 1918 were 72,192,000 tons, valued at $246,043,000; those in 1917 were 75,573,207 tons, valued at $238,260,444. The average selling value in 1918 was $3.41 per gross ton. Stocks at the mines decreased from 10,628,908 gross tons in 1917 to 8,139,000 in 1918. The decrease in output was due to disturbed industrial conditions, uncertain supply of labor, and inadequate transportation facilities. Government control of the entire steel supply, which became effective in June, 1918, undoubtedly regulated the demand for ore, and stocks at mines and lower Lake ports were somewhat reduced, so that the consumption of ore remained about the same as in 1917.

The Lake Superior district mined about 60,092,000 gross tons and shipped 62,285,000 tons in 1918, or about 86% of the total iron ore mined and shipped in the United States for the year. The average selling price of iron ore at the mines in the Lake Superior district in 1918 was $3.50 a ton, compared with $3.28 a ton in 1917. Shipments of iron ore by boat during 1918, according to figures as provided by the Lake Superior Iron Ore Association, amounted to 61,156,732 gross tons, and the all-rail shipments to blast furnaces, including those near Duluth, as estimated by the *Iron Trade Review*, amounted to 1,885,000 tons. The U. S. Geological Survey figures do not include about 879,000 tons of manganiferous iron ore (ore containing 5% or more manganese) mined and shipped from the Lake Superior district in 1918.

The Southeastern states, which include the Birmingham district, mined and shipped in 1918 about 10% of the grand total. The quantity mined in these states in 1918 is estimated at 6,906,000 gross tons, compared with 8,333,766 tons mined in 1917, and shipments in 1918 are estimated at 7,249,000 tons, valued at $17,405,000, or $2.40 a ton, compared with 8,396,841 tons, valued at $16,437,775, or $1.96 a ton, in 1917.

The Northeastern states—New Jersey, New York, and Pennsylvania—mined in 1918 approximately 1,862,000 gross tons, compared with 2,340,960 tons in 1917, a decrease of 20%, and shipped 1,821,000 tons in 1918, compared with 2,379,393 tons in 1917, a decrease of 23%. The average selling value of the ore in these states in 1918 was $4.91 a ton, compared with $4.45 in 1917.

In the Western states—Colorado, New Mexico, Utah, and Wyoming—about 750,000 gross tons of iron ore was mined in 1918. Shipments amounted to approximately 740,000 tons. The average selling value of the ore in this group of states in 1918 was $1.72 a ton, compared with $1.39 a ton in 1917.

Other states, including California, Connecticut, Iowa, Maryland, Massachusetts, Missouri, Montana, Nevada, and West Virginia, in which there are small iron-mining operations, are estimated to have mined about 102,000 gross tons and to have shipped about 97,000 tons. The estimated average selling value of the ore shipped from these several states in 1918 was $3.90 a ton, compared with $3.86 a ton in 1917.

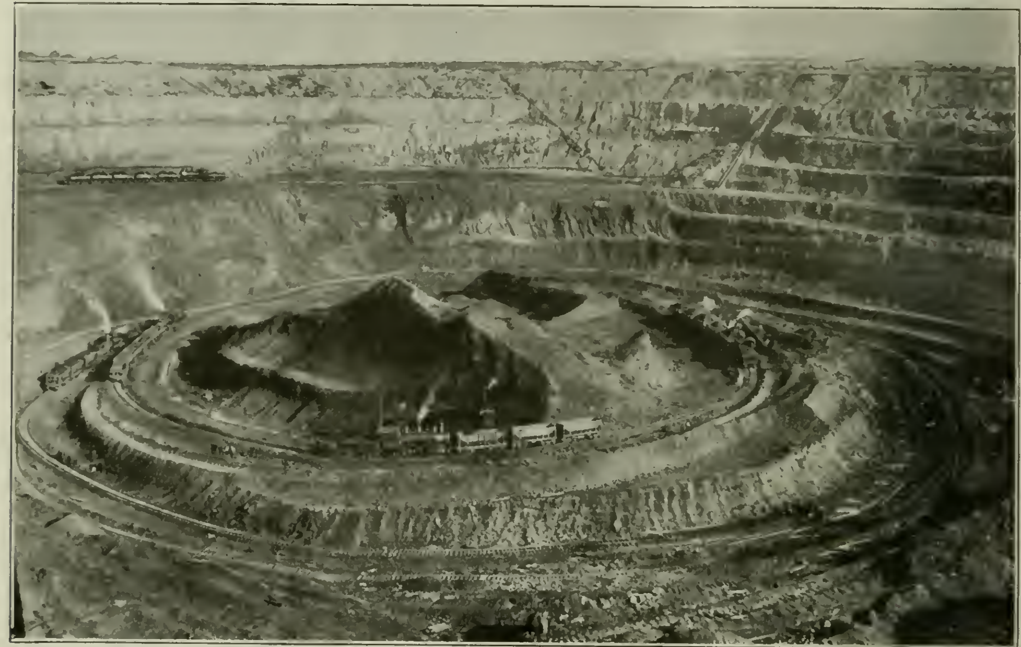
Imports of iron ore in 1918 amounted to 787,468 gross tons, compared with 971,663 tons in 1917, according to the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce. The imports of pig iron (chiefly ferromanganese and ferrosilicon) were 34,711 gross tons in 1918, compared with 76,786 tons in 1917. The exports of iron ore in 1918 were 1,256,431 gross tons, compared with 1,132,313 tons in 1917, and the exports of pig iron, including a minor quantity of ferromanganese and ferrosilicon, were 269,527 gross tons in 1918, compared with an output of 656,220 tons in 1917.

The accompanying table shows the iron ore mined and shipped in the United States by the principal producing states. The figures for 1917 are final, but those for 1918 are subject to such revision as complete data may make necessary.

ESTIMATE OF IRON ORE MINED AND SHIPPED IN THE UNITED STATES IN 1918, WITH ACTUAL FIGURES FOR 1917

	Ore Mined (Gross Tons)		Ore Shipped			
			1917 (Actual)		1918 (Estimated)	
District	1917 (Actual)	1918 (Estimated)	Quantity (Gross Tons)	Value	Quantity (Gross Tons)	Value
Lake Superior:						
Michigan	17,868,601	17,131,000	17,712,916	$62,833,624	17,805,000	$63,920,000
Minnesota	44,595,232	41,870,000	44,962,127	142,901,148	43,303,000	150,261,000
Wisconsin	1,202,235	1,091,000	1,179,709	3,913,437	1,177,000	3,863,000
Totals	63,666,068	60,092,000	63,854,752	$209,648,209	62,285,000	$218,044,000
Southeastern States:						
Alabama	7,037,707	5,745,000	7,101,586	$13,049,535	6,107,000	$13,345,000
Georgia	226,630	232,000	211,501	524,175	236,000	927,000
North Carolina	599,526	82,000	611,417	1,681,616	82,000	493,000
Tennessee		417,000			415,000	1,243,000
Virginia	469,903	430,000	472,337	1,182,449	409,000	1,397,000
Totals	8,333,766	6,906,000	8,396,841	$16,437,775	7,249,000	$17,405,000
Northeastern States:						
New Jersey	489,943	470,000	474,708	$2,341,160	423,000	$2,307,000
New York	1,304,317	875,000	1,356,011	7,381,333	889,000	5,661,000
Pennsylvania	546,700	517,000	548,674	873,320	509,000	975,000
Totals	2,340,960	1,862,000	2,379,393	$10,595,813	1,821,000	$8,943,000
Western States:						
Colorado	837,673	750,000	832,056	$1,153,455	740,000	$1,273,000
New Mexico						
Utah						
Wyoming						
Other States	110,384	102,000	110,165	425,192	97,000	378,000
Grand totals	75,288,851	69,712,000	75,573,207	$238,260,444	72,192,000	$246,043,000

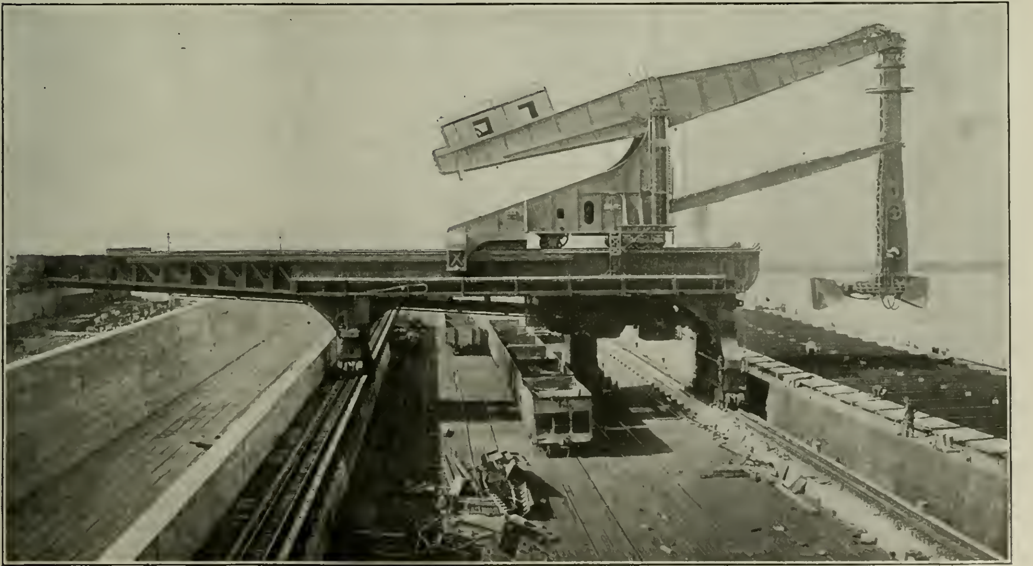
Lake Superior Iron-Ore Transportation



OPEN-PIT MINING BY STEAM SHOVEL ON THE MESABI RANGE. ORE IS LOADED DIRECTLY INTO 50-TON CARS

LOADED CARS ARE HAULED FROM PIT OR MINE SHAFT AND MADE UP IN TRAINS OF 50 CARS OR MORE

LOADING IRON ORE AT NO. 4 AND NO. 5 DOCKS OF THE DULUTH, MISSABE & NORTHERN RAILWAY COMPANY



ONE OF THE HULETT 15-TON AUTOMATIC UNLOADERS AT THE DOCKS AT ASHTABULA, OHIO
Eight of these machines are installed on this particular dock, the installation having been made by Wellman-Seaver-Morgan Co. The ore is removed from the hold of the boat and is carried to standard railroad cars for shipment to furnaces.

Russia Today
Its Lessons and Opportunities[*]

BY LESLIE URQUHART

THE great causes for which we took up arms over 50 months ago and which we have ever since unfalteringly sustained—bringing to their defence such an accumulation of power as has never yet in all the world's history been wielded by any single nation—stand now very near the topmost pinnacle of triumph. I would put it even more strongly were it not for President Wilson's wise reminder that "this business is not yet over." To that triumph all our Allies in the great League of Liberty have contributed their share of suffering, heroism, and endurance. But there is one of them that seems to have no part or lot in the splendor of it. Hardly one ray of the light that illumines our hearts reaches to that abyss of darkness and chaos and agony in which Russia is blindly staggering. For her there is no sense of deliverance, of a noble task brought to the verge of noble accomplishment, but only despair, misery, and a well-nigh inextricable anarchy.

Yet I would ask you to remember that without Russia that first fierce onslaught of the Germans upon the liberties of Europe could hardly have been withstood; that for two-and-a-half years, although starved of munitions, stabbed by traitors, and preyed upon by the most maddeningly corrupt and incompetent bureaucracy that ever muddled a nation's destinies, Russia remained faithful to the Allied cause, suffered unflinchingly for it, and abandoned it only when an internal upheaval that was like a cataclysm of nature had swept away all government and authority and when the minds of her people were bewitched and their morale was broken by a poisonous propaganda of class hatred and spoliation that rotted all discipline, all sense of right and wrong, all confidence and security, and flung back 180 million human beings upon the law of the jungle. And I would also ask you to remember that though we and all the Western Allies have had to pay heavily for Russia's defection, Russia herself has had to pay more heavily still; that during the last 18 months her state has grown progressively worse and now presents a picture of unrelieved ruin and wretchedness such as humanity has rarely, if ever, gazed upon; and that there are millions of brave Russian souls to whom the thought that their country was half cajoled and half cudgelled into breaking faith with the Allies brings a shame that gnaws deeper than the physical horrors and deprivations they are daily witnessing and enduring.

We cannot help Russia as we ought to help her if we allow our minds to dwell too much on the single fact that she dropped out of the alliance. Let us not forget that had it not been for Russia we should not now have entered the promised land of victory and peace; that for three years Russia held at least half of the enemy's forces on the East so that he was never able to bring his full weight to bear upon the Western Allies; that Russia all the time was fighting a twofold battle—the Germans and Austrians without, and corruption, treachery, and the grossest kind of administrative inefficiency within; that her industrial development and equipment were barely those of Great Britain of a hundred years ago; that German influence permeated the court, the secret police and the bureaucracy, obstructing everything, confounding everything; and that for month after weary month the Russian troops had little but their hands and naked breasts and their valorous souls to oppose to the storms of shells and bullets that were let loose upon them.

Frightful was the price that Russia paid for incompetence, favoritism and unreadiness—the loss of Poland, the ravaging of her Western provinces and casualties in killed, wounded, and prisoners that amounted to well over eight millions. Never was a trusting people so shamelessly betrayed by its rulers. And then on the top of this came the revolution, a momentary fitful gleam of hope and recovery, followed by a darkness as of death. And when they could endure no more, the word peace was uttered, and the idea of peace became an obsession. The soil was fertile for the propaganda of traitors and German emissaries, who undermined by lying words and false teaching the courage, the patriotism, and the honor of the army and the people, and, as a result, gradually at first but soon with a Gadarene rush, there ensued such a plunge into social, industrial, financial, and military chaos as even the opulent annals of human folly and wretchedness cannot parallel. But through all the terrible dislocations of the last 18 months—a society overthrown, a government scrapped, an empire given over to famine, brigandage, and anarchy, and a nation of 180 millions thrust and bludgeoned into a shameful peace—let us not forget the men who fought for the honor and sanity of their native land, the officers who banded themselves into "death battalions" and perished wholesale in a vain effort to recall the rank and file to their sense of duty, the men who remained unmovably loyal and disciplined, the great soldiers and patriots like Kaledin, Korniloff, Alexeieff, Russky, Gourko, and many others, civilians and soldiers alike, who never hesitated to tell the country the truth and struggled with magnificent courage against the traitors and anarchists working for Germany in their midst. If the Russian revolution has revealed the weaknesses of the Russian character and the savageries of which human nature is capable when it bursts through the paper wrappings of civilization, it has also enriched the scroll of heroism with many a splendid tale of devotion and self-sacrifice.

We must remember this. We must remember, too, those fundamental conditions which have always and from every point of view made Russia a staggering subject. For what is Russia? She is a land nearly three times as large as the United States, inhabited in the European portion alone by over twenty races, boasting a population of nearly 180 million souls and covering an area of over 8½ million square miles. She is a land in which the towns are merely islets in a rural ocean, in which industrialism is only just beginning to take root, in which railways and schools are in their infancy and in which 85% of the people live on and by the soil, only 15% living in the towns. She was governed by an autocracy bound up with the Orthodox Church, buttressed by the bureaucracy and resting mainly on the ignorance, the devotion, the half-patriarchal, half-communistic instincts of the peasantry. The Russian people only 56 years ago were emancipated from serfdom; there has, therefore, been little time for the development of that orderly sequence of classes and grades familiar to Europe, but just the Czar at the top and the peasant at the bottom, and in between one artificial link—the bureaucracy.

---

[*] A lecture delivered under the auspices of the British Russia Club and the United Russia Societies Association, in London, Jan 9, 1919

When the dynasty fell, the Socialists in the Duma, representing the working classes of the towns, who are barely 10% of the population of Russia, organized the Soviet or Council of Workmen's Delegates, including in it later delegates from the rank and file of the army and navy. Kerensky was one of the leading members of this Socialist group, which formed at first the majority; but included in the Soviet from practically the beginning were the wilder spirits among the returned exiles—Internationalists, hare-brained anarchists, visionaries, German agents disguised under Russian names, Lenine, Trotzky, and the host of madmen and traitors who gradually got control of the Soviets and who are the rulers of European Russia today.

The Soviets are in the present application of the word the direct representation, in every city, town, and village, of the manual workers, to the exclusion of the thinking section of the community. The local Soviets are represented in the Central Soviet, which governs the country. The Soviet is, in short, the exclusive dictatorship of the proletariat. Popular representation is carried to an extreme absurdity, a member of the Soviet represents no more than 500 votes; every manual worker, male or female, after reaching the age of 18 has a vote—hence a confused medley of all passions, badly digested, irresponsible political theories, confusion worse confounded. Bolshevism is a subtle poison. It offers to the ignorant masses impossible yet captivating promises. It taints political opinion. It declares that the world was made for the poor, the shiftless, the disinherited, the under-dogs, the failures. It insinuates itself, almost unnoticed and unawares, in industrial or military organizations. Its keynote is the assertion that a nation is composed of only two classes, the bourgeoisie, the thinking or ruling class, and the proletariat, or working class; and that the interests of these two classes are essentially antagonistic. The ideals of Bolshevism are not those of liberty and equality. Bolshevism holds that the dictatorship of the proletariat, the exclusive autocracy of the manual worker and of the soldier, is a higher state of existence, which cannot be attained by evolution, but demands the bloody path of revolution and destruction. The proletariat, therefore, must alone be armed.

In place of the state, the Bolshevist creed required the establishment of the dictatorship of the proletariat to enforce their will on the hated bourgeoisie. To do this—and they set themselves to do it—the machinery of state and of civilization had to be destroyed. From practically the beginning of the Russian revolution, the Bolsheviks in the Soviet, directed and assisted monetarily and in every other way by Germany, at first by an insinuating propaganda of peace and class hatred and plunder, demoralized discipline in the army and among the workers at home. As their influence became stronger they openly took control of the land, the mines, the railways, the newspapers, and postal and telegraphic communications, to run them for the sole exclusive benefit of the workers; and finally the Bolshevik gang in German pay sold the country to the Kaiser, broke faith with the Allies, and by a merciless system of terrorism—ten thousand times more autocratic, cruel, harsh, and murderous than the world has ever known—have succeeded, though with constantly increasing difficulty, in maintaining themselves in power to this day.

The Soviet government is supported by the Red Guards, or an army composed of working men bedevilled by the Bolshevik creed, Internationalists, Letts, Germans, Austrians, and even Chinamen and criminals from Russian prisons.

Universal military service has been established in the country under their control; the bourgeoisie are compulsorily enrolled for hard labor in the rear, and are not allowed to enter the fighting ranks. On pain of death, officers of the former regular army are obliged to join, and are closely watched by special commissaries, who are appointed for this purpose, and recruits are obtained from among famished men by the daily allowance of 2 lb. of bread, half of which they sell for 25 to 30 rubles. The privates receive 600 rubles a month; the officers receive more. For every fighting day against the Siberian or the Southeastern armies the men are paid as much as 300 to 500 rubles. With the printing presses in its hands, printing, as at present, at the rate of 20,000,000 rubles per day, and without any care for the consequent depression of the ruble value, the Bolshevik government can well afford to be liberal in its payments to its supporters.

The officers are of three categories: officers of the regular army pressed into service, who, given the opportunity, would gladly go over with their men to the anti-Bolshevik forces; the second category, non-commissioned officers, old and disciplined soldiers of the regular army raised to officers' rank, who enforce strict discipline in the ranks—this class are simply mercenaries, but are good professional soldiers; and, lastly, there are the men, about 8000 officers, who have received six months' training and are, perhaps, imbued with Bolshevist ideas and are the most loyal enthusiasts of the Red Army.

Discipline is now strictly enforced, the death penalty and flagellation being among the punishments which are meted out for indiscipline or treason; 25,000 Chinamen and Letts who form separate battalions or are distributed in companies among the less reliable regiments, and who simply act as executioners, receive 50 rubles for each murder they commit.

The Bolshevik army numbered about 300,000 on July 1, 1918, but the inducements offered, both in pay and food, loot, and the success of the Bolshevists, have brought in many recruits, and it now numbers about

600,000 men. They are well equipped with rifles, guns, and ammunition, and the Bolshevists see to it that, whatever may happen to the remainder of Russia, they are liberally supplied with food. In fights against the Siberian army and the volunteer army of General Dennikin, the Red Guards, when in superior numbers, have put up at times a good fight; but these men, who are themselves well munitioned and equipped, have never had to fight against modern artillery of as large caliber as their own. Though it would be dangerous to minimize the strength and power for evil of this army, its constitution is such that its morale is likely to break down under a reverse, and many of the men are ready to desert to the other side.

The anti-Bolshevist forces have, in fact, received many recruits from the Bolshevist ranks; and, taking all the fronts, together they now probably number nearly half a million, of whom, however, only about a half can be said to be really well equipped. The best organized and most powerful of the anti-Bolshevist armies is the one in Siberia under Admiral Koltchak, numbering about 250,000. General Dennikin's volunteer army consists of about 130,000 men and operates in Southeastern Russia, with its headquarters at Ekaterinodar, in the Kuban; and General Krasenoff's force of Cossacks and peasants in the Don country is, perhaps, 100,000 strong. All these forces in the last six months have increased at least as rapidly as the Bolshevists and are composed of better human material. That is a significant and a hopeful sign.

Having completed the economic ruin of their country, the Bolshevists are deliberately trying to prevent the possibility of regeneration by killing off all that is best and bravest and most intelligent. It is not merely the destruction of the wealth of Russia, but the murder of her very soul, that they are attempting; and they have so far succeeded as to turn the towns in European Russia under their control into prison houses in which a terrorized people starve and kill one another to make a Bolshevik revolutionary holiday.

The manual workers have got what they wanted—they have expropriated the factories and industries, but these they cannot operate. They have paper money in abundance, but the railway workers are not working, and food is not being brought into the towns. Meanwhile, the peasants will not sell, and hide their grain for fear of confiscation, and do not produce more than they can themselves consume.

At the end of July I saw at night in Petrograd and Moscow ever-lengthening queues of terrified and starving people, crouching in the darkness and the cold round the bakers' shops, waiting for them to open. It was little enough they got by doing so. Even then bread was practically unprocurable except at about 10s. a pound; butter, eggs, and fats, sugar and tea have disappeared; meat was all but unprocurable; any kind of fuel is practically unprocurable; boots cost £50 per pair; an ordinary overcoat costs £200. They are passing through a terrible winter, a racking, hopeless winter, in which not merely scores but hundreds of thousands of Russians are doomed to die miserably without food, without fuel, without clothing, the victims of a revolution that, by destroying the means of life, destroys life itself. But the experience, though a cruel one, may prove in the end to be salutary if it teaches the bemused workmen who are their friends and who their enemies, and if it rouses the peasants to assert themselves on the side of law and order.

From the moment the Soviet came into power it denounced the war and the Allies, and Great Britain most of all. But, above everything else, it sought to set class against class and to convince the workingman that the employer, the capitalist, the man in the black coat, is his inveterate enemy. The result of this doctrine we see in the complete collapse of all normal life, the wreckage of the instruments and agencies of production, and now in the awful spectre of famine. Everybody was to be free to do just as he pleased. Everyone was to be an employer; no one was to be employed. The people were to rule, and they were taught that ruling consisted in following their own inclinations, satisfying whatever appetite the whim of the moment might suggest, loafing in the streets, doing no work, drawing large pay, stealing whatever attracted them, and, above all, marking down for arrest or murder any man of education and position. There are great communities in Russia at this moment that are falling through starvation into savagery. Into savagery because nothing rubs off the varnish of civilization so quickly or so completely as hunger. In times such as these what is worst in human nature is thrown violently to the surface; and European Russia today presents the awful spectacle of 100,000,000 people each fighting with his own hand to keep body and soul together.

There can be no doubt whatever that all over Russia men are longing for a return to order and discipline and would welcome any man or group or organization that was capable of restoring the fundamentals of civilized society. Here and there a reaction has already set in. This reaction against Bolshevism set in many months ago when the Ukraine seceded from North and Central Russia, and the unarmed and defenceless people invited the Germans to occupy their country and protect them from the Bolshevik. Conditions in the Ukraine under Bolshevik control were so anarchical that even German vassalage, with its guarantee of order and security, seemed preferable.

Bolshevism, except in the towns, never gained influence in Siberia. Land allotments are larger, food is plentiful, and the people are more prosperous and of a higher intelligence than the masses of Greater Russia. That the feeling of antagonism was especially strong in Siberia is shown by the success of small bands of Czecho-Slovaks, Cossacks, and Russians, who during last summer cleared the Bolsheviks out of the towns on the railways from the Pacific Coast to the Volga. The Siberian government established at Omsk, with which the Allies are now in close coöperation, has abolished all Bolshevik laws and regulations, has recognized foreign indebtedness, titles to land and property, has reëstablished the law courts, justiciary, and police, and is now raising and equipping a large army with Allied assistance to clear the Bolsheviks out of Russia.

The peasants, after seizing the land in their neighborhood in the first days of the revolution, found that after all, there was little to divide, as only about 10% of the agricultural land in European Russia belongs to private landowners. That though these lands in the hands of their former proprietors produced 50% of the total grain crops of European Russia, in the hands of the peasants, without technical knowledge and proper equipment, they gave only a tithe of their former yield.

Just as the peasants are now asking the real owners to resume possession of their land, so in many a mine and factory the workmen have discovered that managers and directors, after all, have their uses, and have begged them to take over the control once more. That, so far as it goes, is a sign of returning sanity. Then, again, the Cossacks and patriotic volunteers have formed a confederation in Southeastern Russia which commands the great railways to Siberia and the Caucasus, the rich corn lands of the Kuban between the Black Sea and the Caspian, and the mineral district of the Donetz Valley. Then, too, the peasants, who are the ultimate power in Russia and who for long looked on in wondering apathy at the madness of the towns, are realizing today that it touches them very nearly, that when once you begin to confiscate, even the fruits of the peasants' toil are not exempt, and that order and security are the basis of all things. They are suffering in their own homes and persons from the universal spirit of anarchy and pillage and from the not less universal shortage of the commodities they need in their business. They love their native soil, they have no feeling of sympathy whatever for the Internationalists who repudiate all patriotism and all religion, and if they had understood what was happening they would have been utterly against a peace that involved the surrender of Russian territory. But they are ignorant, unorganized, bewildered, weary, and depressed; and it will be long, I fear, without help from outside, before they are able to assert themselves in any effective fashion. Finally, there are small Allied expeditions on the Murman Coast and in Siberia, in the Caucasus and the Black Sea littoral.

But how is a return to stable government going to be brought about? It is my firm conviction that if the Russians are left to do this alone, or with ineffective material support, the road will be long and bloody, and millions will die before the goal is reached.

What is our duty, what are our interests in these premises? Anyone can see that if Germany, even a defeated Germany, is left in a position to dominate European Russia and exploit her resources and manpower, then—no matter what happens in the West—Germany will not only have won this war, but, a decade or so from now, will be able to start a greater one with an almost assured prospect of success. Germany, said the Prime Minister recently, has no America. Germany, unless we are very careful and resolute, will find her America in Russia, and will organize in her own interests the endless resources of men and food and natural wealth of what was the Russian Empire. And if she could do that she could afford to throw over the Central Europe project; she could afford to let Turkey and the Bagdad Railway go; she could turn her face definitely toward the East and strike into the heart of Asia through routes inaccessible to us. That is a direct menace to our Eastern Empire and an indirect menace to the whole world. I believe profoundly that a dismembered, Germanized, derelict Russia would prove a source of well-nigh endless strife among the nations; and that wars as much greater than this one as this one exceeds all its predecessors will inevitably break out if Russia, with her teeming population, her incredible stores of natural wealth, becomes a prize to be snatched by the strongest power.

Germany foisted the Bolshevists on the Russian people to destroy the civilized and thinking elements of Russian society, who were loyal and still are loyal to the Allied cause. It is true, the Bolshevist movement will come to an end of its own excesses—of this there can be no doubt—but the uncultured, predatory, and materialistic elements which predominate in this organization are no friends of the Allies; they form a new bourgeoisie of, to use a Russian word, the Koulak, or of the "fist," instead of the brain. This new, uncultured, and reactionary class will by its very origin and nature have a German orientation.

The future peace of the world, in my judgment, absolutely demands and depends upon a strong, self-contained, united, and independent Russia that shall be mistress in her own household. Russia before the war occupied about one-sixth of the earth's surface, and the restoration of law and order over this vast area, its economic rehabilitation, and its rewelding into a state powerful enough to resist aggression and to forestall a universal scramble for its markets, form, as it seems to me, the biggest series of problems that the war has so far propounded. To assist in their solution is a duty that so long as we (England) hold India we cannot shirk. It is a duty we owe to mankind and to the universal determination that this, the greatest and most terrible of all wars, shall also be the last. It is a duty also that we owe to our once great ally who spent her strength in the darkest hour, who put forth an effort beyond her powers, and fell stricken before victory dawned.

Sham sentiment and ignorance in the early days of the revolution clouded the comprehension of the Allied governments as to the Russian situation and the foulness of the Bolshevik leaders' control. The Allied governments cannot be acquitted of their share of blame for having dallied with and semi-officially recognized the Bolshevik regime, whose leaders made no secret of their desire to shatter civilization.

But now, if the statements made by their official representatives mean anything at all, the Allies and the United States have pledged themselves to overthrow the brutal tyranny of the Bolsheviks and to reëstablish law and order in Russia.

The British government, through Lord Milner as Minister for War, has declared that we cannot in honor withdraw our troops from Russia, as that would mean leaving the Russians who have joined us in all good faith to the fate which awaits them at the hands of the Bolsheviks.

President Wilson has spoken like a true friend of liberty and has said that he intends to "stand by Russia as well as France"; he has pledged himself regarding the independence of Poland, and made this question one of his fourteen points, and the Entente premiers at Versailles last July declared that a "restored Poland was essential to the peace of Europe." The carrying out of this program pledges the Allies and the United States to render active assistance to the

Polish people in their opposition to the Bolshevik attempts to join hands with their German friends, with the consequent devastation of the Baltic provinces and the annihilation of Poland as a nation.

On December 30, M. Pichon, the French Foreign Minister, in the French Chamber stated with a true understanding, and with the enthusiastic approval of the members, that all Allied actions in Russia were directed against Germany. That none of these movements constituted intervention in the internal policy of Russia, but that they were defending themselves in a country where their interests were considerable. M. Pichon stated that "the action of the Allies is aimed at preserving the healthy portions of Russia from the influence of Bolshevism," but that M. Clemenceau "had given strict orders to the French military chiefs that the efforts necessary for crushing Bolshevism shall be made by Russian forces. That Allied material support has for its object simply to allow for reorganization, so as to bring about the economic encirclement of Bolshevism." Continuing, he said, "any peace that would allow Russia to continue to exist in a state of civil war, with her present hateful and abominable government, would not be a peace of justice. We should be certainly threatened with a resumption of hostilities."

It remains, therefore, for the Allies and the United States to fulfill their promises and their professions of faith by adequate material support. There are small Allied expeditions in the North, the Murman Coast, and Archangel and Siberia; small Allied contingents have been landed at Black Sea ports, and assistance is being given by the British navy to the populations of the Baltic littoral. But none of these forces by themselves are sufficiently strong to do more than hold the ports and the country in the immediate vicinity where they are stationed.

The people in the Ukraine welcome Allied assistance; their tendency is not pro-German; on the contrary, they have always hated German military occupation and exploitation of their country. During their occupation, however, the German troops kept law and order and stamped out the Bolshevik peril. The Allies have ordered the Germans to clear out of the country. They are bound, therefore, to assist the Russians by every possible means to fill the gap that is thus created. Otherwise, what is already happening in Courland, Livonia, Esthonia, and Poland will be repeated in the Ukraine, the granary of European Russia. The withdrawal of German troops from the Baltic provinces has meant the immediate devastation and occupation of the country by the Russian Bolshevik Red Guards, and the spreading by every method of terrorism of their poisonous propaganda.

It must surely be clear that the efforts necessary to stamp out Bolshevism in European Russia cannot be generated from within. The patriotic elements in Central Russia have no military organization, nor arms, nor equipment, nor food; and they are separated from the small Allied contingents at the ports by hundreds of miles of Bolshevist territory. Unless, therefore, the Allies seriously address themselves to the task, the only hope for the liberation of European Russia rests with the Russian forces that are being slowly organized in Siberia and the Southeast. And that hope, considering the enormous difficulties of transport and munitionment, cannot be early realized. The fate of 100,000,000 human beings in North and Central Russia is at stake. Are they to be abandoned to the living death of Bolshevism, or are they to be rescued with the help of the Allies? Can there be any doubt as to which alternative should be chosen?

The Allies are assisting the patriotic elements on the confines of what was the Russian Empire, but these elements are scattered, are almost without means of intercommunication, and depend for their equipment as fighting forces on supplies brought many thousands of miles from their respective bases. Before they can effectively coöperate, or offer anything more than a localized resistance to the enemy, and, still more, before they are in a position to subjugate him, many millions of European Russians, I fear, must perish in infinite wretchedness.

And every month's delay in recognizing the Bolshevists for what they are—the enemies not only of Russia but of all mankind—merely enables them to entrench their position, to gather more power and authority into their hands, to expand their program of murder and spoliation, to attack, plunder, and devastate neighboring states as they are doing at this moment in Poland and the Baltic provinces, and, finally, to join hands with their friends in Germany and to aim at the overthrow of the entire structure of European society. I say deliberately that if a policy of economic encirclement, coupled with a determination to leave it to the Russians themselves to crush Bolshevism, is all that the Allies can contribute to the solution of this appalling problem, then God help the Russian people.

There is a natural disinclination among the Allied statesmen to embark on what may seem to be fresh military commitments, and it is not to be wondered at that there is a general feeling among the soldiers of the Allies who have borne the brunt of over four years of this terrible war, that they should not be compelled to participate in further military operations on new fronts far away from home. It has already been officially stated that the British and Allied forces in Russia are small, and that their withdrawal in the near future is contemplated so soon as volunteers can take their place. That these volunteers will be forthcoming there can be little doubt if it is explained clearly that the intention is that they should act as a police force to keep law and order at essential points while the Russians are organizing themselves for their fight against the Bolshevik enemies of the Russian nation. The actual size of such forces is of secondary importance to the moral effect which the presence of Allied troops would have in stopping the spread of Bolshevism. There is nothing the patriotic Russian elements desire less than that the Allies should prejudice their cause by military operations against the Bolsheviks—all that they pray for is that the Allies, out of their plenty, should supply them liberally with arms, equipment, and munitions which they so sadly lack, and give them the chance to organize themselves to clear their country of these enemies of mankind.

I am convinced that, to be of any lasting use, the Russian forces, with Allied material assistance, must strike at the heart or head of the trouble, not at the extremities. If the winter closing of the Baltic makes a military occupation of Petrograd and Moscow too difficult an enterprise at the moment, then at least the Ukraine can be saved from Bolshevist terrorism and its great wealth of food preserved for distribution among the famishing population of Greater Russia. The advent of Russian anti-Bolshevist forces into North and Central Russia, bringing with them food from the Ukraine as also from Siberia and the Southeast, will be welcomed by the starving population with open arms. But quick action is necessary. There is a surplus of at least 1½ million tons of wheat and other grain stock in the Ukraine at this moment; the Bolshevists are too busy on the Ural and Southeastern front and in the Baltic provinces to undertake the invasion of the country yet awhile, but they are doing all they can through local emissaries to stir up anarchy, and, if they succeed, not only will all the crops be seized, but there will be no sowing in the spring for the next harvest. Between now and the spring is the vital time, and if the Allies utilize it to police the Ukraine, to allow the purely Russian forces to organize in their rear, to enforce the security which will induce the peasants to sow their crops, then I believe that, with the help of a volunteer Allied expedition to police Petrograd and a simultaneous move on the part of the patriotic Russian forces from Siberia, the Eastern Federation and the Ukraine, the reign of Bolshevism would be quickly over.

Military action of the kind I have here suggested does not imply interference with the political aspirations of the Russian people. It is, and should continue to be, no concern of the Allies what particular form or system of government is finally established in Russia. This is an internal affair of the Russian people, and must be left entirely for them to settle in their own way and at their own time. It would, therefore, be a fatal mistake for the Allies to tie themselves up with any political party whatsoever. There are many parties in Russia and many leaders, but though their political views are often divergent they are now united in their determination to support any healthy movement toward the establishment of law and order and of a stable government.

The Allies in their dealings with Russia must have one aim and one hope. That aim can only be to counteract the disintegrating effects of German and Bolshevist policy in Russia and to help in the reëstablishment of safety, law, and order, without which no stable government is possible. And that hope can only be that Russia, after all her suffering and tribulation, will be ruled by wise and trusted men—a country so governed is a free country, be the form of its constitution what it may.

Russia has had her revolution. She is now in the deepest bog of chaos that any nation has ever known. Some sort of military dictatorship for the restoration of public security would seem to be marked down by all past experience as the next step in her journey. And when circumstances permit the Siberian forces and those of the Southeastern Federation to join up, it is certain that Admiral Koltchak and General Dennikin—both men of high patriotism, character, and ability—will form a condominium in opposing their united fronts to the Bolshevists. At any rate, it is only after the indispensable foundation of law and order has been secured that it will be possible to convoke a national or constituent Assembly that will really give the Russian people an opportunity of choosing the form of government they desire. And I venture, for what it is worth, to throw out the suggestion that this consummation is more likely to be hastened if in Russia, as in France, the Allies agree to recognize one supreme authority.

It must, however, be understood that Allied assistance implies something more than military or police action. It implies also a pooling of brains and energy in the administration of the country's public and foreign debt, the institution of banks, the organization and reëquipment of the railways, the provision of essential goods and machinery, a restarting of the wheels of commerce, a sustained and many-sided missionary undertaking in which soldiers, financiers, traders, engineers, manufacturers, and all the Allied governments will have to coöperate. For nearly four years the Russian people have been unable to procure at any price such necessary goods as clothing, boots, nails, iron, steel, and the simplest agricultural implements; and these unexampled deprivations have been the cause not only of intense hardship but also of the idleness and lethargy that prevail among the peasants and workpeople today.

Of what use is money when there is nothing to buy? Why under such conditions should the peasant produce more than he can consume or the worker be at the trouble of earning wages which he cannot spend? To reëstablish trade, and, with it, the incentive to work, is, therefore, imperative. The opening of some of the ports under Allied control has already begun to contribute materially to this end; and I am glad to say that the British government is zealously encouraging the export of British goods to Siberia and the Urals. This policy has the double effect of resuscitating the economic life of the country and of establishing sympathetic trade relations which in the future will be of the highest politico-economic importance both to Russia and to Britain. It helps, moreover, to facilitate the return to normal conditions, and that, after all, is what Russia needs for her salvation.

There is in Russia—her whole history shows it—an immense power of resilience. Although the Bolshevists have inflicted upon her damage a thousand times greater than the grimmest imagination has ever ventured to conceive, yet, in spite of everything, I have faith in her future. After all, it is impossible permanently to destroy a nation that rests on the solid, the perpetually self-renewing, basis of agriculture. The utmost injury that foreign foes or domestic fools or traitors can inflict on a country that draws its strength from the bounty of nature cannot, in the essence of things, be more than temporary. It cannot touch the deeper and fundamental sources of life and well-being. When, therefore, we know that four-fifths of the people of Russia live on the land, and that food products alone before the war furnished about 70% of the country's exports, we know that Russia is indestructible, and that though she may bend before the storms that assail her, she can never be broken.

Whatever the future form of the government of the Russian state will be, of one thing I feel certain—that the Ukraine as well as Southern Russia will again come together with Greater Russia. The Ukraine as a separate independent republic can be only a temporary creation, and was due mainly to the desire of the population to rid themselves of the Bolshevik control of Greater Russia; over 80% of her frontier marches with Russia. Over 50% of the population within her own boundaries are Russian, with whom the Little Russians are closely intermarried. Ethnologically, they are the same people, and the language is nearer to Russian than any other Slav tongue. Her industries, manufactures and railways are owned by Russians, and her economic and political system is so interdependent with that of Russia as to make it practically certain that she will in one form or another reënter the Russian state. I am no less certain that Siberia cannot afford, for geographical, political, and economic reasons, to separate herself from Greater Russia—indeed, the Siberians themselves do not desire to do so.

As to the North Caucasus, this, also, will remain Russian, and likewise, in regard to the trans-Caucasus, where 50 separate races live and 50 different languages are spoken, I am of opinion that, with the exception of Russian Armenia, which should be joined to Armenia in Turkey, it would be a geographical, political, and economic absurdity to form separate or independent states. If this were done the trans-Caucasus would again become the cockpit of warring tribes, and in the interests of the different peoples themselves the government of a strong and free Russia will be a necessity. Besides these, there are about 18,000,000 Moslems in the Russian Empire, 8,000,000 of whom are scattered throughout Central Asia. These people, speaking several dialects and three independent languages, are so surrounded by Russians, divided by sect, economic conditions and geographical distribution, and are so untutored, that it would be impossible for them to unite or to separate themselves from Russian control. There remain Poland and Finland, which will separate themselves entirely and become independent nations. The Baltic provinces may be freed, but there must be special connection with Russia in order that she may have access to Baltic ports. The late Russian Empire will thus, in my judgment, and in that of Russians who are competent to form an opinion, be reconstituted geographically much as it was before the war, with the territorial exceptions just mentioned.

But when sanity is again in the ascendant, Russia will find herself confronted with an immense foreign indebtedness. There is only one way in which she can discharge it, and that is by developing her natural resources—in other words, her soil and its contents and its products, her untold riches in timber and minerals. Those riches at present are lying idle and almost untouched.

Why? The answer lies on the surface. Russia has virtually no railways and few roads. With a population of little more than one-half, and with an area of only one-third Russia's, the United States has more than five times the mileage of railways. That explains everything. It explains why Russian industrialism is still in its infancy and why the amazing wealth of the country has never been developed. Multiply means of communication and means of transport, and Russia's material future is beyond comparison greater than that of any other land.

Russia and Siberia open a field for commercial and industrial development incomparably greater than any other country in the world. Russia cannot do this work alone: she requires the enterprise and the financial and technical coöperation of our traders, industrialists, and engineers, to the mutual political and economic benefit of the Russian and British peoples. I urge that consideration as one of the chief reasons why the British government and the British people should watch with solicitude the course of events in Russia and should frame a Russian policy on far-seeing and sympathetic lines. It is certainly an important reason, and, one, moreover, that no people living, as we do, by commerce, can ignore, and that time can only emphasize. For if economic laws are laws of nature, and govern the political economy of the universe—and it has been shown that Bolshevism in Russia was largely due to the bad economic conditions, disorganization, and discontent—it follows that a prosperous and free Russia will be a conservative and enlightened nation, a sure guardian of civilization and the future peace of the world.

It is a British interest of the first moment, and from every conceivable standpoint, that Russia should regain her freedom and her power. In helping her to do so, in exorcising the evil spirits that now possess her, we may be sure we are furthering the cause of civilization itself far more than any selfish or material interest of our own. Two things are imperatively needed if the sanity and safety of the world are to be secured and if mankind is to go forward under a happier despensation: One is that Bolshevism should be beaten down; the other is that Russia should be raised up.

Mining Congress and Unemployment

The American Mining Congress has issued a request to its members to coöperate with the War Department and the Department of Labor in connection with the finding of work for returning soldiers. A blank is being sent out, in order to obtain the necessary information, the questions asked being as follows:

1. How many miners, skilled and unskilled, can you use if sent to you at once?
2. If you cannot use men now, how quickly will you need men?
3. Estimate the number in each classification and kind of employment.
4. Wages to be paid in each classification and kind of employment.
5. How many specialized men and what?
6. Wages of specialized men?
7. Living conditions and costs.
8. Is this employment permanent or temporary?
9. Will you pay transportation from any given point?
10. Do you board your employees?
11. Have you any preference as to married or unmarried men, color or race?
12. Do you wish to specify union or non-union men?

If it is desired to apply for the release and return of any particular men, the request should be made on a separate sheet. In all cases the question as to remuneration must be answered, and information given as to whether the position is now available or will be within a reasonable time.

Platinum at Franklin Camp, B. C.

VICTORIA CORRESPONDENCE

The recent establishment of the fact that there is platinum-bearing mineral in the Franklin camp, near Grand Forks, B. C., has caused a flutter of interest in British Columbia mining circles. William Thomlinson, ore sampler for the Canadian Munition Resources Commission, spent some time in that district late last summer, and his report, which has just been published, is accepted by some as indicating that prospectors are close on the trail of the source of the platinum which has been found in the placer ground of the Tulameen River.

Mr. Thomlinson states that he is authorized to make public the following information regarding the tests for platinum made on the material taken by himself, in September, 1918, from mineral claims situated on the so-called "black lead" in Franklin camp, Grand Forks mining division. He proceeds:

"Early in the month of August I visited Franklin camp and took samples from the various workings on the Maple Leaf mineral claim, and sent the samples to the Dominion assay office at Vancouver to be assayed for platinum. Two of the samples from the Maple Leaf claim taken from an open cut from which two cars of copper ore had been shipped were found to contain, respectively, .15 oz. and .17 oz. of platinum per ton, and the results appear to me to indicate that the platinum content of the ore was roughly proportionate to the amount of the primary copper minerals, especially chalcopyrite, showing in the ore.

"Later J. J. O'Neil, of the Dominion Geological Survey, visited the Maple Leaf claim with me, and, being interested in the mode of occurrence of the platinum, took a sample of almost pure chalcopyrite, occurring as a small lense in the pyroxenite, and had the sample assayed for platinum at the Dominion assay office at Vancouver. This sample showed a content of .38 oz. platinum per ton.

"The mineral-bearing gangue on the Maple Leaf claim is mainly pyroxenite, with some tongues or inclusions of augite-syenite on the hanging-wall side of the lode, and the copper minerals, principally chalcopyrite, occur in bunches and veinlets and as disseminated specks, throughout the pyroxenite and the syenite.

"Owing to good results from the Maple Leaf samples, and noting that the pyroxenite zone, or so-called "black lead," extends almost entirely across Franklin camp, I visited and sampled all the principal properties situated on the pyroxenite-syenite contact zone. On most of the claims so situated, the lode material appeared to be barren of economic minerals; but on several of the claims there could be seen at or near contacts a tendency for the copper or iron sulphides to form mineralized belts or masses. Most of my samples were taken from places where such segregations of copper and iron sulphides occurred, and especially from where the copper-bearing minerals were in evidence, though the oxides and sulphides of iron were also included in the samples.

"Although most of the samples taken, on being assayed, showed appreciable amounts of platinum, it cannot yet be stated with certainty that more than very small portions of the 'black lead' or pyroxenite belt can be mined on a commercial basis.

"In the samples assayed there appeared to be certain proportions between the copper-bearing minerals present and the platinum and the platinum contents; but at the Mountain Lion claim the platinum appears to be entirely associated with sulphides and oxides of iron.

"Whether the platinum occurs as native platinum or as sperrylite, the arsenide of platinum, has not yet been determined; but I presume it may be in the latter form and associated with the sulphides and oxides of copper and iron where they are found segregated in the pyroxenite zone.

"On several properties, such as the Gloucester M. C., situated near to and on the dip of the pyroxenite zone, platinum may also be found associated with the sulphide ores, and perhaps it may be advisable to have all the ores of the entire camp tested for the metals of the platinum group.

"There is, however, much to be learned regarding the mode of occurrence of the platinum, and as to the average value of the material forming the so-called 'black lead.'

"It is probable that only certain portions of the pyroxenite zone contain platinum, copper, or other metals in economic amounts. Therefore, much further investigation may be required; but I certainly consider the matter worthy of detailed research on the part of the government or of the large mining corporations.

"Samples of the undernamed properties contained platinum as follows: Maple Leaf, three samples, .15, .17 and .38 oz.; Lucky Jack, three samples, .04, .06 and .08 oz.; Mountain Lion, two samples, .09 and .09 oz.; Golden Age, one sample, .06 oz.; Averill Gap, two samples, .09 and .09 oz.; Buffalo, two samples, .08 and .19 oz.; Ottawa, one sample, .06 oz.; and Columbia, one sample, .04 ounce."

Alaska Treadwell, Alaska Mexican, and Alaska United Gold Mining Companies

A report issued by President F. W. Bradley, of the Alaska Treadwell, Alaska Mexican, and Alaska United Gold Mining companies, on Oct. 23, 1918, covers the operation of those companies on Douglas Island, Alaska, for the twelve months of 1917 and six months of 1918, in addition to the secretary's balance sheet as of June 30, 1918.

A short summary of conditions leading up and subsequent to the flooding of the Treadwell, "700," and Mexican mines is given, and it is stated that the probability of reopening the flooded workings will depend on the development at the Ready Bullion mine. At this mine, from Jan. 1, 1917, to Sept. 30, 1918, there was milled 328,990 tons, which gave a total yield of $724,686.19, at a cost of $826,819.42, which includes $54,691.89 for shaft sinking, new headframe and shaft-house, and $126,428.51 which has been spent in safeguarding the mine against salt-water leaks. At the Ready Bullion, an Alaska-Juneau type of caving stope has been cut out in the foot-wall country above the 450 level, about 600 ft. inland from the shore line, to secure waste to fill the cavities left in the mine as the broken ore and caved pillars are drawn and hoisted for the mill. The report states that the shaft has now been sunk, a crosscut started for the 2800 level, and development is being continued on the 2600 level.

The following table gives the receipts and expenditures for the three companies during 18 months ending June 30, 1918.

RECEIPTS AND EXPENDITURES OF ALASKA TREADWELL, ALASKA MEXICAN, AND ALASKA UNITED GOLD MINING COMPANIES

Companies	Receipts	Expenditures	Excess of Receipts Over Expenditures
	Twelve Months of 1917		
Treadwell	$2,370,799.93	$1,999,178 62	$371,621.31
Mexican	212,923.58	149,680.32	63,243.26
United	771,554.02	861,788.52	90,234.50 (a)
	Six Months of 1918		
Treadwell.	$441,718.50	$418,006.01	$23,712.49
Mexican.	35,033 33	37,933.57	2,900.24 (a)
United..	190,498 99	284,622.20	94,123.21 (a)

(a) Expenditures over receipts.

Exploration at the Shakan molybdenite property consisted of a tunnel driven 320 ft. on the strike of the vein, which shows an average width of 7.7 ft. with an average of 1.89% molybdenite. In addition to the development work, a wharf, warehouse and shop have been built and a tramway to the mouth of the tunnel is under construction.

Mercantile business owned exclusively by the Treadwell company earned a profit of $76,754.81 in 1917 and $23,206.54 during the first six months of 1918. Inventory as of June 30, 1918, shows supplies on hand totaling $538,039.17.

The Douglas Island companies own and operate three hydro-electric plants, which have all been tied in with the Alaska-Juneau steam-electric plant, and this has enabled them to sell and offer for sale all their steam-electric generating machinery and boilers. Net earnings from the sale of power were $62,678 in 1917, and $15,493.51 for the first six months of 1918.

Development on the 2800 level of the Ready Bullion mine is to proceed as the mine operations pay for the work, after making as large payments as possible on the indebtedness of the Treadwell company. Mr. Bradley's report closes as follows: "The affairs and operations of the three Douglas Island companies are so interlocked that it seems more logical to wind up all their lives concurrently with the working out of the Ready Bullion mine, rather than to start any immediate dissolution proceedings. Besides, such proceedings should be postponed until the verdict for or against the future of the Ready Bullion mine has been rendered by the 2800 level development work. In the meanwhile, continued patience should be asked of the shareholders in the matter of dividend payments."

Government Tools for Trade Schools

A bill (House No. 15,625) has been introduced in the House by Representative Caldwell, of New York, under which high schools and other educational institutions in the United States may be equipped with a first-class machine shop for industrial training. The machines with which to equip these schools are now in the possession of the War Department, and Mr. Caldwell proposes that "the Secretary of War shall lend them to trade and technical schools, universities, and other recognized educational institutions, which, in the discretion of the Secretary of War, should have such equipment."

The Government is protected, it being provided that "each institution so equipped shall be responsible to the United States of America, under regulations to be prescribed by the Secretary of War, for the proper care of and the safe return of such equipment when demanded, ordinary wear and tear excepted."

There is estimated to be between $200,000,000 and $300,000,000 worth of Government-owned machine tools, bought on account of the war, of which amount perhaps one-third may be absorbed by existing arsenals. The remainder, according to the terms of the appropriation bill under which they were bought, must be sold to bring the greatest possible returns to the Government.

There is no ready market for these tools at the present time, machine shops throughout the country being overstocked on account of their expansion during the war. Therefore, the sale of these tools, unless made at a considerable loss, will be strung over a number of years, which will have the effect of demoralizing the machine-building industry and lowering wages in that field. This will also entail the storage of the tools at the Government expense, and storage charges on this class of machinery approximate 20c. per sq.ft. per annum.

The proposed plan should appeal with particular strength to labor organizations, as it will put each of their members in the mechanical trades in a position to better his equipment for competition in the labor market, and at the same time put to the best practical use equipment which he and his fellow machinists have already produced.

There is a precedent in this proposal in that the War Department has been for many years empowered to lend military equipment to National Guard organizations and other bodies for military training purposes. This material can, of course, all be recalled in case it is needed in the event of another war. Before munitions can be made, however, the United States must have the machines with which to make them, and the proposal gives a means not only to educate in the public schools of America all who desire to become mechanics, but also provides storage on this material at no cost to the Government, and insures its availability when needed.

Natural and Synthetic Nitrate

A correspondent of *The Times*, London, is quoted in the *West Coast Leader* as saying that, except perhaps in Germany, not much progress has been made in the actual manufacture of synthetic nitrate, though preparations have been made, presumably as war measures. Whether these will materialize to any extent as commercial propositions under peace conditions remains to be seen. With the fall in exchange and reduction in the gold premium, the cost of production of nitrate of soda in Chile has been reduced by about 2s. per quintal. Before the war there was almost as much sulphate of ammonia being produced as is the case now, and as the demand for nitrate of soda and sulphate of ammonia will almost certainly be far greater than in pre-war times for agricultural purposes, it is reasonable to assume that nitrate producers will be able readily to dispose of at least their pre-war output.

The Kerr Lake Mining Co. reports for the fiscal year ended Aug. 31, 1918, a production of 2,582,993 oz. of silver at an operating cost of 28c. per oz. Development work to the extent of 3088 ft. during the year maintained the company's ore reserves, despite the record production.

Ore Dressing and Metallurgy

Valve control by electrical means is an attractive idea from every point of view, and the scope of application is capable of considerable expansion. An arrangement for use in connection with the blowers which supply air to blast furnaces is described; and the details of control and the safety measures provided should prove of interest.

A mechanically operated pulp sampler, by which an impartial sample is obtainable, is a necessary part of the equipment in almost all wet crushing mills. The apparatus described and illustrated herewith is not designed along entirely new lines, but several improved features have been incorporated, and actual results have proved its efficiency.

Electrical Valve Control

Motor-operating mechanisms have been applied to numerous water and steam valves, especially those of large size and where it was desirable to operate the valves from a distant point. However, only recently have they been used for purely industrial applications. Electrical engineers of steel plants will be particularly interested in the accompanying illustration, which shows two Dean valve controls on the delivery side of the blowers which supply air to the blast furnace of the Mark Manufacturing Co.'s new plate mill near Indiana Harbor, Indiana.

The air for the blast furnace is supplied by two Ingersoll-Rand 5-stage turbo blowers rated at 4000 hp., with a speed of 2250 to 2800 r.p.m. and an air delivery of 34,400 to 55,000 cu.ft. per min., at 14 lb. pressure. The air is taken in through two 72-in. intakes, the screened top of one of which can be seen in the illustration. The two discharge lines are 36-in. in diameter and lead from the blowers in the power house to the main discharge line just outside. There are two 36-in. gate valves placed at the point where the 36-in. lines enter the 48-in. main discharge line.

From the illustration it will be seen that the valves are approximately 15 ft. above the ground; hence they would be inaccessible to operate by hand. It would also be inconvenient to operate the steam throttle on the turbo blowers and valves simultaneously. At least two attendants would be required to close the throttle of the turbine and the gate valve at anywhere near the same time. Therefore, to make the operation of the valves convenient, and to guard against serious irregularities of the air flow to the blast furnace, two Dean valve controls were installed in the two 36-in. discharge lines, with the valve-control stations near the turbine throttles. With this equipment the engineer can start the turbine, and then, by merely placing the handle of the valve-control station in the open position, open the corresponding discharge valve. This convenient and speedy control is especially desirable when changing from one turbine to another. The importance of being able to open and close these two valves rapidly will be appreciated when it is remembered that blast furnaces are seldom shut down, although it is often necessary or desirable to shut down a turbo blower.

The Dean valve control is made by the Cutler-Hammer Co., of Milwaukee and New York. Primarily, it consists of a high-torque squirrel-cage motor, limit switches, with special gear arrangement, and one or more control stations.

The Dean system is entirely electrical in operation, using a fully inclosed motor as the source of power.

ELECTRICAL VALVE CONTROL ON BLOWER DISCHARGES

This motor runs at a speed of about 1600 r.p.m. and is connected to a system of combined worm and planetary gearing for the purpose of speed reduction to the valve stem. The gearing is inclosed in an oil-tight casing, and the limit mechanism is included in a space above the gearing, the whole, together with the motor, forming a single unit with only four bolting-down holes. All cables from the motor to the limit switch are incased in steel conduit, and the unit is as impervious to moisture as it is possible to make it. The motor is easily removable from the casing and can be changed in a few minutes.

The weak feature of most electrical valve controls is the inability to seat the gate securely under all conditions, caused by the motor circuit being interrupted before the limit of travel is reached, and the gate being allowed to drift into its seat. This drift is a most uncertain quantity and is dependent on friction of the moving parts. The Dean system drives the valve gate directly into the seat, under power, and to the exact point of tight closing, after which the trip mechanism releases the motor and gears from the valve stem, thus entirely eliminating over-travel, due to momentum of moving parts. It is this momentum that is the cause of jamming the gate.

Control of the valves is secured by small control stations, placed in heavy cast-iron boxes suitable for attaching to a wall or floor standard; and as many points of control as is desired, for one valve, may be obtained, at any distance from the valve. Each station is fitted with indicating lights showing the position of the gate.

The application of the Dean system to an existing standard gate valve is accomplished by furnishing a new yoke and a pair of driving gears, and it may be installed without putting the valve out of service. It is particularly adaptable to valves of the outside screw-and-yoke type, as pads for the support of the unit may be welded onto the existing yoke.

Automatic Ore-Pulp Sampler

The illustration shows a design of wet-pulp sampler which is actuated by a mechanism directly connected with a contrivance similar to a certain type of water or solution gage. The sampler possesses some features not found in the usual type of water-actuated machine. Mention is made of the apparatus in Bulletin 164 of the Institution of Mining and Metallurgy; and the drawing and data appear in connection with a report made by the Cornish Subcommittee of the Tin and Tungsten Research Committee.

It was necessary to select a sampler in which confidence could be placed. Accordingly, preliminary experiments were made on a portion of the pulp stream to ascertain: (1) The relative merits of different slot movements, and whether the slot should move horizontally and parallel with the axis of the stream or at right angles to it and down through it; (2) the solid-to-liquid ratio of the sample taken; (3) the solid-to-liquid ratio of the whole of the pulp flowing.

Two similar slot samplers were fixed to take the pulp stream in series, one moving horizontally and parallel with the axis of the stream, the other moving at right angles to it and down through it. For a period of 45 min., while the samplers were working, the whole of the pulp passing was collected in a large receptacle, evaporated, dried, and sampled.

Being satisfied that the horizontally moving sampler fulfilled the requirements, the committee had three of these made for sampling the pulp, and a larger one for sampling the effluent from the mill. Three samplers of this pattern and size were arranged to work in unison by being attached at the required distance to a long rod moving on roller guides in front of the three batteries, to which rod a reciprocating motion was given by a tippler, actuated by water. The oscillation of the tippler caused the samplers to cut their respective pulp streams at the same moment, the interval between successive cuts being governed by the rate of flow of water into the tippler.

The three samplers having been fixed in position in front of the mill, a preliminary trial run was made to ascertain: (1) The number of cuts per hour required to produce a pail full of pulp per day from each battery; (2) to establish the solid-to-liquid ratio of each sample in (1). The results of the trial are shown in the accompanying table.

DETAILS OF OPERATION OF AUTOMATIC SAMPLER

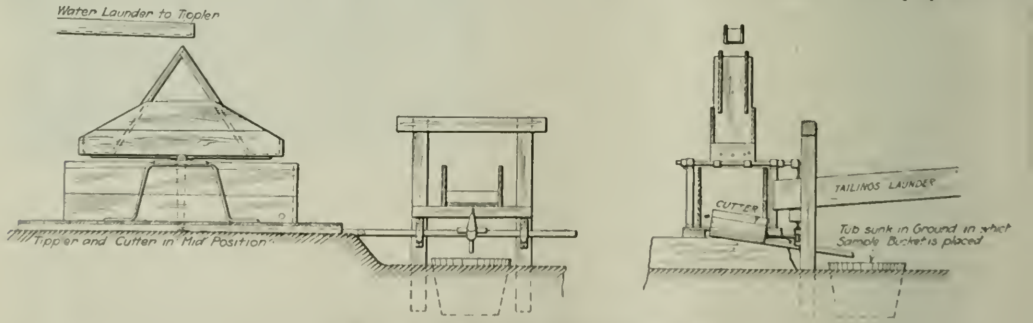
No. of Battery	Pattern of 10-Stamp Battery	Length of Run in Hours	No. of Cuts	Pulp			Solid-Liquid Ratio	Remarks
				Dry Solids	Water	Total		
1	Holman	4	60	456.5	2435.5	2892	$\frac{1}{5.3}$	
2	Holman	4	60	478.0	2694.0	3172	$\frac{1}{5.6}$	New shoes
3	Harvey	4	60	553.5	2588.5	3142	$\frac{1}{4.6}$	

Note 1.—Batteries No. 1 and No. 2 are of 1050-lb. stamps; Battery No. 3 is of 1250-lb. stamps.

Note 2.—The mill foreman states that the weights are practically in proportion to the duties.

The figures in the table showing the amount of dry solids taken by each sampler, being closely in accord with the relation of the stamp weights, justified the decision to add together the whole of the pulp obtained in each of the three pails to form the daily sample of the mill pulp.

In the preliminary trial the number of cuts per hour was 15, but it was decided to increase this to 20 for the final test. All tailings or effluent from the various parts of the mill left it in one main stream, except a small quantity of overflow water which was pumped back for dressing purposes. This latter was measured and its fine suspended material assayed. The result, affecting the assay value of the main effluent by only 0.05 lb. of Sn per ton, was considered negligible.


Water Launder to Tippler
Tipper and Cutter in Mid Position
CUTTER
TAILINGS LAUNDER
Tub sunk in Ground in which Sample Bucket is placed

METHOD OF OPERATING ORE-PULP SAMPLER

Industrial News from Washington

By Paul Wooton, Special Correspondent

Agreement Reached on Oil-Lands Bill

After years of consideration, the House and the Senate conferees have agreed upon a measure "to encourage and promote the mining of coal, phosphate, oil, gas, and sodium on the public domain." The House, after some discussion, accepted the conference report upon this, the Oil-Lands Leasing Bill. So far as oil, sodium, and phosphate are concerned, the bill provides for leasing. In the case of coal, however, there is a sale provision as well.

The conference report brought out an acrimonious discussion in the Senate. Senator Smoot was the chief opponent to its acceptance. Senator Pittman, in submitting the conference report, spoke as follows with regard to the oil feature of the measure:

> The Senate, in dealing with the oil situation, did not disturb that portion of the public domain which was reserved for the benefit of the Navy. The Secretary of the Navy and the Secretary of the Interior reserve certain of the public lands which were supposed to carry or did carry oil, for the use and benefit of the Navy. In our bill providing for the leasing of oil lands we eliminated all that land. The House, however, incorporated in its bill a provision for the development of those Navy reserves. The provision in the House bill was that the claimant of an oil well or, rather, the claimant of a mining claim under existing law who had developed an oil well that was producing, should have the right, upon the surrender of all claim of title to the mining claim under existing law, to a lease of the well.
>
> That provision was drawn by the Secretary of the Navy, the Attorney General, and the Secretary of the Interior. We adopted that in toto. In other words, as far as the Navy reserves were concerned, we have adopted everything that the Department of the Navy, the Interior Department, and the Department of Justice have asked us to adopt. As far as the Navy reserves are concerned, we reached a compromise. The House bill provided that, outside naval oil reserves, where a man had developed an oil well in good faith, without fraud, upon the public domain, under the belief that he was doing it under existing law, he should have a right to a lease on the claim, provided he surrendered all claim of title, at a royalty of not less than one-eighth, to be fixed by the Secretary of the Interior, both as to past royalty and as to future royalty. . . . The Senate bill provided expressly that the royalty should be a fixed amount, one-eighth, as to past production and future production. The compromise was that as to past production, which had probably been expended in the form of dividends or costs of new developments, there should be a fixed royalty of one-eighth, and as to the future royalties under the lease it should be not less than one-eighth and as much more as the Secretary of the Interior should state. That was the compromise and that is the bill of the conferees.

Protection for Manganese Unlikely

Efforts to continue the domestic production of manganese will not be encouraged by the Government, it is understood. The more promising reserves of this material offer only one year's supply. Additional reserves contain another year's requirements, but it is felt that these should be let alone for a possible emergency. Of course it would be impossible to make these reserves available in two years' time. The matter has been looked into by the Tariff Commission, and it is regarded as unlikely that any effort will be made to secure tariff protection for the domestic manganese industry.

The U. S. Geological Survey and the engineers co-operating with it have examined 1200 manganese deposits since the beginning of the war. At the crest of domestic production, there were 225 properties on a shipping basis. There are now 40 operations still doing work, but they are being kept alive by old contracts in practically every case.

The new contract arranged recently for Arkansas ore shows clearly, it is held, that the consumers will so penalize the siliceous ores as to leave no chance for their profitable production.

Disposal of Nitrate Stocks

The Federal Government has a surplus of 226,000 tons of sodium nitrate in the United States and 120,000 tons in Chile. An arrangement has been perfected between the director of sales for the War Department and American importers whereby the latter agree to dispose of the surplus in this country, the Government undertaking to sell to foreign interests the stocks held in South America. The importers who will have the responsibility for the sale of the surplus are held out of the primary market for shipment to the United States pending the distribution and sale of this surplus, or until import restrictions are removed by the signing of peace. The decision in this connection was reached at a conference between the director of sales, the nitrate committee, and representatives of the War Trade and War Industries boards.

Potash Bill Amended

After hearing the representatives of domestic producers of potash, the Senate Committee on Mines and Mining amended Senator Henderson's bill in some particulars and reported it favorably to the Senate. Every effort is being made to secure its consideration at this session of Congress, but it is regarded as improbable that the measure can be acted upon. The important amendment to the bill qualified the licensing provision so that, for the first 12 months after the peace treaty is signed, the maximum price of potash shall not exceed $2.50 per unit of 20 lb., and for the succeeding 12 months it shall not exceed $2 per unit. Another amendment provides that not more than one-third of the appropriation of $150,000 is to be expended in any fiscal year.

The disposition on the part of the House not to accept the war-minerals section of the validation of contracts bill made it appear, on Feb. 24, that a further change in the section would be made. It is probable that the House will be willing to accept the section if it is limited to chrome, pyrites, manganese, and graphite, and $8,000,000 is specified as the maximum amount which may be devoted to the awards.

American Institute of Mining and Metallurgical Engineers

Concluding sessions of the 119th meeting of the American Institute of Mining and Metallurgical Engineers were marked by papers of much interest and by lively discussions. Social functions were terminated by the annual banquet at the Biltmore Hotel and a visit on Thursday, Feb. 20, to the Federal shipbuilding plant at Newark, New Jersey.

SESSIONS held on the first two days of the annual meeting of the Institute were briefly reported in the last issue of the *Journal.* The presentation of technical papers was concluded on Feb. 19. At the session of mining, milling, and geology, held on that date, interest was focused on three papers dealing with the coal situation.

R. V. Norris stated that an increase of 75c. a ton on anthracite would be allowed by the Government in the near future. He said that from 30 to 35% of the anthracite mining companies are now operating at a loss.

S. D. Warriner stated that what the Government calls regulation is in reality restriction of the law of supply and demand. The coal situation is worse than it has been painted, he asserted, and more than 60% of the anthracite coal now being sent to the market is sold at a loss. The public will have to take notice, he said, of the fact that the average annual production of the anthracite mines is below normal.

Edwin Ludlow said that although the Government had allowed the operators $1,500,000 extra on some sizes, wage increases for the same period amounted to $3,000,000. He said that labor conditions in the mines are now unfavorable to increased production, using the argument that increased wages tend to lessen the energy of the workers.

AN INTERESTING MOVING-PICTURE SHOW

Moving pictures showing operations at the New Cornelia Mining Co.'s plant, mining operations of the Utah Copper Co., of the Nevada Consolidated Copper Co., milling operations of the Utah Copper Co., and smelting operations of the Garfield Smelting Co. were shown on Feb. 19 during the afternoon. The pictures were taken by the U. S. Bureau of Mines, with the coöperation of the various companies. The Eureka Pit, at Ely, Nev., and the Liberty Pit, of the Nevada Consolidated, were shown in a striking manner. Panoramas of the McGill smeltery and town site, of the Arthur and Magna concentrators, and of the Garfield smeltery were thrown on the screen. Operations at the mines at Bingham Canyon and Ely, Nev., involving drilling, bank shooting, and blasting out ore, were shown in detail, and the method of loading the overburden by steam shovels into cars and dumping was also depicted. Drilling holes with a churn drill, which was transferred by being loaded onto a car by a locomotive crane, was also illustrated, as was the blasting of boulders in the way of the steam shovel, having first provided portable safety houses for protection of the men from flying debris.

Unloading ore from cars into bins at the Arthur and Magna concentrators was illustrated on the screen, as well as the feeding of the ore on coarse grizzlies, pan conveyors, crusher rolls, Impact Screens, and Garfield tables.

ANNUAL DINNER AT THE BILTMORE

The annual banquet was held at the Biltmore Hotel on Feb. 19 and was well attended. Only three speakers were announced on the program, which was a change from previous years. Lawrence Addicks, presiding, before introducing the speakers, took occasion to commend the ladies for their part in war work, referring to them as "companions in arms." The first speaker was D. B. Dowling, president of the Canadian Institute of Mining Engineers, who expressed his desire to return the warm welcome he and his comrades received on their visit to this meeting. He stated that instead of Canada being known as the "Lady of the Snows," it should be designated the "Lady of the Warm Heart," as far as members of the American Institute were concerned. The speaker also hoped that through their allied efforts in the war, Canada and the United States will have attained feelings of mutual respect; which sentiment brought forth the cheers of the diners.

In introducing Sydney J. Jennings, president of the Institute during the last year, Mr. Addicks told the story of the hired man refusing to operate one of the new tractors on the market for hauling material, on the ground that he had required 20 years to understand a mule and it was too late in life to begin on a tractor. The same situation applied to understanding "farewell addresses" of outgoing presidents of the Institute, declared Mr. Addicks. He also stated that the Institute never enjoyed a more prosperous year than it did during Mr. Jennings' tenure of office.

The outgoing president opened his address by referring to the Colorado meeting last October, when he promised a warm welcome to Western members who would attend the next annual meeting. He also wished to extend the same welcome to members of the Canadian Institute, and told of the great advantage possessed by a city like New York for such a meeting of mining engineers. He defined a New Yorker as a man who, when he is not a southerner, is a New Englander who went west and came back to New York.

The speaker discussed many different activities of the organization during the last year. The membership of the Institute increased to 7700, the largest number by far recorded in its history. The goal to be attained, considering the advantages offered by the Institute, should be 14,000, inclusive of members, associates, and juniors.

The Institute had contributed generously toward winning the war, and of the 845 members who wore the uniform of the Allies, 23 died in service.

The president said that he had visited six of the 15 local sections during the year, and the secretary and C. W. Goodale, vice-president, had visited the others. Certain schisms were arising in the mining engineering profession, among which was a movement to form state mining societies, like trades unions, for the purpose of licensing engineers. The idea of raising the wages paid to engineers was laudable, the president maintained, but it was doubtful as to whether the method suggested was likely to achieve success. This therefore was the opportunity of the Engineering Council, the representative of all national engineering bodies, to focus the efforts of various organizations in this direction and help to bring the engineer before the public.

The change in name to that of American Institute of Mining and Metallurgical Engineers was welcomed by the speaker as being a step in the direction toward the inclusion of a larger number of men already interested in mining or in closely allied industries.

The papers presented during the session, especially those on what were termed "human" engineering, possessed extraordinary interest.

Chairman Addicks, in presenting Horace V. Winchell, the recently elected president, stated that the Institute had decided to elect the best mining geologist in the whole city of Minneapolis. However, the chairman continued in a humorous vein, the query arose that if a mining geologist cannot actually mine or develop a mine, what good is he? The answer to this is that, if you have a really good geologist, and he likes you, you can take him into court, and he will prove anything.

Mr. Winchell addressed the assemblage as "Fellow prospectors, ladies, and gentlemen," and stated that though he was familiar with the "apex" in a geological sense, he failed to appreciate the "apex of the vein" of humor of the chairman. He then made a strong plea to the assembled engineers to consider seriously the part they are called upon to take during the immediate future. Continuing, Mr. Winchell said in part:

"Though engineers can reflect with pride on the service they rendered during the recent conflict, it is not sufficient complacently to remember the past. The engineer should endeavor to get 100% efficiency out of himself and his organization. The factory, mine, and schools should provide subjects for careful consideration. The better we understand the world and its problems, the better we will be able to perform everything that concerns our own welfare. Formerly we needed foreign capital for development of our resources. Now the European nations owe us fabulous sums. This change in our status is of tremendous importance to the engineer.

"The first problem is the restoration of the devastated areas. The railroads and highways of the world are worn out and must be renewed. All this means an unprecedented effort for this country. Labor is in a condition of unrest and uncertainty which must be readjusted. This again demands the intelligence and study of engineers. Bolshevism is the antithesis of democracy. It is an abomination which is subversive of order and must be opposed by every influence which desires the welfare of mankind. The engineer is not alive to his possibilities. He is too retiring, too absorbed, and too much of a materialist. He should take part in every move for humanity, and should be a moral and educational force in every community. Efficiency stressed too much becomes an end in itself. Of the efficiency of the German people, Dr. Nicholas Murray Butler says: 'The war has taught a lesson. The proper place for efficiency is as the servant of a moral idea; otherwise it will attain only disaster.' Therefore efficiency should not be used solely for the material result obtained, often translated as tons per hour, but for the development of character.

"The education of engineers is too defective in economics, and the bad mining laws of the country are also the result of this lack of proper education. The engineer has a keen appreciation of this defect, but he is unable to provide remedies. He then becomes cynical when no remedies are provided by others. Engineers should develop the ability to make a simple analysis. They should develop pride of profession, pride of race, and pride of country."

Visit to the Shipbuilding Plant

On Thursday the members of the Institute and their friends visited the Federal Shipbuilding Co.'s plant at Newark, N. J. The party reached the plant in the forenoon and was divided into small groups, each under the leadership of one of the company's staff. The foundry, boiler, machine, and plate shops were visited in turn. All of the shops have been recently constructed, and they represent, both in building and equipment, the best that engineering experience can devise. The 12 shipways contained steel vessels in various stages of construction. One large cargo boat, in an almost completed condition, was inspected. The morning was all too short for such an extensive trip. The luncheon that completed the visit was an excellent and much appreciated testimonial to the courtesy and thoughtfulness of the shipbuilding company.

German Vandalism

The *Journal* has already drawn attention to the lamentable way in which the Germans maltreated the iron mines at Briey during their occupation of the territory in which the mines are situated. Additional information on the subject has been furnished by *Union Economique de L'Est*, from which it is learned that the Germans exploited the property by enlarging the stopes and by robbing the pillars protecting the roof, pillars which the French Mines Administration considered necessary, and which now are ruined in those workings wherein the Germans operated. Three disadvantages result from this exploitation of the pillars. In the first place, as they no longer are sufficiently strong; they must be strengthened by brick-walls, which are costly; or they will be crushed by the roof, and that would result in a big loss of ore. Second, the fall of the roof into the mine would bring about an increase in the inflow, as it would be impossible to build the supporting walls, which the destructive operations of the enemy have made necessary, quickly enough. Third, the falling of the roof would bring about subsidences of the surface, resulting in serious damage, especially when the regions thus exploited are situated under working plants, running water, railways, roads or villages.

Most of the steel works of the metallurgical plants were dismantled, robbed, and destroyed by the German bandits. The blast furnaces were not destroyed with the same ruthless thoroughness, but everywhere the blowers have been stolen. All the material and equipment have been carried to the plants in Alsace Lorraine, Luxembourg, and Germany, and part of it has already been found in the reconquered regions occupied by the French troops. This material lies, for the most part, exposed to rain, dust, and oxidation. The thieves had no time to use it; but, in any case, their aim was, above all, to ruin France.

The plants of the Acieries de Longwy, at Longwy, and of the Société de la Providence, at Rehon, can be considered as almost completely destroyed. Everything, or almost everything, must be rebuilt. The works of La Chiers have sustained comparatively little harm. The blast furnaces and the steel works were damaged only slightly, but all the rolling mills were dismantled.

The plant of the Société Metallurgique de Senellemaubeuge, is almost untouched. The blast furnaces, the mixer, the converters, the Thomas steel works and the blooming mills were only slightly damaged. The machinery of the rolling mills was, however, taken away; but the company knows the German factory in which it was placed. This plant will be able to resume operations in three or four months' time, with a monthly production of about 20,000 tons of raw products.

As for the plant of the Société Villerupt Laval-Dieu, which was bought over by the Senelle-maubeuge in 1913, the Villerupt blast furnaces are in bad condition and look as if they could never be used again, but, by way of compensation, the rolling mills and the Martin furnaces at Laval-Dieu are intact. The Germans used them as a workshop for important repairs, and the furnaces were still warm when the Allied troops arrived.

Adjustment of Mexican Finances

Following a number of informal conferences by representatives of American, British, and French governments in Paris, the appointment of an international commission was made recently for the purpose of adjusting and stabilizing financial affairs in Mexico, thereby protecting the interests of foreign investors and making it possible for the Carranza government to secure the funds necessary for the rehabilitation of the country.

The committee consists of ten American, five British and five French bankers. T. W. Lamont is to act as chairman. Other American members are: J. P. Morgan, John J. Mitchell, Walter T. Rosen, Charles H. Sabin, Mortimer L. Schiff, James A. Stillman, James N. Wallace, Albert H. Wiggin, and Robert Winsor. The following men have been appointed as alternates for the American members: John H. Fulton, Benjamin S. Guinness, Jerome J. Hanauer, E. D. Hulbert, Frank W. Remick, Francis H. Sisson, Edward R. Tinker, and J. Y. G. Walker.

Though no definite program of procedure has yet been announced by the committee, in general its functions will be to inform itself as fully as possible as to existing conditions in Mexico, with a view to such positive action as may be taken whenever circumstances permit.

New Date Set for 27th's Return

According to our latest news from the 27th Engineers, cabled by Colonel Perry this week, it is expected that the regiment will embark for home on Mar. 5. There have been disappointments during the last two months of waiting, but some confidence in the new date seems to be indicated.

The disappointment is as keen on this side as it must be on the other. Let there be no similar disappointing of the men in the welcome they receive on their return. They are coming back hoping for the old acquaintances and the old surroundings, and it may safely be said that the welcome awaiting them will be more appreciated if they are assured that their old employment, or better, awaits them when the shouting is over.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including interest	$19,745.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
W. L. Strauss	10.00
Employees Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5.00
Carl J. Trauerman (second contribution)	5.00
Carl Tombo	6.00
Total	$19,965.46

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Chile Copper Company

The seventh quarterly report of the Chile Copper Co., covering the third quarter of 1918, shows that copper production was 23,398,490 lb., as compared with 24,556,156 lb. for the quarter ended June 30, 1918. Total ore treated was 968,115 dry tons, averaging 1.60% copper, as compared with 950,885 tons, of 1.58% copper, during the second quarter. Net copper recovery was 81.72 per cent.

The following costs and profits are stated on the basis of copper sold and actually delivered, the undelivered copper being carried in the inventory at cost:

	Third Quarter 1918, Per Lb	Second Quarter 1918, Per Lb
Cost of production, exclusive of excess-profits tax, and obsolescence	18.30c	17.75c
Cost f.o.b. plant, including depreciation	11.94c	11.28c
Cost of delivering, including freights, handling, selling, miscellaneous expenses, and income taxes, with credits for miscellaneous earnings	2.87c	2.59c.
Depletion of ore reserves, interest and amortization of bond discount	3.49c	3.86c

The following tabulation shows the financial outcome of the operations of both the Chile Exploration Co and the Chile Copper Co. for the third quarter of 1918, compared with the results for the preceding quarter:

	Third Quarter 1918	Second Quarter 1918
Net profit on copper delivered (after deducting depreciation)	$3,276,944.84	$2,006,671.55
Miscellaneous income	46,091.06	68,878.36
Interest on call loans and bank balances of the Chile Copper Co	78,181.35	15,634.96
Total income	$3,401,217.25	$2,091,184.67
Amortized discount on 15-year 6% convertible bonds	35,000.00	35,000.00
Accrued bond interest of Chile Copper Co	660,008.26	572,788.58
Expenses of Chile Copper Co	4,578.54	37,648.53
Balance undivided profits—both companies	$2,701,630.45	$1,445,747.56

The above earnings are computed on the basis of 25.48c. per lb. of copper delivered during the quarter, compared with 23.69c. per lb. delivered during the preceding quarter.

Editorials

Russia

WE GIVE a great deal of space this week to the subject of Russia, for two principal reasons: (1) the Russian problem comes pretty near to being the most important of all problems at the present time; (2) Leslie Urquhart, a distinguished British mining engineer and administrator of mines, is recognized among his professional colleagues as the leading authority on the Russian problem. We think we may say that he has attained general recognition in Great Britain to the same effect. As the head of the great Anglo-Russian mining and metallurgical enterprises in Siberia, as an engineer and administrator who has been accustomed to close observation and accurate deduction, as one who has recently been in Russia on a prolonged visit for the purpose of looking after the affairs of his companies, there is scarcely anyone who is better qualified to speak about conditions there and to forecast the prospects.

It is amazing that the statesmen and politicians who are trying to arrange the terms of peace in Paris should be so blind to the situation in Russia and what needs to be done there. What is the use of arranging a League of Nations if Russia is going to be left helpless and subject to the exploitation of Germany? In that great country, with its marvelous natural resources, Germany would find the opportunities that the United States had in the Great West after the Civil War.

The idea of separating Germany and Russia by a line of buffer states is a doubtful expedient. Mr. Urquhart expects to see the Ukraine, the Baltic provinces, and other parts of the former empire gravitate back to Great Russia. Inevitably will they do so, for the same economic reasons that made them come together in the past will keep them from remaining apart in the future. We are inclined to go further in expecting to see the return of Poland and Lithuania, which will have difficulty in preserving any economic independence. They must draw either to Germany or to Russia, and will naturally lean to the latter, with which they are kin. Even so with Finland, although there is no kinship.

America and Great Britain should lend a helping hand to those loyal, humiliated Russians who are endeavoring to recover their country from the clutches of the Bolsheviki, who have created such a hideous disaster.

Federal Income Tax Law

ON FEB. 6 the Conference Committee reported to the Senate and to the House the largest tax bill of history. It may be recalled that during 1917 and 1918 there was considerable discussion in regard to the intent of certain sections of the earlier laws, and that an important ruling was rendered by the Treasury Department under date of Feb. 7, 1917, in respect to depreciation and depletion to be allowed in the case of mines. In this connection it will be of interest to compare the paragraphs on this subject under "Deductions Allowed" as they appear in the amended bill of October, 1917, and in the present conference bill:

Federal Income Tax Law, enacted Sept. 8, 1916, as amended by the acts of Mar. 3, 1917, and Oct. 3, 1917. Part I—On individuals. Deductions allowed. Sec. 5, Par. 8: "(a) In the case of oil and gas wells a reasonable allowance for actual reduction in flow and production to be ascertained not by the flush flow, but by the settled production or regular flow; (b) in the case of mines a reasonable allowance for depletion thereof not to exceed the market value in the mine of the product thereof, which has been mined and sold during the year for which the return and computation are made, such reasonable allowance to be made in the case of both (a) and (b) under rules and regulations to be prescribed by the Secretary of the Treasury: Provided, That when the allowance authorized in (a) and (b) shall equal the capital originally invested, or in case of purchase made prior to Mar. 1, 1913, the fair market value as of that date, no further allowance shall be made. No deduction shall be allowed for any amount paid out for new buildings, permanent improvements, or betterments, made to increase the value of the property or estate, and no deduction shall be made for any amount of expense of restoring property or making good the exhaustion thereof for which an allowance is or has been made."

Conference Bill. Title II—Income Tax. Part II—Individuals. Deductions allowed. Sec. 214: "(10) In the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for depletion and for depreciation of improvements, according to the peculiar conditions in each case, based upon cost including cost of development not otherwise deducted: Provided, That in the case of such properties acquired prior to Mar. 1, 1913, the fair market value of the property (or the taxpayer's interest therein) on that date shall be taken in lieu of cost up to that date: Provided further, That in the case of mines, oil and gas wells, discovered by the taxpayer, on or after Mar. 1, 1913, and not acquired as the result of purchase of a proven tract or lease, where the fair market value of the property is materially disproportionate to the cost, the depletion allowance shall be based upon the fair market value of the property at the date of the discovery, or within 30 days thereafter; such reasonable allowance in all the above cases to be made under rules and regulations to be prescribed by the Commissioner with the approval of the Secretary. In the case of leases the deductions allowed by this paragraph shall be equitably apportioned between the lessor and lessee."

In respect to the depletion of mine and oil properties it is evident that the present bill attempts to simplify without altering the intent of the earlier bill. The wording is somewhat different, but the opinions and rulings of the department made during 1917 and 1918 will undoubtedly apply without the necessity of review and modification.

The provision for the valuation of a mining property discovered since Mar. 1, 1913, namely, that it "shall be based upon a fair market value of the property at the date of discovery, or within 30 days thereafter," may be eminently fair in its intent toward the discoverer or owner of the property, but its application will admit of various and sundry conclusions. Especially is this true when the department's ruling of Feb. 7, 1917, is taken into consideration. One sentence of that ruling reads: "Neither must the value determined as of Mar. 1, 1913, be speculative, but must be determined upon the basis of the salable value en bloc. . . ."

The value of a discovery from a prospector's point of view is often a large sum and does not appreciably diminish in the course of 30 days. From the purchaser's point of view, a prospect is more likely to be considered a liability than an asset of value, and seldom is it considered worth much more than a grubstake.

We have no solution for the vexatious problem of determining the salable value of a prospect, especially when the problem is complicated by the fact that, in practice, prospective value is an essential factor in its solution, whereas, by law, prospective value must not be taken into consideration.

The Treasury Department has, however, shown justice in its interpretation of the law during the last year; and we scarcely expect serious conflict upon this point in the future when a serious attempt is made to reach an equitable valuation for depletion and tax purposes.

The Engineer in Politics

ONE of our distinguished public officials has rightly said that every matter of interest was a political matter. Sooner or later every subject that attracts public attention gets into politics in some form or other, and it is right that it should. In our form of government, political parties make laws and enforce them; they provide or arrange for public utilities and many of our private necessities; they largely regulate the lives of the people. When we say that certain subjects must be removed from the field of politics we do not mean the advice to be taken literally. It is the baneful effects of politics that are harmful. If a man is in the civil service he occupies his position continuously because of a law passed by some political party when in power. Our public-school system, which we cherish because it is far removed from the field of politics, is superior to that of some other states because it was not sponsored by a political party.

But what has all this to do with mining engineers? Just this: Engineers—mining engineers no more, no less, than other engineers—are unquestionably entitled to take a prominent part in all public affairs. The capable engineer is not gifted with any special intuition, but, no matter how strange the subject and if given time and opportunity, he knows how, and will be able, to get at its principles and details. With these in mind he is able to create and construct, to stimulate human effort, and to accomplish.

For some unaccountable reason, and in spite of being well equipped, the engineer is prone to take but little interest in public affairs; and there is no doubt that he is shirking his civic duty by remaining in the background. Several of our prominent engineering societies have maintained for years that it was improper for such organizations to express views on public or political questions officially. If they insist on taking that attitude, the public cannot be criticised for regarding their members as a collection of "high-brow" incompetents.

There was never a time when our Government and the public were in greater need of the careful guiding thought of such men as are in the engineering profession. The Government does not appreciate and the public does not know what engineers can do, and so neither asks for help from them. We let our special talents be known to a few who may have use for them. We take our pay, and feel that we have done something useful. But we have a broader field in which to work—one where our work will not be measured in dollars and cents; possibly not even in gratitude. Our pay, if we realize any, will be only in the consciousness of something done that was worth while.

It is our duty to take an active interest in public affairs, to get into politics and make our presence felt. If our political system is dirty, we have no business to wash our hands of it until we have done our best to remedy this deplorable situation. Far from being unethical and unprofessional, it is our privilege and our duty, both in the aggregate and as individuals, to let our light so shine that it may be seen of men.

Salvage of War Equipment

REDISTRIBUTION and economic use of the immense stocks of supplies and equipment now in Government hands form a problem, or many problems, of serious moment. We have already pointed out that the Government ought to use great care and judgment in disposing of its stores of metals, so that their distribution may not unduly interfere with normal production and trade.

A suggestion has been made, in the form of a bill recently introduced into Congress by Representative Caldwell, of New York, authorizing the Secretary of War to lend to such educational institutions as may be able to use them, machine tools suitable for their purpose. It is estimated that the Government, through its war activities, has come into possession of machine tools to the value of $200,000,000 to $300,000,000. Some of these pieces will remain in service in the arsenals, and some will be absorbed into normal manufacturing enterprises, but the great majority must be either stored or scrapped.

There is scarcely a school that is attempting to give manual or technical training that could not use some pieces of this machinery to advantage. It has been paid for, it has served its primary purpose, and now, if an additional use may be found for it other than as scrap, all of the American people will be gainers.

We would not advocate the establishment of new trade schools in order to conserve machinery—there are already too many struggling for existence under financial handicaps. But we most emphatically support the plan of loaning or giving to the established institutions, under proper restrictions, such material as they want and can use to advantage. Such action will relieve the Government of what might constitute wanton destruction, and it will supply some of the schools with badly needed equipment of standard pattern, but, above all, it will give to additional hundreds an opportunity of acquiring mechanical skill.

Whether our boys are to become tradesmen, farmers, miners, mechanics, or what not, a certain amount of mechanical training will not be wasted. The tradesman runs his truck; the farmer now uses steam power, electricity, and gasoline; the miner handles all sorts of machines—in short, we are living in a mechanical age, and a man who cannot handle the simple tools is, or ought to be, the exception.

There is in this suggestion a point of some importance in addition to that of helping the boys. These machines will only be loaned. If an emergency arises, they will immediately be restored to the Government, and, in the meantime, there will have been trained a large number of men who can use them. In other words, we have in this proposal a practical phase of preparedness.

We hope that our representatives at Washington will see the wisdom of the plan proposed by Mr. Caldwell, that the authorization asked will be granted, and that every school in position to make use of the equipment will ask for and get it.

BY THE WAY

George Graham Rice, a poet of surpassing imagination when it comes to promoting oil and other stocks that are warranted to make purchasers wealthy even faster than a grand jury can return indictments, was adjudged insolvent by Judge Martin T. Manton of the Federal District Court, Feb. 3, in the face of his claim that he had "Rice oil stocks" of great value. According to the Federal authorities, Rice's liabilities exceed $700,000, though he asserts he has assets consisting of outstanding accounts worth $237,000, stocks and other securities to the value of $200,000, and the aforesaid oil stocks. Two indictments for grand larceny against Rice were found by the Grand Jury last July, two days after he was arrested by Federal agents on a charge of using the mails to defraud.

The writer of "Grub Stakes and Millions," published in *Harper's Monthly* of February, 1880, gives an excellent example of how some would-be social reformers get their dope. He says, in part: "At a certain depth . . . you stop at side drifts or cross-cuttings in which men are at work, and here you see, walled in by rock, the fissure vein. Some are 'stoping,' or cutting pieces away with the pick; others holding the steel wedges, and others striking them tremendous blows with sledge-hammers. They are, by-the-way, in the habit of accompanying these blows with guttural sounds, the hearing of which induced a special correspondent of the gentler sex—ignoring the fact that they receive three dollars per diem, own chronometer watches, and have fine bank accounts, and silver spoons on their tables—to write a soul-moving description of the poor down-trodden miner, imprisoned far from the light of the blessed day, uttering terrible groans as he toiled his life away for the enrichment of the bloated and pampered capitalist."

Cap'n Dick was keeping cases on the new compressor and was apparently well satisfied with its performance. "M'son, it do my 'eart good to see 'er gaw. There she stan's, twenty-four 'ours in tha day, a-workin' forth an' back an' blawin' like some bloody gert creature. An' 'ow do tha men like un? W'y, dam-me, son, never a word o' complaint 'as I 'eard. Only one time 'as I ever 'eard kickin' 'aout men 'avin' too much h'air. Nummer o' years h'ago Dicky Broad, 'e wuz tribbitin' to Dolrand mine, an' Sundays 'e wuz pumpin' church h'organ. One day 'long come one o' these 'ere chaps w'ot 'ad a wonnerful touch on tha h'organ, so rector 'e h'asks 'im to play mornin' service. An' 'ow 'e could play, m'son. 'E'd start to one h'end o' tha bloody keys an' dash down to t'other, an' 'ere all tha time wuz Dicky in tha bellus-pit, a-workin' tha pump 'andle an' sweatin' sumthin' h'awful. After service, Dicky 'e come h'out, an' walkin' h'up to this 'ere h'organ man 'e sez, 'Mister, I don't naw thee, but I tell 'e one thing—if th'art to play service tonight, thee can do as thee bloody well pleases, but I'm gawin' to blaw "H'abide Wi Me." ' "

A compass is a handy thing to take along on one's travels, and it has been said that traveling broadens the mind. But some folks have the misfortune to be shunted back home before the broadening influence overcomes the single-track habit of thought. Sometimes domestic affairs cut short one's journeying; sometimes urgent business; and sometimes the loss of a job or the patent necessity of getting back on the job, lest it be taken away. Compasses are better guides than will-o'-the-wisps. Straws show which way the wind blows, to be sure; but winds are fickle, and even a patient camel may get Bolshevik notions when straws predominate. You can imbibe "Dutch courage" through straws, but the wisdom of travelers owes more to the compass. The compass of Cristoforo Colombo showed the way westward. Some compasses have the "W" on one side and others have the "W" on the other side. All English and American ships have the "W" invariably on the same side. An engineer's compass usually has the "W" on the right side. In French and in Spanish, the "W" is generally "O." The worthy gentlemen who traveled with Cristoforo Colombo were justified in worrying to a certain extent when they observed a variation in the relation of the magnetic needle to the pole star, after a considerable change in longitude. In modern times mariners can keep pretty close to a course, unless dodging torpedoes, mines, or an effeminate book published every year or so that gives the latest news on the magnetic variation at different points. But local attraction is the cause of many people fooling themselves, chiefly by ignoring the effects of local attraction. A good surveyor can do fair work with a needle, even where the local attraction is erratic; simply taking backsights and studying out the correct bearings. But some folks consider themselves superior to looking over the fields of local attraction, remarking that it is not necessary. In the case of the eminent consulting engineer who took observations at intervals with his Brunton compass, commenting later on the remarkably straight course steered by the officers of the P. & O. steamer from Key West to Havana, one may suspect a humorous evasion of local attraction. But the first prize for solid ivory should be awarded to a graduate mining engineer who sharply criticized some surveying work done by a French engineer in Peru, saying that Monsieur J. had entirely balled up the location of some mining claims by getting directions totally reversed; simply due to the fact that he failed to remember the well-known principle that the weighted end of the magnetic needle always points toward the most distant pole. When drinks were ordered in appreciation of the joke, this partly traveled person persisted that he was in deadly earnest; making no concessions until asked where in thunder the fool needle would point when exactly equidistant from the poles—terrestrial, magnetic, or barber's, as the case might be. How many readers of the *Journal* can tell, off hand, the answer to this question?

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over any order in coupons if so requested.

COPPER

10503—ALASKA—Mining Copper at Kennecott, Alaska. (Min. and Sci. Press, Jan. 11, 1919; 7½ pp., illus.) 20c.

10504—ARIZONA—Mining Methods of United Verde Extension Mining Co. Chas. A. Mitke. (Bull. 145, A. I. M. E., Jan., 1919; 13 pp., illus.)

10505—BRITISH COLUMBIA—Indian River Copper Deposits, Vancouver Mining Division. Charles Camsell. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 2½ pp.)

10506—CENTRAL STATES—Silver, Copper, Lead, and Zinc in the Central States in 1917. J. P. Dunlop and B. S. Butler. (Mineral Resources of the U. S., 1917—Part I; 58 pp.)

10507—COPPER—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917—Part I; 36 pp.)

10508—CUPRO-NICKEL; an Examination of Its Physical Properties and Structure. T. H. A. Eastick. (Metal Ind., Jan., 1919; 3 pp., illus.)

10508a—FINANCE—Anaconda Copper Mining Company. (Eng. and Min. Journ., Feb. 1, 1919; 2 pp.) 20c.

10509—METALLURGY—Volatilization of Cuprous Chloride on Melting Copper Containing Chlorine. S. Skowronski and K. W. McComas. (Bull. 146, A. I. M. E., Feb., 1919; 11 pp., illus.)

10510—PURE COPPER—The Effect of Progressive Cold Work Upon the Tensile Properties of Pure Copper. W. E. Alkins. (Advance copy, Inst. of Metals, Sept., 1918; 14 pp., illus.)

10511—QUEENSLAND—Resources of the Cloncurry Copper Field—I. S. Harris. (Chem. Eng. and Min. Rev., Nov. 5, 1918; 4 pp., illus.)

10512—UTAH COPPER ENTERPRISE. IX, The Smelting of the Concentrate. T. A. Rickard (Min. and Sci. Press, Dec. 28, 1918; 8 pp., illus.) 20c.

GOLD AND SILVER GEOLOGY

10513—NEVADA—Geology and Ore Deposits of the Yerington District, Nevada. Adolph Knopf. (Prof. Paper 114, U. S. Geol. Surv.; 68 pp., illus.)

10514—BRITISH COLUMBIA—Investigations in the Slocan District, B. C. M. F. Bancroft (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 13 pp.)

GOLD AND SILVER—GENERAL

10515—CENTRAL STATES—Silver, Copper, Lead, and Zinc in the Central States in 1917. J. P. Dunlop and B. S. Butler. (Mineral Resources of the U. S., 1917—Part I; 58 pp.)

10516—GRAPHICS of Gold and Silver. M. W. von Bernewitz. (Min. and Sci. Press, Feb. 15, 1919; 1 p., illus.) 20c.

10517—MILL—The New Mill of the Elkoro Mines Company. Henry Hanson. (Salt Lake Mining Rev., Jan. 30, 1919; 2½ pp., illus.) 20c

10518—UTAH—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917—Part I; 36 pp.)

GOLD AND SILVER—CYANIDING

10519—PRECIPITATION—Effect of Oxygen upon the Precipitation of Metals from Cyanide Solutions. (Bull. 145, A. I. M. E., Jan., 1919; 2 pp.) Discussion of paper of T. B. Crowe.

10520—TAILINGS—The Process and Plant of the Dayton Placer Recovery. George T. Hansen. (Salt Lake Min. Rev., Jan. 15, 1919; 2 pp., illus.) 20c

IRON AND STEEL—METALLURGY

10521—ALLOY STEEL—Effect of Rate of Temperature Change on Transformations in Alloy Steel. H. Scott. (Bull. 146, A. I. M. E., Feb., 1919; 11 pp., illus.)

10522—BLAST FURNACES—Etude sur Les Hauts Fourneaux, d'Apres les Travaux de Francis Mulet. M. Damour. (Bull. de la Soc. de l'Ind. Minerale, 3 Livr., 1918; 47 pp., illus.)

10523—BLAST-FURNACE GAS—Remarques Relatives a la Composition des Gaz de Haut Fourneau et Methodes Volumetriques Pour le Calcul du Gaz Produit et du Vent Souflle. J. Seigle. (Bull. de la Soc. de l'Ind. Minerale, 3 Livr., 1918; 19 pp., illus.)

10524—BLAST FURNACE SLAG—Widening Demand for Blast-Furnace Slag. Clarence E. Wright. (Iron Age, Jan. 23, 1919; 2½ pp., illus.)

10525—ELECTRIC FURNACE—Developments in the Rennerfelt Furnace. H. A. De Fries and Jonas Hertenius. (Iron Age, Jan. 16, 1919; 1½ pp., illus.)

10526—ELECTRIC SMELTING OF IRON ORES—The Commercial Feasibility of the Electric Smelting of Iron Ores in British Columbia. Alfred Stansfield. (Bull. 2, B. C. Dept. of Mines, 1919; 95 pp.)

10527—FRANCE—Les Gisements de Fer de la Savoie. Albert Bordeaux. (Bull. de la Soc. de l'Ind. Minerale, 3 Livr., 1918; 17 pp., illus.)

10528—MANGANESE ALLOYS—Use of Manganese Alloys in Open-hearth Practice. Samuel L. Hoyt. (Bull. 146, A. I. M. E., Feb., 1919; 12 pp.)

10529—OXYGEN IN IRON AND STEEL—A Critical Study of the Ledebur Method for Determining Oxygen in Iron and Steel. J. R. Cain and Earl Pettijohn. (Tech. Paper No. 118, Bureau of Standards, Jan. 11, 1919; 33 pp., illus.)

10530—POTASH CONTENT of Blast Furnace Charges. N. H. Gellert. (Iron Age, Feb. 6, 1919; 1½ pp.)

10531—REFRACTORIES—Basic Refractories for the Open-hearth. J. Spotts McDowell and Raymond M. Howe. (Bull. 146, A. I. M. E.; 18 pp., illus.)

10532—RUST-PROOFING of Iron and Steel. Elmer S. Whittier. (Metal Ind., Feb., 1919; 3 pp.)

10533—SPECIFIC DENSITY OF STEEL—Does Forging Increase Specific Density of Steel? H. E. Doerr. (Bull. 145, A. I. M. E., Jan., 1919; 2½ pp., illus.)

LEAD AND ZINC

10534—ALLOYS—Recherches sur des Alliages Riches en Zinc. Leon Guillet and Victor Bernard. (Rev. de Metallurgie, Sept.-Oct., 1918; 19 pp., illus.)

10535—CENTRAL STATES—Silver, Copper, Lead and Zinc in the Central States in 1917. J. P. Dunlop and B. S. Butler. (Mineral Resources of the U. S., 1917—Part I; 58 pp.)

10536—CONDENSATION of Zinc from Its Vapor. (Bull. 145, A. I. M. E., Jan., 1919; 1½ pp.) Discussion of paper of C. H. Fulton.

10537—ELECTROLYTIC DEPOSITION of Zinc. H. E. Broughton. (Chem. and Met. Eng., Feb. 15, 1919; 8 pp., illus.)

10538—FLOTATION—Treatment of Accumulated Tailing as Practiced by the Zinc Corporation. Geo. C. Klug. (Min. Mag., Dec., 1918; 3 pp., illus.) 40c.

10539—FLOTATION of Oxidized Ores of Lead. Glenn L. Allen (Chem. and Met. Eng., Feb. 15, 1919; 7 pp., illus.)

10540—FOREIGN ZINC-SMELTING CAPACITIES and Prospects. W. R. Ingalls. (Eng. and Min. Journ., Feb. 1, 1919; 1 p.) 20c.

10541—MINING AND MILLING of Lead and Zinc Ores in the Missouri-Kansas-Oklahoma Zinc District. Clarence A. Wright. (Bull. 154, U. S. Bureau of Mines; 134 pp., illus.)

10542—UTAH—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917—Part I; 36 pp.)

10543—UTAH—The Big Cottonwood Coalition Mines Co. C. E. Robertson. (Salt Lake Min. Rev., Jan. 30, 1919; 1½ pp., illus.) 20c.

OTHER METALS

10544—ALUMINUM—Annealing Cold-Rolled Aluminum Sheets by Abbreviated Exposures at Various Temperatures. Robert J. Anderson. (Advance copy, Inst. of Metals, Oct., 1918; 18 pp., illus.)

10545—ALUMINUM Industry in 1918; a Review of the Conditions Existing as to Supply and Demand of the Light Metal and Outlook for the Future. (Metal Ind., Jan., 1919; ½ pp.)

10546—ALUMINUM: Its Use in the Motor Industry in England; the Application of the Metal in Replacing Steel and Other Metals. E. Carey Hill. (Metal Ind., Dec., 1918; 4 pp., illus.) 20c

10547—ANTIMONY—A Bibliography on the Analysis of Antimony. (Elton R. Darling. (Chem. Eng., Jan., 1919; 2 pp.)

10548—CHROME—Brief on the Status of the Chrome Industry. Courtenny De Kalb. (Min. and Sci. Press, Jan. 4, 1919; 4½ pp.) 20c.

10549—MAGNESIUM in 1917. Ralph W. Stone. (Mineral Resources of the U. S., 1917—Part I; 6 pp.)

10550—MANGANESE—Developing Arkansas Manganese. (Iron Tr. Rev., Jan. 30, 1919; 2½ pp., illus.)

10551—MANGANESE—Problems Involved in Concentration and Utilization of Domestic Low-grade Manganese Ore. Edmund Newton. (Bull. 146, A. I. M. E., 10 pp.)

10552—MANGANESE—Use of Manganese Alloys in Open-hearth Practice. Samuel L. Hoyt. (Bull. 146, A. I. M. E., Feb., 1919; 12 pp.)

10553—MANGANESE in New Mexico. E. H. Wells. (Bull. 2, N. M. State School of Mines, 1918; 85 pp., illus.)

10554—MANGANESE Investigations in the Slocan District, B. C. M. F. Bancroft. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 13 pp.)

10555—NICKEL—Occurrence, Production, Treatment, Etc., with special reference to South Africa. T. G. Trevor. (So. Afr. Journ. of Ind., Nov., 1918; 10 pp.)

10556—TIN—Effect of Heating and Quenching Cornish Tin Ores Before Crushing. Arthur Yates, also discussion. (Bull. 170 and 171, I. M. M., Nov. 14 and Dec. 12, 1918; 4 pp.)

10557—TIN DEPOSITS in Nassarawa, Nigeria. W. E. Thomas. (Min. Mag., Nov., 1918; 3 pp., illus.) 40c.

10558—TUNGSTEN ORES—Experiments Relating to the Enrichment of Tungsten Ores. R. W. Gannett. (Econ. Geol., Jan.-Feb., 1919; 11 pp.)

NON-METALLIC MINERALS

10559—ASBESTOS—Shot Drilling Around Thetford Mines. J. W. Davis. (Can. Min. Journ., Jan. 22, 1919; 2 pp., illus.) 20c.

10560—BARITE Deposits of Missouri. W. A. Tarr. (Econ. Geol., Jan.-Feb., 1919; 22 pp., illus.)

10561—BRITISH COLUMBIA—Note on the Occurrence of Diatomaceous Earth, Clay, and Magnesite Along the Route of the Pacific Great Eastern Railway. Charles Camsell. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 3 pp.)

10562—EPSOMITE—Spotted Lakes of Epsomite in Washington and British Columbia. Olaf P. Jenkins. (From Vol. XLVI, Am. Journ. of Sci., Nov., 1918; 7 pp., illus.)

10563—FLUORSPAR AND CRYOLITE in 1917. Ernest F. Burchard. (Mineral Resources of the U. S., 1917—Part II; 13 pp.)

10564—GRAPHITE—Alabama Graphite in 1918. W. F. Prouty. (Eng. and Min. Journ., Jan. 25, 1919; 2 pp.) 20c.

10565—GRAPHITE INDUSTRY, The. Chas. Spearman. (Can. Min. Journ., Feb. 12, 1919; 1¾ pp.)

10566—LIMESTONES of Ontario. Howells Frechette. (Summary Report, Mines Branch of the Can. Dept. of Mines, 1917; 26 pp.)

10567—MAGNESITE—Basic Refractories for the Open-hearth. J. Spotts McDowell and Raymond M. Howe. (Bull. 146, A. I. M. E., Feb., 1919; 18 pp., illus.)

10568—NITRATE OF SODA in 1918. (Chem. Tr. Journ., Jan. 18, 1919; 1½ pp.)

10569—PHOSPHATE—A Geologic Reconnaissance for Phosphate and Coal in Southeastern Idaho and Western Wyoming. Alfred Reginald Schultz. (Bull. 680, U. S. Geol. Surv., 1918; 84 pp., illus.)

10570—RHODESIA—The Mineral Resources of Rhodesia. F. P. Mennell. (So. Afr. Journ. of Ind., Nov., 1918; 7 pp.)

10571—SALT—Notes of a Discovery of Rock Salt in Nova Scotia. L. Heber Cole. (Can. Min. Journ., Jan. 8, 1919; 2 pp., illus.) 20c.

10572—SILICATES—Les Siliciures Metalliques. Jean Escard. (Metaux, Alliages et Machines, Jan., 1919; 2¼ pp.)

10573—SODIUM Salts in 1917. Roger C. Wells. (Mineral Resources of the U. S., 1917—Part II; 37 pp.)

PETROLEUM AND NATURAL GAS

10574—COLOMBIA—Petroleum Development Now Under Way and in Prospect in Colombia, South America. (Oil Tr. Journ., Feb., 1919; 1 pp.) 40c.

10575—GOVERNMENT CONTROL—Coöperation in the Oil Industry. (Min. and Oil Bull., Jan., 1919; 3 pp., illus.)

10576—MOROCCO—Les Terrains Petrolifères au Maroc. G. Moussu. (Bull. Soc. d'Encouragement, Sept.-Oct., 1918; 6½ pp., illus.)

10577—NATURAL GAS: Its Production, Service and Conservation. Samuel S. Wyer. (Bull. 102, Part VII. U. S. National Museum, Mineral Ind. of the U. S., 1918; 67 pp., illus.)

10578—NATURAL-GAS STORAGE. L. S. Panyity. (Bull. 145. A. I. M. E., Jan., 1919; 2½ pp., illus.)

10579—OIL SHALE—Commercial Possibilities of Oil Shale. Harry J. Wolf. (Eng. and Min. Journ., Feb. 1, 1919; 2½ pp., illus.) 20c.

10580—OKLAHOMA—Structure and Oil and Gas Resources of the Osage Reservation, Oklahoma. Frank R. Clark. (Bull. 686-I, U. S. Geol. Surv., 1919.)

10581—SCOTLAND—The Scottish Mineral Oil Industry. (Journ. Soc. Chem. Ind., Dec. 31, 1918; 1⅓ pp.)

10582—WATERS—Petroleum Hydrology Applied to Mid-Continent Field. Roy O. Neal. (Bull. 145. A. I. M. E., Jan., 1919; 7½ pp.)

ECONOMIC GEOLOGY—GENERAL

10583—BRITISH COLUMBIA—Economic Geology of the Hazelton District, B. C. J. J. O'Neill. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 3 pp.)

10584—BRITISH COLUMBIA—Reconnaissance Along the Pacific Great Eastern Railway Between Squamish and Lillooet. C. Camsell. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 11 pp., illus.)

10585—DIPS—Anomalous Dips. Eugene Wesley Shaw. (Econ. Geol., Dec., 1918; 11½ pp.) 60c.

10586—NEVADA—The Genesis of the Ores at Tonopah, Nevada. Edson S. Bastin and Francis B. Laney. (Prof. Paper 104, U. S. Geol. Surv., 1918; 50 pp., illus.)

10587—RACEWINITE: A Peculiar Mineral from Ore Deposits in Utah. A. N. Winchell. (Vol. XIII, Econ. Geol., Dec., 1918; 5 pp., illus.)

10588—TESTS—Simple Tests of Economic Minerals. Herbert Lang. (Min. and Sci. Press, Jan. 4, 1919; 2¾ pp.) 20c.

MINING—GENERAL

10589—ALASKA—Alaska's Mineral Development During 1918. J. L. McPherson. (Min. and Sci. Press, Jan. 11, 1919; 3 pp., illus.) 20c.

10590—ANTHRACITE MINING COSTS—R. V. Norris, E.M., M. Sc. (Bull. 146, A. I. M. E., Feb., 1919; 14 pp., illus.)

10591—CANADA—A General Summary of the Mineral Production of Canada During the Year 1917. John McLeish. (No. 499, Can. Dept. of Mines, 1919; 27 pp.)

10592—COAL—Methods of Mining Coal. W. C. Bochert. (The Pahasapa Quart., Feb., 1919; 14 pp., illus.)

10593—DRAIN TUNNEL—The Tintic Drain Tunnel and Its Objects. E. E Grimes. (Salt Lake Min. Rev., Feb. 15, 1919; 3 pp., illus.) 20c

10594—DRILLING—Shot Drilling Around Thetford Mines. J. W. Davis. (Can. Min. Journ., Jan. 22, 1919; 2 pp., illus.) 20c.

10595—EXPLOSIONS—Effect of the Velocity of Ventilating Current Upon Mine Explosions. G. S. Rice and W. L. Egy. (Coal Age, Feb. 13, 1919; 1¼ pp., illus.)

10599—IDAHO—Mining in Idaho in 1918. R. N. Bell. (Eng. and Min. Journ., Feb. 1, 1919; 2¼ pp.) 20c.

10600—INDIA—The Mineral Production of India During 1917. H. H. Hayden. (Vol. XLIX, Part II, Geol. Surv. of India, 1918; 62 pp.)

10601—INTERNATIONAL CONTROL OF MINERALS. C. K. Leith. (Mineral Resources of the U. S., 1917—Part I; 10 pp.)

10602—MADAGASCAR—Les Mines de Madagascar en 1918. M. F. Bonnefond. (L'Echo des Mines et de la Metal., Jan. 5, 1919; 1 p.)

10603—MANITOBA—Mining in Northern Manitoba, 1918. R. C. Wallace. (Can. Min. Journ., Dec. 15, 1918; 3 pp., illus.)

10604—MEXICO—Mining in Mexico Today. (Eng. and Min. Journ., Jan. 25, 1919; 2¾ pp., illus.) 20c.

10605—MEXICO—The Future of Mexican Mining. (Eng. and Min. Journ., Feb. 1, 1919; 1¼ pp.) 20c.

10606—MINE CARS—Standardization of Mine Cars in Metal Mines. R. M. Raymond. (Eng. and Min. Journ., Feb. 1, 1919; 4¼ pp., illus.) 20c.

METALLURGY—GENERAL

10611—ADMIRALTY GUN-METAL—The Influence of Impurities on the Mechanical Properties of Admiralty Gun-Metal. F. Johnson. (Advance copy, Inst. of Metals, Oct., 1918; 12 pp., illus.)

10612—ALLOY—A Case of Disintegration of a Copper-Aluminum Alloy. Richard Seligman and Percy Williams. (Advance copy, Inst. of Metals, Oct., 1918; 3 pp., illus.)

10613—ALLOYS of Copper and Zinc: An Investigation of Some of Their Mechanical Properties. F. Johnson. (Advance copy, Inst. of Metals, Oct., 1918; 9 pp., illus.)

10614—BRASS—A Comparison of Grain-Size Measurements and Brinell Hardness of Cartridge Brass. W. H. Bassett and C. H. Davis. (Bull. 145, A. I. M. E., Jan., 1919; 21½ pp., illus.)

10615—BRONZE—Effect of Heat Treatment on Bronze. F. F. Hausen and O. A. Knight. (Iron Age, Feb. 6, 1919; 2¼ pp., illus.)

10616—BRONZES—The Constitution of the Tin Bronzes. Samuel L. Hoyt. (Bull. 144, A. I. M. E., Dec., 1918; 6½ pp., illus.) 40c.

10617—COPPER PLATING—Automatic Copper Plating. Joseph W. Richards. (Bull. 145, A. I. M. E., Jan., 1919; 5 pp., illus.)

10618—ELECTROSTATIC PRECIPITATION. R. B. Rathbun. (Min. and Sci. Press, Jan. 4, 1919; 1 p.) 20c.

10619—FOUNDRY—Use of Oil Fuel in the Foundry in Urgent Exceptional Circumstances. A. E. Plant. (Advance copy, Inst. of Metals, Oct., 1918; 5 pp.)

10620—HARDNESS OF METALS—The Resistance of Metals to Penetration Under Impact. C. A. Edwards. (Advance copy Inst. of Metals, Sept., 1918; 28 pp., illus.)

10621—MANGANESE BRONZE—P. E. McKinney. (Bull. 146, A. I. M. E., Feb., 1919; 4½ pp.)

FUELS

10627—COAL—Lignite Coals and Their Utilization. C. C. O'Harra. (The Pahasapa Quart., Feb., 1919; 21 pp., illus.)

10628—COAL CONSUMPTION—Report on the Rate of Coal Consumption in Various Electric Generating Stations and Industrial Establishments in Canada and the United States. (Hydro-Electric Power Commission of Ont., Feb. 15, 1918; 12 pp., illus.)

10629—CONSERVATION—Coal Economy from a National Standpoint. W. H. Casmey. (Trans. of the Manchester Geol. and Min. Soc., May, 1918; 16½ pp., illus.)

MINING AND METALLURGICAL MACHINERY

10634—COMPRESSING AIR Efficiently. Charles A. Hirschberg. (Compressed Air Mag., Feb., 1919; 10½ pp., illus.)

10635—ELECTRIC FURNACES—Electric Heated Industrial Furnaces. Geo. J. Kirkgasser. (Ind. Management, Jan., 1919; 6¾ pp., illus.) 40c.

10636—ELECTRICAL MACHINERY—Some Developments in the Electrical Industry During 1918. John Liston. (Gen. Elec. Rev., Jan., 1919; 38 pp., illus.)

SAMPLING AND ASSAYING

10637—COAL—Sampling and Analyzing Coal. Charles Bentley. (The Pahasapa Quart., Feb., 1919; 6 pp., illus.)

10638—COAL ANALYSIS—Method of Least Squares Applied to Estimating Errors in Coal Analysis. J. D. Davis and J. G. Fairchild. (Tech. Paper 171, U. S. Bureau of Mines, 1918; 36 pp., illus.)

10639—PHOSPHORUS IN BRONZES. Rapid Method of Estimating. T. E. Rooney. (Advance copy, Inst. of Metals, Oct., 1918; 2 pp.)

10640—SAMPLING. F. W. Bunyan. (Min. and Sci. Press, Dec. 21, 1918; 6 pp., illus.) 20c.

INDUSTRIAL CHEMISTRY

10641—AMMONIA RECOVERY—Effect of "Direct" and "Indirect" Ammonia Recovery Upon Other Byproducts. Thomas B. Smith. (Iron and Coal Tr. Rev., Dec. 27, 1918; 1 p.) 40c.

10642—ARSENICAL COMPOUNDS and Sodium Carbonate. M Rindl. (So. Afr. Journ. of Ind., Nov., 1918; 9 pp.)

10643—COAL GAS—The Relation Between Molecular Structure and the Activity Towards Hydrogen Sulphide of Oxide of Iron. G. Weyman. (Journ. Soc. Chem. Ind., Dec. 31, 1918; 3¾ pp.)

MISCELLANEOUS

10648—EDUCATION—Need for Vocational Schools in Mining Communities. J C. Wright. (Bull. 145, A. I. M. E., Jan., 1919; 3½ pp.)

10649—HEALTH—Prevention of Illness Among Employees in Mines, A. J. Lanza, M.D. (Bull. 146, A. I. M. E.; 3 pp.)

10650—LABOR—Employment of Mine Labor. Herbert M Wilson. (Bull. 145, A. I. M. E., Jan., 1919; 3 pp.)

Personals

Have You Contributed to the Association of the 27th Engineers?

W. A. Bancroft, treasurer of the Mass Consolidated Mining Co., of Boston, Mass., recently visited the Lake Superior district.

A. J. Robin, assayer and chemist, formerly of Durango, Colo., has sold his business there and is at present in Denver, Colorado.

W. H. Goodchild has been in Cuba on examination work. He was in New York recently for about a week, and has now returned to London.

James Humes, formerly superintendent of the Silver King Coalition Mines Co., Park City, Utah, has resigned. He is succeeded by **S. A. Knowles.**

Lieut. Leighton Stewart, who has been overseas with the Canadian Engineers, has returned to New York, where he has reopened an office at 42 Broadway.

James MacNaughton, vice-president and general manager of the Calumet & Hecla Mining Co., Calumet, Mich., has returned home from a business trip to New York and Boston.

C. F. Tu and **T. L. Chang**, Chinese mining engineers, are making a tour of the mining districts of the United States, and are studying the methods employed in the Grass Valley and Nevada City districts of California.

C. M. Wilson, formerly engineer for the Garfield Smelting Co., has been appointed chief engineer of the Mexican department of the American Smelting and Refining Co., at El Paso, Texas. He succeeds **L. M. Sheridan**, who resigned.

H. W. Edmondson, recently a captain in the U. S. Engineering Corps, has received an honorable discharge from the Army, and left New York on Feb. 25 for Oatman, Ariz., where he will examine the Vivian Leyland group of mines.

S. M. Levy, superintendent of the Calaveras Copper Co., has returned to Copperopolis, Calif., from New York, where he had been in consultation with the owners of the mines, the Ames estate of Boston, and Charles A. Stoneham, of New York.

Lieut. W. V. DeCamp, formerly mine superintendent for the Consolidated Arizona Smelting Co., Mayer, Ariz., and until recently stationed at Camp Humphries, Va., has received his discharge and is now doing special work at the Columbia School of Mines, New York.

Lieut. Robert Earle McConnell, mining engineer, sailed on Feb. 27 for Europe in the interest of the U. S. Government to proceed with representatives of associated powers upon an investigation of special engineering developments. Lieut McConnell is to be absent for three or four months.

J. H. McMillan, provincial district inspector of mines for the Prince Rupert district, British Columbia, has resigned to become general manager of the Jasper Park Collieries, Ltd., of Alberta, Canada. He will have his headquarters at Pocahontas, where the company's largest colliery is situated.

P. H. Royster, of the U S Bureau of Mines, Pittsburgh, Penn., recently registered at the office of the American Institute of Mining and Metallurgical Engineers, New York. Others who registered there during the last week were: R R Landon, from the Philippines, Major L W Wicks, H B Smith, of New Britain, Conn., D R Stevett of St. Cyr, Quebec, Canada, and Prof William R Chedsey, of State College, Pennsylvania.

Obituary

Charles H. Gibbs, geologist, died on Feb 18, after an illness of several days. He settled in Utah in 1901, where he became geologist for the Utah Fuel Co and general manager of the Wasatch Mines Co at Alta. He was a member of the American Institute of Mining Engineers, and of the American Mining Congress.

Dennis Reardon, formerly superintendent of the Green Hill-Cleveland mine, in the Coeur d'Alene district of Idaho, died recently in Los Angeles, Calif. He had been actively connected with mining operations for more than a quarter of a century. About two years ago he took charge of the property of the Royal Mining Co., in Missoula County, Mont., where a body of high-grade ore was developed.

Joseph Sillman, president and founder of the Michigan Smelting and Refining Co., Detroit, Mich., died of pneumonia at his home on Feb. 15. He settled in Detroit about 25 years ago, and in 1900 established the company of which he was the dominating genius up to the time of his death. His special ability in the reclamation of certain waste materials was recognized by the Government, and he was made a member of the committee directing the equable distribution of non-ferrous materials and the reduction of waste of these materials. He was also active in the Government work of controlling the distribution of tin during the serious shortage of that material. Mr. Sillman was president of the Valley Smelting Co., of Cleveland, Ohio; vice-president of the Peninsular Brass Works, and secretary and treasurer of the Thiery & Kendrick Manufacturing Company.

George E. Drummond, president of the firm of Drummond, McCall & Co., of Montreal, died at Claridge's Hotel, London, England, on Feb. 17, after an illness of about one week. He was born in Ireland, in 1858, and in 1866 settled in Canada with his parents. In the year 1881 he became associated with James T. McCall, and the firm of Drummond, McCall & Co. was established. Business developed rapidly, and the firm soon became an extensive manufacturer as well as importer of iron and steel and was closely connected with various other mining and manufacturing interests. Mr. Drummond was president of the Drummond Mines, Ltd. He became president of the Montreal Board of Trade in 1904, and of the Canadian Manufacturers' Association. He belonged to many social clubs, and was a member of the Royal Colonial Institute of London, England. He was the author of "The Iron Industry in Canada" and "Fiscal and Imperial Defense Questions."

Societies

Mining and Metallurgical Society of America, New York section, held a meeting at Columbia University Club, 4 West 43d St. on Feb. 27. The principal subject of the evening was "Taxation as Applied to the Mining Industry."

American Association of Engineers will hold its annual meeting at Chicago, Ill., on May 13, when Col. Walter Dill Scott, in charge of classification of personnel, U. S. Army, will give a talk on "Fitting the Engineer to His Job."

Utah Society of Engineers held a meeting at Salt Lake City, Utah, on Feb. 19. The problem of potash production was discussed and a number of papers on the subject were presented. A paper was read by Dr. E. K. Cameron, formerly of the U. S. Bureau of Soils, on the "General Potash Situation." Germany's part in supplying the greater part of the market in the past was reviewed, and it was pointed out that it was now incumbent on America to become a factor in the supply. Other papers were: "The Nebraska Potash Brines," by Dr. W. D. Bonner; "Potash from Leucite Rock," by Guy Sterling, dealing with deposits of wyomingite owned by the Liberty Potash Co. and read by L. A. Bailey of that company; a paper by A. Cohen, chemist for the Mineral Products Co. in regard to the alunite deposits at Marysvale, read by L. D. Anderson. The process used in extracting potash from brine at Salduro, 120 miles west of Salt Lake by the Solvay Process Co was described by E. A. Margetts and a general outline of the agricultural uses of potash was given by E M Ledyard, agricultural director of the U S Smelting Co. An informal talk on the recovery of potash made by the Ogden Portland Cement Co at Brigham City was given by O C Hart. The meeting was largely attended and there was considerable discussion.

Industrial News

Epping-Carpenter Pump Co., of Pittsburgh, Penn., announces that Theodore R. Hermanson, formerly with the Worthington Machinery Co has become associated with the Epping-Carpenter company as works manager.

Pacific Coast Steel Co., Seattle has opened a sales office at 52 Broadway, New York. L. G. Knight who has been connected with the Seattle office for some time, will have charge of sales of products from the Seattle and San Francisco mills.

Trade Catalogs

Schieren Beltings. Charles A. Schieren Co., 30-38 Ferry St., New York. A new price list; 6 x 9; pp. 12; illustrated.

Storage Battery. Edison Storage Battery Co., Orange, N. J. Pp. 30; 6 x 9; illustrated. A pamphlet descriptive of Edison alkaline storage battery for electric vehicles.

Tanks. Walter A. Zelnicker Supply Co., 325 Locust St., St. Louis, Mo. Bulletin No. 259; 3¾ x 8¼; pp. 16; illustrated. Descriptive of new and used tanks of all kinds and sizes. Copy free on request.

Storage Battery Locomotives. Edison Storage Battery Co., Orange, N. J. Bulletin No. 608; 6 x 9; pp. 24; illustrated. A pamphlet descriptive of Edison storage batteries for use in locomotives for metal mines, coal mines and industrial plants of all kinds.

Wiring Devices. Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Catalog in Spanish; 8 x 10½; pp. 24; illustrated. The majority of the C-H wiring devices are listed the same as in the 1919 English catalog. It is intended for distribution to the Central and South American trade.

Schieren Beltings. Charles A. Schieren Co., 30-38 Ferry St., New York. A pamphlet entitled "The Story of Schieren Beltings"; 5½ x 7¾; pp. 32; illustrated. This book is dedicated to the belt buyers. It describes the various steps in tanning and manufacturing leather belting, and the extreme care and time required to transform the raw hides into an efficient means for transmitting power safely and continuously.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alumina, Production of. Ralph H. McKee, Ridgefield Park, N. J. (U. S. No. 1,290,269; Jan. 7, 1919.)

Amalgamating Pocket for Treating Ore. Erastus B. Bennett, Denver, Colo. (U. S. No. 1,290,016; Dec. 31, 1918.)

Blasting Gun. William H. Cherry, Shipman, Ill. (U. S. No. 1,290,086; Jan. 7, 1919.)

Boring Drill, Rotary. Howard R. Hughes, Houston, Tex. (U. S. No. 1,289,179; Dec. 31, 1918.)

Castings of Rare Earth Metals and Their Alloys, Process of Making. Alcan Hirsch and Marx Hirsch, New York, N. Y., assignors to Alpha Products Co., Inc. (U. S. No. 1,290,010-11; Dec. 31, 1918.)

Coke, Utilization of Acid. George L. Prichard, Port Arthur, Tex., assignor to Gulf Refining Co., Pittsburgh, Penn. (U. S. No. 1,290,315, Jan. 7, 1919.)

Coke Oven. Robert S. Moss, Chicago, and Arthur Roberts, Evanston, Ill. (U. S. No. 1,289,870; Dec. 31, 1918.)

Copper, Treatment of Cement. Clarence A. Hall, Philadelphia, Penn., assignor to Pennsylvania Salt Manufacturing Co., Philadelphia, Penn. (U. S. No. 1,290,024, Dec. 31, 1918.)

Drilling Holes in Rock, Process of. George H. Gilman, Claremont, N. H., assignor to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,290,172; Jan. 7, 1919.)

Dump Car, Side Tilting. Alexander M. Gow, Duluth, Minn. (U. S. No. 1,290,735; Jan. 7, 1919.)

Ferromanganese, Process of Producing. John Tyler Jones, Pittsburgh, Penn., assignor to Thomas J. Howells, Pittsburgh, Penn. (U. S. No. 1,289,799; Dec. 31, 1918.)

Fire Clays, Art of Purifying. Henry L. Kohler, St. Louis, Mo. (U. S. No. 1,290,241; Jan. 7, 1919.)

Flotation Process. Rudolf Gahl, Miami, Ariz., assignor to Utah Copper Co. (U. S. No. 1,290,166; Jan. 7, 1919.)

Furnace. Alfred Smallwood, London, England. (U. S. No. 1,290,383-5; Jan. 7, 1919.)

Furnace, Alloying. Frederick L. McGahan, Los Angeles, Calif. (U. S. No. 1,290,268, Jan. 7, 1919.)

Furnace, Heat Treatment. Alfred Smallwood, London, England. (U. S. No. 1,290,381, Jan. 7, 1919.)

Furnace, Liquid Fuel. Dudley Wright, Bankfield, Ulverston, England. (U. S. No. 1,290,826; Jan. 7, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Feb. 21

University of California College of Mines has recently installed new equipment of working models for treatment of gold and silver ores, including latest standard types of flotation.

California Chapter American Mining Congress, recently organized, has elected following officers: George W. Starr, Grass Valley, governor; Albert Burch, San Francisco, first vice-governor; L. P. St. Claire, Los Angeles, second vice-governor; J. R. Kingsbury, San Francisco, third vice-governor, and L. D. Gordon, San Francisco.

RENO, NEV.—Feb. 22

The Attachment Levied Against the Rochester Mines Co. by the Elda Fina Mining Co., in connection with the $2,270,000 apex suit filed by the latter, has been released, and the Rochester mine and mill are again operating. Consolidation of the Rochester Mines Co., Rochester Merger Mines Co., Rochester Elda Fina Mining Co., Rochester Combined Mining Co., and Nenzel Crown Point Mining Co. is now assured, under an agreement recently signed. Funds will be administered and the mines operated by the trustees, F. M. Manson, manager of the Western Ore Purchasing Co., and Judge L. N. French. The Combined and Rochester mills have a capacity of more than 600 tons daily.

Non-Metallic Commercial Minerals are being produced in considerable volume in southern Nevada. M. C. Hole, representing Los Angeles interests, has built a plant for refining silica, which is being mined from large deposits near Beatty. Three grades of silica are produced, the greater part of the output being sold to manufacturers of glass and paints. Fluorine is shipped to the Pacific Coast from large deposits near Carrara, south of Beatty, and a refinery is to be provided. Carbonate of lime, used in making dry colors and whiting, is produced in large quantity near Ash Meadows. In the same district the Standard Oil Co. is working deposits of clay. The product is used in clarifying oil and is of superior quality.

PHOENIX, ARIZ.—Feb. 25

All Mines and Smelteries of the Verde District closed on Feb. 14 for a period of three months or more. United Verde and United Verde Extension were the first to shut down, following the failure of a sufficient number of miners to appear for work. At the former 182 men reported, and 65 at the latter, though the ultimatum previously issued by these companies called for 250 men at the United Verde and 100 at the Extension. There are now several thousand idle mine and smeltery workers in the district, and many more are indirectly affected.

Law Governing Mine-Shaft Operation has been introduced in a bill in the Legislature establishing state rules with the following provisions: Hoisting engineers must be over 18, not users of intoxicants or drugs; hoist must have indicator and rope marks; 800 ft. a minute to be the greatest speed in hoisting men; inspection daily; wire ropes when over 200 ft. deep; at least 25 ft. clearance in gallows frame; iron-bonnetted cage, with gates; buckets must be held for clearance 15 ft. above shaft bottom; and bulkheads must be provided above men working in bottom of shaft or winze.

Excavation of Sacramento Hill, with steam shovels which are now working upon the crest, by the Copper Queen company, is being conducted with considerable caution because the crest is above the only road and only railroad that enters Bisbee. The overburden of rock varies from 50 to 200 ft., but averages about 80 ft. This rock is being carried, at the rate of over 150,000 cu.yd. a month, to points around shafts, where level areas are to be provided for shops, and may create a new and level townsite for workmen's homes. Some rock also may go underground, for stope filling. It carries only a trace of copper.

Mine Taxes amounted to $115,112 out of a special school-tax levy of $132,605 for four districts. At Hayden, the Ray Consolidated and American Smelting and Refining companies paid all but $300 of the school district's assessment of $5986. The Gila County tax roll of $163,810,000 has 91% of the valuation assessed against mining companies. Mines, smelteries, and similar works, are set at about $148,600,000, town lots and improvements at $5,347,000, cattle at $3,100,000 and main-line railroads at $2,610,000. Within the state at large, the mining industry pays about 63% of the taxes, and, with the railroads and other larger corporations, pays 75% of the total. These taxes are assessed on an arbitrary valuation, on five-year production periods, so there will be no particular decrease this year, because of relatively low valuation of the gross product.

Ignorance of the English Language will seriously affect the Spanish-speaking miners of Arizona, if the passage of a bill occurs prohibiting the employment of all non-English speaking persons in mines, quarries, open cuts, tunnels, in elevators or on electrical construction, and around machinery. The state mine inspector, his deputies, or any state officer may be judges. Passage of such a bill would affect seriously the camps of Metcalf, Morenci, Clifton, Ray and Ajo, and hundreds of small properties nearer the Mexican border. At Ajo, only Indians and Mexicans would remain over summer in the open-cut work. The bill has passed the House, effective Jan. 1, 1920. Other mining legislation under consideration includes the miners' home bill, which appears to have been killed by adverse report; a bill demanding change rooms and baths for men in smelteries, which has been shelved, but such provisions are to be added to older legislation; a bill granting $10,000 bonus to the first producing oil well found in Arizona, which the Senate has favorably reported. Another act gives protection to water courses or wells against oil seeps or sumps. Arizona has no oil wells at present.

MORENCI, ARIZ.—Feb. 20

A Bond Issue of Greenlee County to the amount of $200,000 is to be voted on soon, the money to be used for road building and road repairs. It is intended to provide work for returning soldiers and sailors, and for men of the district thrown out of work by curtailment of mining operations. The roads are needed, and there will be little opposition from the taxpayers.

WALLACE, IDAHO—Feb. 22

Idaho Mining Association held its annual meeting at Boise on Feb. 11 and 12 and elected the following officers for the coming year: President, Jerome J. Day, of Moscow and Wallace; vice-president, J. B Eldridge, of Boise; secretary and treasurer, Ravenal Macbeth, of Mackay; executive committee: James F. McCarthy, of Wallace; I. E. Rockwell, of Bellevue; W. N. Sweet, of Boise.

John A. Percival, president of the Consolidated-Interstate Callahan, when asked recently regarding the company's plans, said that the low prices of zinc and lead, high costs of labor and supplies, together with excessive freight rates, had made operation at a profit impossible. Under these circumstances it was his opinion that the company should suspend production and conserve its resources until conditions improve. However, no action is to be taken, according to Mr. Percival, until the directors, who will meet in New York on Mar. 3, have expressed their opinion. The company is now producing at the rate of 6000 tons of concentrates and crude ore per month, mostly zinc. Another matter that will be acted upon by the directors is the situation of the main office, now at 61 Broadway, New York. It was originally in Duluth. It is proposed to move the office to Wallace, which, Mr. Percival stated, is the logical place. There are three vacancies on the board of directors, caused by the resignation of the representatives of the American Metal Co., namely, C. M. Loeb, Otto Sussman, and Julian B. Beatty, all of New York. The vacancies may be temporarily filled by the directors, or the matter may go over until the annual meeting of stockholders on April 14.

Vocational Training of Miners, made possible through an appropriation by the Federal government, has been started under the supervision of Francis A. Thomson, dean of the Idaho School of Mines. Most of the applicants are ex-soldiers, and these will be given the preference. The initial class is now receiving instruction in the Morning mine, the property of the Federal Mining and Smelting Co. Although vocational training is common in other lines of industry, this is one of the first attempts to introduce it in mining, and the result is being watched with much interest by mine managers and experts in vocational training. Operators in the Coeur d'Alene district are giving the system cordial coöperation, for they recognize that its success means eventually higher efficiency in underground work. The school is under the immediate direction of F. H. Skeels, a mining engineer. The class now working in the Morning mine is engaged in running a drift under contract, which is expected to enable the pupils to earn fair wages; the cost to the company will be no more than if the work was done by its own employees. More applicants are on file than can be accommodated at this time, but it is expected that arrangements will be made to start classes in other mines.

BUTTE, MONT.—Feb. 22

Conditions in Butte following the 10-day period of excitement due to the strike called by the I. W. W. are again normal, and all companies are working that were operating at the time it was announced that there would be a reversion to the sliding-scale agreement. It is now certain that the strike was not caused by the refusal of the large majority of miners and craftsmen to accept the changed conditions, but was brought about by threats of violence to the men who dared to go to work. Upon declaring the strike, the I. W. W. organization announced that the mines would never operate again until the companies paid $6 a day for a six-hour day. When the men returned to work under protection, the I. W. W., calling the strike off, said that it would be resumed later and at the same time denounced the American Federation of Labor. It is to be noted that the Anaconda Copper Mining Co., though consenting to return to the sliding scale of wages based upon the price of copper, announced that it would pay 50c. a day bonus to each man. This, a purely voluntary act on the company's part, was promised in view of the fact that the cost of living was somewhat higher than when the sliding-scale agreement was entered into.

SALT LAKE CITY, UTAH—Feb. 21

Mine Safety Laws for the metal-mining industry are being prepared by the Utah State Industrial Commission. Rules drafted by C. A. Allen, chief of the mine inspection department and also in the employ of the U. S. Bureau of Mines, have been gone over by members of the commission working with a committee representing the mining industry, the object being to devise a set of uniform rules, which will serve as a basis for inspection work by the commission and by insurance companies. On the operators' committee are: C. E. Allen, United States Smelting and Refining Co.; V. S. Rood, Utah Apex mine, Bingham Canyon; O. N. Friendly, Judge Mining and Smelting Co., Park City; and A. P. Mayberry, Centennial-Eureka mine, Eureka. For the miners; Ephraim Adamson, Park City; for the industrial commission: W. E. Harrison, state metal-mine inspector, and C. A. Allen, chief mine inspector. Insurance companies were also represented. Later all operators of the state will be given opportunity for further suggestions.

The U. S. Bureau of Mines Station at the University of Utah has completed another year of work, report of which has been made by Thomas Varley, metallurgist in charge, to J E. Merril, director of the School of Mines. Volatilization has been proved to be adaptable to ores carrying copper, lead, gold, and silver, whether the minerals were found as sulphides, oxides, or carrying carbonates or silicates. Recoveries of copper have been 90 to 98%, and recoveries on lead ores have been better than 90%, the gold in the ores also being saved. Silver ores have not given as good results, although in many cases the recovery has exceeded 80%. The problem of obtaining higher recoveries on silver ores is at present under investigation. Under most conditions zinc has not been volatilized, and efforts are being made toward the subsequent recovery of that metal from the residues. The bureau is striving to determine means of treating low-grade and complex ores of the state by any feasible method. The milling equipment in the metallurgical building has been entirely overhauled, and much additional machinery installed. Attention will be devoted chiefly to the volatilization process and to ore dressing.

DENVER, COLO.—Feb. 24

The Number of Idle Men Is Increasing in Denver, and many of the returning soldiers are finding difficulty in getting back into civil life. An organized effort is being made by the U. S. Employment Service and Colorado employers to find places for the returning men. The efforts of operators in the mining districts are being repaid by a steady increase in the efficiency of their labor forces.

A Menace to Milling Operations in Colorado is recognized in a bill to prevent pollution of streams. This measure is most drastic in its provisions, and if enforced would close down every milling plant in the state. The bill was introduced by Representative Hall, of Jefferson County, and is backed by Golden interests, which are displeased with the muddy appearance of Clear Creek. If such a bill should become a law it would prevent new mills from running tailings into the streams, and might cause trouble for all plants operating under water rights which were not older than the rights of the irrigation ditches.

Production of Tungsten in Colorado has practically ceased. All the important mines in the Boulder field have been shut down. Operators contend that without a tariff to protect them from the cheaply produced Chinese ores and concentrates they can no longer profitably work their mines. During 1918 Colorado produced the equivalent of 1965 tons of concentrates carrying 60% WO_3 as against 5065 tons by the entire United States, and 1781 tons by California. The value of the Colorado output is estimated at $1,965,000. The bulk of this production is from Boulder County. During 1918, a total of 10,448 tons of tungsten ores was imported, of which 6165 tons came from China. The price during the greater part of the year was about $25 per unit of WO_3 for a 60% product. Since the signing of the armistice the price has declined rapidly, until there is little or no demand for the ore.

Colorado School of Mines may be controlled by its own graduates in the near future. The Fincher bill, which has just passed the second reading in the State Senate, provides that three of the five members of the board of trustees, appointed by the Governor, shall be alumni of the school. At present only one member of the board must be a graduate of the institution. To become a law, the bill must receive a favorable vote on final reading before the Senate, and must have the approval of the other branch of the Legislature. In the past the school has suffered as a result of ill-advised appointments by governors who did not fully appreciate that their appointees sometimes had little or no interest in the ultimate welfare of the school, or perhaps lacked both the training and experience that would make them desirable directors of an educational institution. Many believe that the passage of the Fincher bill will be a step in the right direction, and those interested in the welfare of the institution hope it will be a guarantee that the high standard of this well-known school of mines is to be maintained.

A Metal-Mining Fund is to be created by the passage of a bill introduced by Representative Girard and other members of the Mining Committee of the House. This bill was introduced in accordance with a resolution unanimously adopted at the annual meeting of the Colorado Metal Mining Association. Primarily the purpose of the proposed law is to provide a method whereby the producing metal mines of the state shall share equitably the expenses of maintaining a state organization. This is to be accomplished by a tax of one-twentieth of 1% of the gross output of the mines, or, in other words a tax of 50c. per $1000 of output. Estimating the total production of the state at $10,000,000 this tax will raise approximately $20,000. Allowing for coöperative work with county and national mining organizations, this amount will be no more than necessary properly to conduct the activities of the organization. Under the state constitution, the present mining organization cannot be chartered, and only through some agency, more or less under the control of the state, is it possible to levy and collect a tax on mine output. This is effected in the proposed bill by the creation of the Metal Mining Fund and the appointment of a board of directors which it is assumed will also compose the executive board of the Colorado Metal Mining Association, and the Colorado Chapter of the American Mining Congress. The first section of the bill provides for the method of assessing and collecting the fund, which is based upon the gross output as determined by the statement filed with the county assessor under the provisions of the present law. Section 2 provides for the appointment of a board of nine directors, three of whom shall be appointed for a term of six years, three for four years, and three for two years. Section 3 provides for organization of the board, duties of the chairman, and for regular and called meetings of the board. Section 4 outlines the powers of the board, and authorizes investigations regarding the prospecting for, mining production, transportation, buying, selling, treatment or reduction of metalliferous ores, as well as economic conditions relating thereto. Under the provisions of this section it is proposed to give the board the right to make such investigations concerning the mining industry as it shall deem expedient or necessary, and, so far as possible, all powers now exercised by the present mining organization, and not to include anything that might prove burdensome to those engaged in the industry. Section 5 provides that the directors shall receive no salary, but shall be paid their actual and necessary traveling expenses in attending meetings of the board. These meetings shall be held quarterly, and at such other times as shall be decided by the president.

HOUGHTON, MICH.—Feb. 21

A Steam Shovel is being experimented with by the Quincy Mining Co. for underground use as an aid to tramming. Calumet & Hecla, having been conducting a similar experiment for some time, is constructing the shovels on a limited scale in its shops and expects to make a test on a larger scale. A completion of successful trials with shovel tramming, together with the replacing of back-breaking labor which the electric locomotives have already brought about, will solve the greatest labor problem in the Lake Superior mines, that of maintaining a new and constantly shifting supply of trammers.

Bolshevik Sentiment is singularly absent thus far in the Michigan copper and iron districts. Though general conditions are excellent, the feeling among the workingmen is that the copper-metal situation must show a betterment in the near future or further decline in the size of the twice-a-month pay check will come. Such a decrease seems to be certain in the case of the lower-grade and higher-cost producers. Up to the present time wages have been cut by but three of the smaller producers. Most of the mines are running on three-quarter time. A few like the Mohawk, Wolverine, and the mines of the Copper Range company have not curtailed production, nor have they cut wages, explaining that production has been running at less than 80% of normal for the last year. Smelteries in the district continue to pile up copper, but not in alarming quantities. Shipments of metal by freight are unusual and are made only on Government requisitions, filling orders placed before the war.

Electric Haulage will soon be installed at No. 6 shaft in the old Osceola workings. This is a very long haul. Two four-ton trolleys will be used. Five storage batteries will be placed in North Kearsarge Nos. 1 and 3. One is now used at the 15th level and one at the 16th level, No 4 North Kearsarge, and doing efficient work. At the Calumet & Hecla mine proper, on the Osceola lode, the use of electric haulage has made profitable the low-grade copper ore. The locomotives haul two cars approximately 1000 ft on each trip. Cars hold three and a half tons and dump by air back of shaft directly into skip. They are used at No. 13 shaft on the 20th, 21st, and 22nd levels; at No. 11 on the 17th, 18th, 19th, and 20th levels; at No. 15 on the 18th, 19th, 20th, and 22nd; and at No. 17 on the 15th, 16th, and 17th levels. Ahmeek has 12 power locomotives, using them in the same way as the Calumet & Hecla and Isle Royale use them. At No. 2 shaft they are working on the 17th, 18th, 19th, and 20th levels; also at the 18th and 19th of No 3, and at the 15th, 16th, 17th, 18th, and 19th levels of No 4. Isle Royale is using four at each shaft, Nos. 4, 5, and 6. At this mine the cars carry five tons an average distance of 800 ft., each car filling a skip.

YELLVILLE, ARK.—Feb. 22

Mine Operators in the North Arkansas Field are protesting against a bill that is before the Arkansas Legislature which, if passed, will levy a tax of 40c. a ton on all lead and zinc ores. Zinc mine operators, especially, consider the measure drastic at such a time as this. Under present conditions the industry is carrying a heavy load in view of the high operating expenses and low ore prices, and operators feel that an additional burden should not be placed upon them. The bill also imposes a tax of 6c. a ton on coal and 18c. a ton on bauxite, as well as a tax on timber products.

NEW YORK—Feb. 20

The Kennecott Copper Corporation will issue Mar. 1, 1919, $12,000,000 in one-year 6% notes, it is officially announced. Although the corporation has cash and Government bonds on hand amounting to approximately $7,000,000, which ordinarily would be sufficient for its purposes, under present conditions it is deemed wise to obtain these additional funds to provide for carrying a considerable stock of copper pending the return of better copper market conditions, as well as to take up $4,000,000 notes of the company, now outstanding, due Mar. 21; to provide for the acquisition of additional properties in Alaska, and in connection with the enlargement of the Braden Copper Co.'s plant in South America. Production has been curtailed over 5% at the mines in Alaska and South America. Work is progressing on new units at Braden mines, which will give 10,000 tons' monthly capacity. Miners' wages at Kennecott have been cut by $1 a day to the 18c. basis.

VICTORIA, B. C.—Feb. 22

Mining Engineers Employed by the Government of British Columbia, of whom there are six, each having charge of one of the mineral districts into which the province has been divided, are to be given authority to make examination of any metalliferous mine, reduction works or concentrating plant of the province. Refusal to recognize their authority will entail a fine of from $10 to $500. It is not suggested that the engineers have received anything but the most courteous treatment from mine and smeltery operators, but William Sloan, Minister of Mines, intends that the engineers shall be provided with full authority in carrying out their duties.

The Decision to Install Electric Furnaces for smelting British Columbia iron ores on the commercial waterway near Seattle, Wash., reached by the Smelters Steel Co., has been received with special interest in British Columbia because of the efforts being made to interest capital in such an industry on the Canadian side. Whether the company will proceed with such an installation for the treatment of British Columbia ores in view of the provincial tax of 37½c. per net ton of ore mined, is considered doubtful. It will be recalled that the provincial government, in furtherance of its desire to see the industry initiated in the province, has offered a bounty of $3 per net ton of pig iron manufactured from local ores and $1.50 per net ton of pig iron produced from foreign ores. This, it is considered, is a satisfactory recompense, when the iron is made in British Columbia, the bounty being substantially above the tax. However, it is said that the Smelters Steel Co. purposes installing four electric furnaces, with a total capacity of 30 tons of high-grade gray iron per day. The furnaces are to be of the arc type, with one electrode to each furnace. The company is reported to have abundant supplies of the flux necessary for smelting purposes near its mines.

TORONTO, ONT.—Feb. 26

Railroad Into Kirkland Lake District was urged upon Sir William Hearst, Premier of Ontario, and other members of the cabinet, by a deputation of mining men who are interested in this gold area. The construction of a branch of the Temiskaming & Northern Ontario R.R. into the Kirkland Lake mining center, a distance of about six miles, they contended, was fully justified by the rapid development of the district, where there are now four producing mines and three others which have mills in the course of construction. At present, all supplies and the output of the mines have to be transported over a wagon road. The Premier gave an encouraging reply, and promised a thorough inquiry into the condition and needs of the district. The deputation also asked for the establishment of a mining recorder's office at Swastika.

The Mining News

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Oliver shaft closed down; 100 miners dropped or transferred to other workings.

COPPER QUEEN (Bisbee) — Last month's removal of overburden on Sacramento hill was 163,000 yd., compared with 100,000 yds., best previous record for the steam shovels.

TUNGSTEN REED (Hereford) — Installing concentrator; boilers and crushers on ground. Water line being laid from series of Huachuca Mountain springs.

Gila County

IRON CAP (Copper Hill)—December production of copper was 990,000 pounds.

Greenlee County

ARIZONA COPPER (Clifton)—Curtailment of operations to start Mar. 1. Details not announced.

ASH PEAK EXTENSION (Duncan)—Main shaft down 325 ft. Will contract for another 100 ft. of depth.

PHELPS DODGE CORP. (Morenci)—Arizona Central mines on single shift. Concentrator and smeltery on five-day-week basis. Copper production to be reduced to 1,250,000 lb. per month. On Feb. 15, blast main to furnace exploded for length of about 200 ft.; line quickly repaired and operations resumed by February 18.

Mohave County

HACKBERRY (Hackberry)—Big mill to start about Mar. 1, on 100,000 tons of developed ore, carrying silver, lead and zinc. Property lately visited by James Murray, of Butte, Montana.

BELLA UNION (Kingman)—Trial run completed of 50-ton mill; erected before ore development had been made.

RICO (Kingman) — First payment of $15,000 on property made to Clack brothers. Compressor and gas engine purchased; plans being made for milling plant, which will use mine water.

Pinal County

KELVIN SULTANA (Kelvin)—Judgment for plaintiff in suit brought by Phoenix Savings Bank and Trust Co., trustees, and property sold. All property, real and personal, purchased by M. M. Hawley, of Chicago.

BUCKHORN (Mesa)—Intend to sink 700 ft., two-compartment shaft about 500 ft. west of present shaft. Present equipment, with addition of compressor, will be used.

YOUNG GOLD (Mesa)—Mine being unwatered preparatory to starting mill; latter idle for about a year.

ARIZONA HERCULES (Ray) — Mill treating about 1000 tons daily now. Pipe line being constructed across Gila River from pumping plant on Kelvin Sultana property.

RAY BROKEN HILLS (Ray)—New tunnel driven approximately 600 ft. Property being surveyed for patent.

MAGMA COPPER (Superior)—January production of copper was 900,000 lb.; December, 1,049,783 pounds.

QUEEN COPPER (Superior)—Getting estimates for new power plant. No decision as yet on equipment.

RED TOP (Superior)—Personal property of Arizona Bonanza Copper Co. sold to satisfy claims brought by P. Hays, of Phoenix. Company will be reorganized and work resumed.

Santa Cruz County

THREE R (Patagonia)—Magma Copper Co. failed to take up option for $750,000. Now reported property being sampled for American S. and R. Company.

Yavapai County

BLACK BUTTE (Constellation) — Purchased by new Omar Mining and Milling Co.; to be under management of R. T. Barton, former owner. Gibson milling plant ordered, with equipment to have daily capacity of 18 tons of silver-lead concentrates.

CALUMET & JEROME (Jerome)—In 80-degree diamond-drill hole, 20 ft. of blue schist, carrying chalcopyrite struck at 320 ft. depth. Ore can be developed by drifting 75 ft. from face of existing tunnel. Above schist 60 ft. of iron pyrites found.

VERDE HUB (Jerome) — Formerly known as Decatur. Will resume work with funds secured in Decatur, Illinois.

VERDE SQUAW (Jerome)—Shut down by T. H. Gray, manager, until big mines of district resume.

ANDREWS (Mayer)—Group acquired by Argonne Copper Co.; organized by D. A. Finlayson and Mathew Hall.

COPPER QUEEN GOLD (Stoddard)—Plans for resuming work announced by president. Louis Goldman, Los Angeles, California.

HOMESTEAD (Walker)—Taken over by U. S. Continental Mines Co.; Mark Bradley in charge. Main shaft to be sunk from 125 to 350 ft.; new hoist and compressor to be installed.

Yuma County

CRITIC (Wenden) — Reported to have found gold telluride ore on 350 level. Carries copper and trace of silver.

RED CLOUD (Yuma)—Leased to International Metal Co., of Los Angeles; Arthur F. Flint in charge. Red Cloud Co. badly affected by burning of new $150,000 mill.

ARKANSAS

Boone County

MARGUERITE (Everton) — Okiozark Mining Co., which is operating Marguerite zinc-silicate mine, completing new concentrator. Equipment, aside from power, consists of 20-ft. two-log washer; five-cell rougher jig; six-cell cleaner jig; one set of 24-inch rolls; and battery of three tables of Wilfley type. Log washer first one installed in North Arkansas zinc field for concentrating zinc ore. Marguerite ore occurs in soft clay gangue free from rock. Rolls used to grind jig tailings before latter go to tables. Property developed by 1500-ft. tunnel and crosscuts. Shaft sunk into tunnel heading by new company, and ore will be moved to mill through both shaft and tunnel.

GLORIA (Zinc)—George Miller, superintendent, states company will put no ore on market until June 1, unless market advances to at least $40 a ton. Property will be kept in operation with small force and production stored.

Marion County

BIG BELL (Rush)—J. L. McCarty, general manager, states mill is making concentrates at rate of 10 tons a day.

MORNING STAR (Rush)—Leased by D. Melton, Alexander Rowden, and J. B. Melton, who have started mill and are working the dumps.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Crushing about 9000 tons per month in 60-stamp mill. Much of best ore from lowest levels. Developed to 4600-ft. depth. Mill tailings retreated by concentration and cyanidation. Electric hoists capable of 7000-ft. depth in good working order.

KENNEDY (Jackson) — Developing new territory. Increasing crew underground. Mill running on fair-grade ore.

CENTRAL EUREKA (Sutter Creek)—Winze at 3500 level, 100 ft. deep, in milling ore. Drifts north and south at bottom of winze reported 140 ft. in ore. New hoist at 3500-ft. level installed. To clean out sump of main shaft and continue sinking. Enough ore blocked out to assure supply for 20 stamps.

OLD EUREKA (Sutter Creek)—Good ore disclosed on lower levels of shaft, deepening of which is to be completed soon. To start new lateral development.

Calaveras County

CALAVERAS COPPER (Copperopolis)—To install hoist at the North Keystone and deepen shaft to 450 ft.; also discovery shaft to 200 ft. Plan additions to crusher and mill. Blast furnace will start in spring.

Eldorado County

CHURCH UNION (Nashville)—Preparing for reopening and new development.

Nevada County

LABOR SURVEY shows 1125 men employed, with evidence of increase. North Star, 450; Empire, 408; Allison Ranch, 117; Golden Center, 78; Sultana, 35; Gold Point Mines, Inc., 35.

PITTSBURG-GOLD FLAT (Nevada City)—To reopen and develop vein disclosed two years ago in Gold Flat; work suspended on account of war. Development through Pittsburg shaft. Former producer.

BLUE POINT (Smartville)—Involved in further litigation regarding claims of $31,244 against Weissbein interests and $25,000 rentals, profits, and interest. Known as the Paddy Campbell mine. Former producer on large scale.

Plumas County

ENGELS COPPER CO. (San Francisco)—Annual election: Henry Engels, president; F. Kland, vice-president; E. E. Paxton, general manager; I. J. Truman, Jr., Richard Spreckels, O. G. Traphagen, J. F. Humburg, directors. Manager's report shows ore developed in tunnels 1, 2, 4, 5, 6. Ore averaging in excess of 2½% copper, carrying gold and silver.

Shasta County

MAMMOTH COPPER (Kennett) — Expected reduction of 50c. a day in wage scale accepted by miners of Mammoth and Balaklala properties. A few men quit at the Balaklala, without demonstration. Affects about 750 men.

GREENHORN COPPER (Tower House)—Development employs 15 men underground. Surface survey of 260 acres, employing men discharged from Army and Navy.

BULLY HILL (Winthrop)—Mine on development work only. Flotation plant down owing to lack of market for copper and zinc.

Sierra County

SIXTEEN-TO-ONE (Alleghany)—New 10-stamp mill for stamping and concentrating only; electrically operated; capacity 30 to 40 tons daily. Operation begun Jan. 14. In general, ore is free milling. M. C. Sullivan, superintendent.

KIRKPATRICK (Forest) — To install ball mills, owing to flaky nature of placer gold.

LOFTUS BLUE LEAD (Howland Flat)—Restraining dam approved by Federal officers; electric plant and hydraulic monitors installed; ready for operation when weather settles; recent heavy snowfall greatly increased available water.

Tuolumne County

McCORMICK (Jacksonville) — Reported output since December, $20,000. Developed by tunnel from the river side, disclosing vein in lower levels which was pockety in upper ground. Andrew McCormick, of Stockton, owner.

PACIFIC GOLD (Jamestown)—New mill crushing 100 tons a day from Dutch-Sweeney mines. To be increased to 300 tons. Formerly the Dutch-Sweeney Mining Co. Also owns App mine adjoining. W. J. Loring, general manager.

IDAHO

Shoshone County

RICHMOND (Adair) — Five carloads copper ore shipped in February, and five in January. Sinking winze 200 ft. from lower tunnel. Ore delivered to railroad by aërial tramway.

AMBERGRIS (Burke)—Crosscut from No. 4 tunnel of Hercules developed shoot of commercial ore. Work transferred to main working level of Hercules and crosscut being run to cut vein 400 ft. deeper. Controlled by the Days.

COPPER KING (Mullan)—Special stockholders' meeting called to decide on offer to purchase property for $250,000 on following terms Cash, $10,000; first year, $40,000; second year, $50,000; balance in payments of $50,000 yearly. Purchasers agree to keep 14 men continuously employed and build 50-ton mill. They are Seattle lumbermen.

GIANT LEDGE (Murray)—Work resumed. Shut down since last September. Shaft down 400 ft., with lead-silver ore developed on 200 and 400 levels. Company began construction of mill last summer, but it is not yet completed.

AMAZON-DIXIE (Wallace)—Vein cut by crosscut from bottom of shaft, 400 ft. below main tunnel. Eight feet exposed shows lead-silver and copper ore. Property in Montana, near state line. Controlled by Cleveland, Ohio, interests.

SUCCESS (Wallace)—Mine closed down and pumps withdrawn, because of low zinc and lead prices without corresponding decrease of wages and other mining costs. Mine reported having good bodies of ore on 1400, 1500 and 1600 levels. Under normal conditions can operate profitably.

SUNSHINE (Wallace)—Has taken over Sunset-Banner and Dewey groups of claims adjoining on west, making a group of 20 claims situated on both sides of Beaver Creek.

MICHIGAN

Copper District

ALLOUEZ (Allouez)—Using six storage-battery locomotives, one each on 19th and 20th levels of No. 1 shaft. Four trolley locomotives, 125 volts, in use in No. 2 shaft on long hauls; tramming efficiency increased.

SENECA (Calumet)—Concrete work in shaft near completion, following which sinking will be resumed.

HANCOCK (Hancock)—Shipped 24 cars of ore to mill week before suspending; cleaning up best of ore already broken down.

MOHAWK (Mohawk)—Ore tonnage increased 15% in first half of February. Underground force approximates requirements for first time in four years. No curtailment to date.

MINNESOTA

Cuyuna Range

LABOR SITUATION has eased considerably, and there is now a surplus of labor on the Range. There is at present no indication of any general reduction in wages.

CUYUNA-MILLE LAC (Ironton) — American Manganese Mfg. Co.'s mine closed down on Feb. 14; 200 men released. Believed shutdown is only temporary. Will remain closed until further ore sales are made from stock or until ore prices become stable.

JOAN NO. 3 (Ironton)—Has bottomed drop shaft successfully Property controlled by Marcus L. Fay.

ONEIDA MINES CO. (Ironton) — Closed down Clark and Sultana mines Feb. 8 Pulled pumps, allowing mines to flood. Sultana hoisted over 9000 tons manganiferous iron ore in January and has 40,000 tons in stockpile. Uncertain ore market, together with tonnage in stock, caused shutdown. New shaft in Clark started in June, 1918, and bottomed successfully in January; is completely equipped, with all surface work done.

WHITMARSH (Ironton) — Martin and Huntington mines completely equipped for full production.

ROWE (Riverton)—Formerly operated by Pittsburgh Steel and Ore Co , will be operated by Pickands, Mather & Co this season Small amount of stripping will be done to uncover more ore; underground workings will be developed from shaft sunk last year, will mill ore in open pit and mine underground ore Plan to produce full capacity this season Ore in pit formerly worked by steam shovel is exhausted, washing plant to be dismantled and sold.

MISSOURI

Camden County

OSAGE (Damsel) — Two-compartment shaft down 112 ft , concrete lining in first 51 ft completed, including collar extending 12 ft above surface Headframe now being constructed Intend to deepen shaft to 207 ft depth, where drillings showed lead and zinc ore carrying gold and silver Reported low-grade ore in shaft at 80-ft level L W Jeffords, president

MONTANA

Jefferson County

COMET (Basin)—Arrangements to be concluded for first 150-ton unit of proposed mill. Will provide for jig and table concentration and flotation. Development continuing on 600 level. Shipping 20-25 tons of ore daily.

CRYSTAL (Basin)—Shipping four to five cars monthly of copper-silver ore. Considerable milling-grade ore blocked out. Lease and bond taken on Goldsmith property. Cntrolled by E. P. Barry and associates.

Silver Bow County

ANACONDA (Butte)—Producing large zinc tonnage; 1200 tons on Feb. 19 and 1600 tons Feb. 20. Zinc ores averaging over 11% zinc, with silver and lead in addition. Custom copper and zinc ores shut off from treatment at smeltery, Butte & Superior and other shippers being notified to cease shipments.

BOSTON & MONTANA DEVELOPMENT (Butte)—Locomotive fired for first time on Feb. 17 on Montana Southern Ry. at Divide. Operation of road expected to begin early in May. Large tonnage of ore in sight on 1000 level of Idanha vein. Development work on Park fissure progressing.

NORTH BUTTE (Butte)—January production was 2,241,829 lb. copper; 99,070 oz. silver; and 143 oz. gold. December output of copper was 2,230,507 pounds. Operations resumed at Speculator on Feb. 19 engine trouble resulting in suspension of night shift. Speculator shaft to remain closed. Daily tonnage, 1200.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Goldfield Development Co. has leased all property, except mill, for five years; will bear all expense and pay 15-20% royalty. Has also purchased Hazel Queen claim and obtained bond on February claim.

Lincoln County

PIOCHE SHIPMENTS of ore for week ended Feb. 13 were: Prince Consolidated, 28 cars; Virginia-Louise, seven; Consolidated Nevada-Utah lessees, two.

BOSTON - PIOCHE (Pioche) — Second payment of $4000 reported made by Mascot Mining Co., lessee, which has resumed operations, after month's shutdown due to influenza. Formerly known as Yuba East group.

DAY (Pioche)—Situated in Bristol district; recently leased to Black Metals Mining Co., controlled by Snyder Bros., of Salt Lake City. Installing hoist and other equipment, preparatory to beginning operations.

PIOCHE MINES (Pioche)—Mill in operation and producing concentrates. Operations hampered by water shortage.

VIRGINIA-LOUISE (Pioche)—During January, 260 ft. of development work performed; 1544 dry tons of iron-manganese fluxing ore, averaging .01 oz. gold, 3 7 oz. silver, and 3.7% lead, shipped

Nye County

HIGH DIVIDE, Gold Seam, Rosetta Divide, and Gold Reef preparing to develop their ground.

ALTO DIVIDE (Divide)—Charles S. Sprague and associates have bought this group, adjoining Gold Zone and East Divide, and have ordered hoisting equipment.

BROUGHER DIVIDE (Divide)—Station and sump at 500 level completed and crosscut being driven to vein, about 100 ft distant. Quartz seams cut in shaft at 480 feet.

DIVIDE CONSOLIDATED (Divide)—Property, including Empire group, adjoins Brougher Divide on northwest, covering extension of main silver vein of Divide High-power surface equipment purchased, and a large shaft will be sunk at least 800 ft J H Miller is president and F M Manson vice-president William Witters, superintendent of Divide mine, is a director

DIVIDE EXTENSION (Divide)—Equipment being provided to sink 150-ft shaft to 400 ft Adjoins Divide on north

EAST DIVIDE (Divide)—Shaft nearing 300-ft point, where crosscuts will be driven to two veins shown at surface Blow-out near shaft yields assays low in gold

GOLD ZONE (Divide)—Drift extended to Divide boundary on 500 level failed to expose commercial ore Crosscuts started to prove whether vein has faulted

NORTH DIVIDE (Divide)—Hoisting machinery being installed on property, adjoining Sutherland Divide group.

SUTHERLAND DIVIDE (Divide)—Machinery purchased and will be installed soon at 400-ft. inclined shaft. This and shallow workings to east have produced shipping ore. J. B. Kendall, former superintendent of Goldfield Consolidated, is manager.

TONOPAH DIVIDEND (Divide) — Two large veins being prospected by drifts on 300 level. Several seams cut.

TONOPAH DIVIDE (Divide)—Crosscut from Divide main shaft on 470 level in exceedingly hard rock, but is expected to cut silver vein by Mar. 1. Auxiliary sinking hoist lowered from 370 to 470 level, and sinking will continue to water level, estimated at 800 ft. Additional mine buildings being erected, some having been brought from Millers, 15 miles west of Tonopah. Orebody at 370 level developed and blocked by crosscuts for length of 380 ft. and has average width of 26 ft. High-grade area at southeast over 40 ft wide, and for length of 70 ft. has averaged $100 per ton. Ore shipped at rate of 35 tons daily to MacNamara mill at Tonopah.

TONOPAH HASBROUCK (Divide) — Electric hoist and compressor bought by superintendent, H F. Bruce. Development work will proceed in 400-ft. shaft and 900-ft. tunnel, both showing good veins. Property has produced shipping ore and has several thousand tons of it in sight. Shipments to be resumed soon.

CONSOLIDATED MAYFLOWER (Pioneer)—Eight working faces on four levels breaking full widths of milling ore Product being stored in old workings. J. B. Kendall, manager, has over 20 men using new "Turbro" drills and breaking ground rapidly. Mill to be enlarged to at least 125 tons' capacity by addition of ball mill. Ore free-milling and friable and can be treated at low cost. Main shaft of Pioneer mine being sunk from 400 to 800 feet.

TONOPAH EXTENSION (Tonopah)—Planned to sink Victor shaft from 1760 to 2060 ft. Ninety-foot steel headframe completed at this shaft, and large Nordberg hoist awaited.

TONOPAH WESTERN (Tonopah)—Negotiations progressing in plan to consolidate this with Great Western, Tonopah Bonanza, and contiguous properties, involving area of between 600 and 700 acres in western part of district. Coalition would result in sinking deep shaft to unwater all western region to at least 2000 feet.

VIRGINIA

Augusta County

CRIMORA MANGANESE (Crimora)—Property recently sold to the American Chemical and Industrial Co., Philadelphia. Plant shut down, but operations will be resumed soon.

Rockingham County

U. S. MANGANESE CORP (Elkton)—Trustee's sale of plant and mines advertised for Feb. 28, at Harrisonburg, Va. Property listed for sale included about 147 acres on or near Hance's Mountain and railway running from main plant to Norfolk & Western Railway

WASHINGTON

Stevens County

ELECTRIC POINT (Boundary)—Closed down temporarily owing to lack of market for property's low-grade lead ores

CANADA

Ontario

ONTARIO-KIRKLAND (Kirkland Lake) —After considerable delay caused by shortage of electric power, new plant is in full operation Funds are available for 1500 ft. of underground work.

BURMA

BURMA MINES (Namtu)—Now engaged in direct smelting of ore from Bawdwin mines Second-grade ores will pass through mill, which is nearing completion (dated Jan 1); will produce lead concentrates and zinc concentrates. Latter will go to acid plant and zinc smeltery at Sakchi, in Bengal, for further treatment Will smelt lead concentrates locally

CHOSEN

ORIENTAL CONSOLIDATED (Unsan) —Advices dated Jan 5 state mills running full capacity, but short 350-400 men underground, retarding development work Good headway being made in tunnel on Suribong power project, December footage being 221. Completion of tunnel expected by Mar. 1. Outside work at Suribong handicapped by cold weather

The Market Report

SILVER AND STERLING EXCHANGE

Feb.	Sterling Exchange	Silver		Feb.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
20	4 7580	101⅛	47¾	24	4 7575	101⅛	47¾
21	4 7575	101⅛	47¾	25	4.7575	101⅛	47¾
22	.....	....	47¾	26	4.7575	101⅛	47¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Feb.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
20	15½ @16	66¾	5.10	4 70 @4 90	6.25
21	15⅜ @15½	66¾	5 10 @5.15	4 80 @4.90	6.25
22	...	...	.....	.....	......
24	15⅛ @15¼	66¾	5.10 @5.15	4 90 @5.05	6.25
25	15.05 @15 25	66¾	5.10 @5.25	5.00 @5.05	6.25
26	15 @15¼	66¾	5.25	5.00 @5.05	6 25

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

Feb.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
20	75	70	(a)	212	209	27½	24	45
21	75	69½	(a)	215	212	27½	24	45
22	..	.	...		.	..	..	.
24	75	71	(a)	212	209	27½	21	45
25	75	70½	(a)	210½	206	27½	21	45
26	74	69½	85	222	213	27½	22	45

(a) No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK, Feb. 26, 1919

During the last week there was a further sharp decline in copper, while at the same time lead advanced. As we have pointed out repeatedly, lead is in the best statistical position of the metals. Zinc was dull and uninteresting.

The War Department, under date of Feb. 18, 1919, published a circular issued by the Director of Purchase, Storage and Traffic, which comprises the following paragraph: "It is believed to be of advantage to the Government in the settlement of any contract to have the contractor retain as much as possible of the property involved, provided he will take it at a fair price. Any property that cannot be disposed of in this way becomes surplus and should be turned over to the Director of Sales for disposal. The Director of Sales is at all times ready to take over and dispose of such property if the contractor will not pay a fair price for it, and it is not the policy of the department to sell property to contractors who are known to intend to market it, or contractors who take it for speculative purposes and not for their own use."

Copper—About the same amount of business was reported by producers as in the previous week, the aggregate being a little more than 5,000,000 lb., made up chiefly of lots of 100,000 to 500,000 lb., but there was one lot of 1,000,000 lb. reported. These figures reflect fully the character of the market. Consumers buy only in small lots and for their immediate requirements, everybody being averse to making commitments for more than a few days ahead. The business that is offered in this way is competed for eagerly, wherefore there were sharp cuts in prices, but in the latter part of the week that tendency seemed to be checked. Last Wednesday the market closed at 16c. Thursday opened with 16c. and closed at 15½c. On Friday considerable business was done at 15¼@15⅜c. On Monday the market went lower still. There has been talk about copper having been sold at 15c., but no sales were made as low as that by any of the producers, and we have no direct information of sales of prompt copper of 15c. by anybody. Today the market was dull, with scarcely any business reported. Copper was freely offered at 15¼c. and 15c. was reported bid.

Last week representatives of the War Department conferred with the copper producers respecting the liquidation of the stocks of copper held by the Government. While definite arrangements have not yet been consummated, it is probable that the Government's stocks will drift back into the hands of the producers. Although this will not reduce the stocks, it will remove a certain menace from the market.

Copper Sheets—The base price of copper sheets is 24½c. per lb. Copper wire is quoted at 19@20c. per lb. f.o.b. mill, carload lots.

Tin—There is nothing very new to report. The prohibition of imports of tin ore in the United States has caused a good deal of anxiety in Bolivia, where the producers are wondering when the market will again be open to them. At present they are not able to find any good outlet in Great Britain, which country is reported still to be maintaining its embargo on tin. In the meantime, stocks of tin are reported to be piling up in the Orient.

Lead—The business of this week was the largest of any week for a long time. Right from the beginning a strong demand developed from many quarters, including manufacturers of white lead, of blue lead products, and miscellaneous consumers, strange to say, one cartridge maker being among the number. The sales during the week, of which we have reports, aggregate 6000 tons. The American Smelting and Refining Co. advanced its price to 5.10c. on Feb. 20. The demand was so strong that other sellers immediately found that they could get better prices, and during Feb. 25 the Smelting company advanced again, this time to 5.25c. Sales have been made at that price, but not in so large quantities as earlier. However, the market closed strong.

The office of the Director of Sales, War Department, makes public the following statement: "A meeting was held Thursday afternoon in the office of the Director of Sales of the War Department to discuss the lead situation as affected by Government surplus. During the conference it developed that the surplus quantity of lead in possession of the War Department is a very small proportion of a year's production. While the Government's figures are not absolutely correct at the moment, it developed that on the basis of present information the War Department could not possibly have more than a few thousand tons to be disposed of ultimately. This quantity represents the surplus of lead in possession of the War Department which was allocated by the Lead Producers' Committee at the instruction of the Ordnance Department to be used on cost-plus contracts. Although the details of the arrangement have not yet been worked out, it is practically agreed that some arrangement can be made between the War Department and the lead producers by which the surplus stock of lead now in the hands of the War Department can be gradually fed into the market without affecting market prices and market conditions."

Zinc—This market continued very dull Business that was reported was all in the neighborhood of 6¼ cents.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 lb. This price was made on Feb. 4 and has continued to date unchanged. The quotations on zinc sheets in "Journal" issues of Feb. 8, 15 and 22 are in error.

Other Metals

Aluminum—Unchanged.

Antimony—The market was dull. We quote spot at 7@7¼c. March-April shipments from China were offered as low as 6⅝c., New York, duty paid.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Market quotation: Ingot 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Weak at $85. San Francisco reports, by telegraph, $87; weak.

Silver and Platinum

Silver—Market continues quiet, with no change in New York official. The London fixed price has declined from 47⅞d. to 47¾d., owing to a reduction in transatlantic freight rates, so as to be on a parity with New York price. No shipment of bar silver to London during the last week. China exchanges are weaker.

Mexican dollars at New York: Feb. 20, 77½; Feb. 21, 77½; Feb. 22, —; Feb. 24, 77½; Feb. 25, 77½; Feb. 26, 77½.

Platinum—Refined ingot, $100.

Palladium—Quoted at $115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 22—Blende, per ton, high, $47.90; basis 60% zinc, premium, $45; Prime Western, $42.50@42; sludge, $40@38; calamine, basis 40% zinc, $28@25; Average selling prices, Blende, $42; calamine, $30; all zinc ores, $41.91.

Lead, high, $58.50; basis 80% lead, $55@50; average selling prices, all grades of lead, $53.20 per ton.

Shipments the week: Blende, 8661, calamine, 71; lead, 1048 tons. Value, all ores the week, $421,890.

Shipments two months: Blende, 85,520; calamine, 1732; lead, 10,100 tons. Value, all ores two months, $4,272,630.

Buyers advanced prices on all ores under premium grades to $42.50 basis at the week-end.

Word received here is that all zinc smelters are closing down 50% of their smelting capacity temporarily, awaiting a readjustment of metal conditions.

Platteville, Wis., Feb. 22—Blende, basis 60%, zinc, $45 base for premium grade and $40 base for high-lead blende. Lead ore, basis 80% lead, $50 per ton base. Shipments reported for the week are 1989 tons blende, 27 tons galena. For the year to date the totals are 13,395 tons blende, 525 tons galena, and 73 tons sulphur ore. During the week 2804 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—A slightly better demand was reported.

Manganese Ore—The supply of metallurgical ore continues far in excess of the demand.

Molybdenum Ore—No business was reported. Molybdenite is quoted nominally at 85c. per lb. of molybdenum sulphide content.

Tungsten Ore—There is no change in the situation in this market. Ore continues to arrive, which makes matters worse. The importation of tungsten ore in December, 1918, was 1033 long tons, whereof 75% came from China.

Pyrites—Unchanged at 16½c. per unit on the basis of 10s. ocean freight. Ocean freights are obtainable at 20@22s.

Iron Trade Review

PITTSBURGH—Feb. 25

From a few quarters come reports of somewhat heavier buying of steel products in the last few days, but the improvement is of slight consequence and the general situation of restricted buying continues. Buying is much less than would be sufficient to represent even an ordinary dull market. It remains a wonderful thing that the mills are operating as well as they are, when apparently there is hardly any actual consumptive demand, consuming lines, with few exceptions, being extremely dull. The conspicuous exception, of course, is the automobile trade, but it cannot, at best, engage as much as 5% of the steel-making capacity. The agricultural-implement makers are fairly busy, but are understood to have large stocks of steel which they are anxious to reduce. The car shops are doing hardly anything. There have been completed and delivered about 20,000 of the 100,000 cars ordered by the Railroad Administration last April, and a few more that railroads refuse to accept on account of the high price, and the whole matter is in abeyance. There are rumors that permission is to be given for resumption of work on some French cars. The Pennsylvania R.R. has instructed the Cambria Steel Co. to proceed with the manufacture of 3000 cars recently ordered. The Fleet Corporation is reducing its stocks of steel. There is hardly any building construction.

In face of conditions that would suggest the consumption of scarcely any steel, the mills continue to run at fair rates, the Steel Corporation at 90% of capacity or better and the large independents at about 60 to 80%, with a few small plants closed entirely. As capacity has increased 40% during the war, steel is being produced at a greater rate than the highest rate at which it was consumed at any time prior to the war. In other words, the situation is an extremely puzzling one. Some market reports attempt to harmonize by estimating production below the actuality and reporting more buying activity than is really found. Steel Corporation officials rather resent the widely published reports that the corporation is stocking steel.

Independent steel producers admit that the steel market is dull, and express the belief that it will not improve at present prices, but there is a divergence of opinion as to whether price reductions at this particular time would stimulate buying. In many quarters it is predicted that "there will be no price declines before Apr. 1," but, as that date is only five weeks distant, the statement is not particularly conclusive. The best guess seems to be that one or other of the large independents will announce price reductions in the heavy-rolled products by Apr. 1, of not less than $4 a ton and probably not over $10 a ton

Pig Iron—There is scarcely any inquiry for pig iron, and apparently the chief reason former prices are maintained is that there is no business to be booked that would be worth cutting prices for. Though deliveries on contracts are fairly large, they are tapering off slightly. It is claimed that furnaces are piling little iron. We repeat former quotations: Bessemer, $32.20; basic, $30; foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh.

Steel—Quotations for regular soft steel are strictly maintained, at $43.50 for billets, $47 for sheet bars and small billets, $46 for slabs, and $57 for wire rods. There is enough inquiry to test the market, but scarcely any buying. Discard steel and regular shell steel can be had at lower prices than those just mentioned, rolled into billets of almost any size, but are in little demand. There is no buying of sheet bars, and shipments against contracts are light. Though independent sheet mills are operating at an average of 60 to 70%, the activity is chiefly among those that make their own steel.

Ferromanganese—The market continues dull. Furnaces continue to mention $200, delivered, as their asking price on 70%, but it is doubtful if any tonnage could be sold even at $150. Spiegeleisen is nominal at $[illegible], furnace, asked for 16 per cent.

Coke—The coke market is somewhat steadier, but not more active. Odd lots of demurrage coke are frequently offered at about $4.50 for furnace grade, but for regular production $5 would be asked. We quote Connellsville coke at $4.50@5 for furnace and $6 for foundry, per net ton at ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75.630	88.702	101.125	36.682	44.356	48.438
Feb	77.585	85.716	......	37.742	42.792	......
Mar	73.861	88.082	......	36.410	43.620	......
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	......
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug	85.407	100.292	......	43.418	49.077	......
Sept	100.740	101.125	......	50.920	49.500	......
Oct	87.332	101.125	......	44.324	49.500	......
Nov	85.891	101.125	......	43.584	48.960	......
Dec	85.960	101.125	......	43.052	48.492	......
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	...	110.000	...	125.000	...
Mar.	23.500	...	110.000	...	125.000	...
April	23.500	...	110.000	...	125.000	...
May	23.500	...	110.000	...	125.000	...
June	23.500	...	110.000	...	125.000	...
July	25.904	...	119.913	...	134.913	...
Aug.	26.000	...	122.000	...	137.000	...
Sept.	26.000	...	122.000	...	137.000	...
Oct.	26.000	...	122.000	...	137.000	...
Nov.	26.000	...	122.000	...	137.000	...
Dec.	(a)	...	118.447	...	133.167	...
Year	24.628	...	115.530	...	130.507	...

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85.500	67.702	293.227	248.557
February	92.000	......	311.525	......
March	(a)	......	318.875	......
April	(a)	......	329.905	......
May	(a)	......	364.217	......
June	(a)	......	331.925	......
July	(a)	......	360.347	......
August	(a)	......	380.900	......
September	(a)	......	343.905	......
October	(a)	......	335.543	......
November	(a)	......	323.550	......
December	(a)	......	267.736	......
Av. year	(a)	......	330.138	......

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973		6.899		29.00	
March	7.201		7.091		29.00	
April	6.772		6.701		29.00	
May	6.818		6.704		29.00	
June	7.611		7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7.836	7.272	7.661	6.922	54.000	50.045
February	7.814		7.639		54.000	
March	7.461		7.286		54.000	
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25		33.95		33.95	
March	37.25		33.95		33.95	
April	36.15		32.95		33.95	
May	36.20		33.00		34.00	
June	36.36		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Feb. 25
Alaska Gold M.	3[illegible]
Alaska Juneau	1[illegible]
Am.Sm.&Ref.,com.	66[illegible]
Am.Sm. & Ref., pf.	105
Am.Sm.Sec., pf., A.	92
Am. Zinc	11[illegible]
Am. Zinc, pf	40
Anaconda	59[illegible]
Batopilas Min	1[illegible]
Bethlehem Steel	62[illegible]
Butte & Superior	18[illegible]
Butte Cop. & Zinc	5[illegible]
Cerro de Pasco	31[illegible]
Chile Cop.	18
Chino	33[illegible]
Colo. Fuel & Iron	38[illegible]
Crucible Steel	59
Crucible Steel, pf	90[illegible]
Dome Mines	13
Federal M. & S.	10
Federal M. & S., pf.	36[illegible]
Great Nor., ore ctf	39[illegible]
Greene Cananea	42[illegible]
Gulf States Steel	56[illegible]
Homestake	98
Inspiration Con.	44[illegible]
International Nickel	25[illegible]
Kennecott	29[illegible]
Lackawanna Steel	66[illegible]
Mexican Petrol	178[illegible]
Miami Copper	22[illegible]
Nat'l Lead, com.	66[illegible]
National Lead, pf.	108[illegible]
Nev. Consol	16
Ontario Min.	7[illegible]
Ray Con	19[illegible]
Republic I.&S.,com.	75[illegible]
Republic I.&S., pf.	101
Sloss-Sheffield	50
Tennessee C. & C.	13
U. S. Steel, com.	93[illegible]
U. S. Steel, pf.	114[illegible]
Utah Copper	68
Va. Iron C. & C.	54

BOSTON CURB*	Feb. 24
Alaska Mines Corp.	‡.12
Boston Ely	95
Boston & Mont.	43
Butte & Lon'n Dev.	12
Calaveras	1
Chief Con.	3[illegible]
Contact	.05
Corbin	‡.25
Cortez	13
Crown Reserve	.50
Crystal Cop	19
Eagle & Blue Bell	2[illegible]
First Nat. Cop.	1[illegible]
Houghton Copper	30
Intermountain	‡.05
Iron Blossom	45
Iron Cap	13[illegible]
Majestic	20
Mexican Metals	.26
Mines of America	05
Mojave Tungsten	.04
Nat. Zinc & Lead	08
Nevada-Douglas	.20
New Baltic	1
Oneco	20
Pacific Mines	‡.35
Rex Cons	05
Yukon Gold	75

SAN FRAN.*	Feb. 4
Alta	.02
Andes	.03
Best & Belcher	02
Caledonia	.03
Challenge Con.	‡ 03
Confidence	04
Con. Virginia	‡ 05
Gould & Curry	.02
Hale & Norcross	.11
Jacket-Cr. Pt.	.03
Mexican	.08
Occidental	.40
Ophir	.09
Overman	.01
Savage	.07
Sierra Nevada	03
Union Con.	08
Utah Con.	‡ 01
Belmont	3 50
Jim Butler	39
MacNamara	25
Midway	27
Mont.-Tonopah	15
North Star	08
Rescue Eula	09
West End Con	1 20
Atlanta	04
Booth	13
Comb. Frac	1 02
Florence	12
Jumbo Extension	12
Kewanas	04
Nevada Hills	03
Nevada Packard	25
Round Mountain	32
Silver Pick	04
White Caps	16

COLO. SPRINGS*	Feb. 4
Cresson Con	4 87[illegible]
Doctor Jack Pot	04
Elkton Con	04
El Paso	14
Gold Sovereign	‡ 02
Golden Cycle	‡ 74
Granite	11
Isabella	05
Mary McKinney	07
Portland	1 00
United Gold M	14[illegible]
Vindicator	44

BOSTON EXCH.†	Feb. 25
Adventure	‡.60
Ahmeek	69[illegible]
Algomah	‡.30
Allouez	‡43
Ariz. Com.	11[illegible]
Arnold	‡.20
Bingham Mines	‡8[illegible]
Bonanza	‡.10
Butte-Balaklava	‡.22
Calumet & Ariz.	57[illegible]
Calumet & Hecla	420
Centennial	‡13[illegible]
Copper Range	40[illegible]
Daly West	‡3
Davis-Daly	‡5
East Butte	9
Franklin	‡3[illegible]
Granby	‡79
Hancock	5[illegible]
Hedley	‡12
Helvetia	‡.20
Indiana	‡.75
Isle Royale	25[illegible]
Keweenaw	‡1[illegible]
Lake	‡3[illegible]
La Salle	2[illegible]
Mason Valley	‡2[illegible]
Mass	‡4[illegible]
Mayflower	‡3[illegible]
Michigan	2[illegible]
Mohawk	51[illegible]
New Arcadian	1[illegible]
New Cornelia	16
New Idria	‡8[illegible]
North Butte	9[illegible]
North Lake	.50
Ojibway	‡1[illegible]
Old Dominion	‡34
Osceola	48[illegible]
Quincy	56
St. Mary's M. L.	‡43
Santa Fe	‡.25
Seneca	‡14
Shannon	2
Shattuck-Ariz.	‡14[illegible]
So. Lake	‡1[illegible]
So. Utah	‡ 14
Superior	5
Superior & Bost.	‡2[illegible]
Trinity	2[illegible]
Tuolumne	.86
U. S. Smelting	47
U. S. Smelting, pf.	47[illegible]
Utah Apex	2[illegible]
Utah Con	8
Utah Metal	1[illegible]
Victoria	1[illegible]
Winona	‡.90
Wolverine	17[illegible]

N. Y. CURB†	Feb. 25
Big Ledge	68[illegible]
Butte & N. Y.	‡.50
Butte Detroit	‡.01[illegible]
Caledonia	.30
Calumet & Jerome	[illegible]
Can. Cop. Corpn.	1[illegible]
Carlisle	‡2
Cashboy	‡.06
Con. Ariz. Sm	1
Con. Coppermines	4[illegible]
Goldfield Con	.17
Goldfield Merger	.05[illegible]
Greenmonster	[illegible]
Hecla Min	4[illegible]
Howe Sound	‡3[illegible]
Jerome Verde	‡.50
Louisiana	‡[illegible]
Magma	‡25
Marsh	.03
McKinley-Dar-Sa.	45
Milford	‡.75
Mother Lode	.32
Nixon Nevada	.40
Ohio Cop.	[illegible]
Rawley	‡2[illegible]
Ray Hercules	2[illegible]
Richmond	‡.56
Rochester Mines	27
St. Joseph Lead	‡11
Standard S. L.	1
Stewart	‡.16
Success	5
Tonopah	‡3[illegible]
Tonopah Ex	2[illegible]
Tribullion	[illegible]
Troy Arizona	‡.10
United Eastern	4[illegible]
United Verde Ext.	‡30
United Zinc	[illegible]
Utica Mines	‡.08

TORONTO*	Feb. 25
Adanac	18
Bailey	04
Beaver Con	.39
Chambers Ferland	09
Coniagas	2 50
Hargraves	03
Kerr Lake	‡5.37[illegible]
La Rose	31[illegible]
Lake Shore	‡ 90
Min. Corp. of Can.	2 00
Nipissing	‡8 75
Peterson Lake	08
Temiskaming	31
Wettlaufer-Lor	01
Davidson	‡ 55
Dome Exten	26
Dome Lake	20
Hollinger	6 12[illegible]
McIntyre	1 62[illegible]
Newray	12[illegible]
Porcu. Crown	28
Teck-Hughes	25
Vipond	20
West Dome	15

* Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

March 8, 1919

Volume 107 *Number* 10

PANORAMIC VIEW OF THE INTERNATIONAL NICKEL COMPANY'S NEW PLANT, LOOKING NORTHEAST

International Nickel Company's Refining Works At Port Colborne, Ontario

By W. L. WOTHERSPOON*

An account of the preliminaries incidental to the erection and of the details relating to the installation of an important plant to supply, among other products, a refined metal—nickel—of which Canada possesses almost a monopoly. The principal features are the permanent character of the buildings, and the solidity and completeness of the various units. Successful operation has already proved the soundness of the design and an annual output of 15,000,000 lb. of nickel is expected.

THE increased demand for nickel products caused the International Nickel Co. to decide, late in 1916, to proceed with the construction of a refining plant in Canada, of sufficient capacity to meet the nickel requirements of the British Empire. An extensive examination of numerous sites was conducted, and it was decided to erect the refining works at Port Colborne, Ontario. Port Colborne is situated on the shore of Lake Erie and is about 20 miles due west from Buffalo. The Welland Canal, connecting Lake Erie with Lake Ontario, passes through the town.

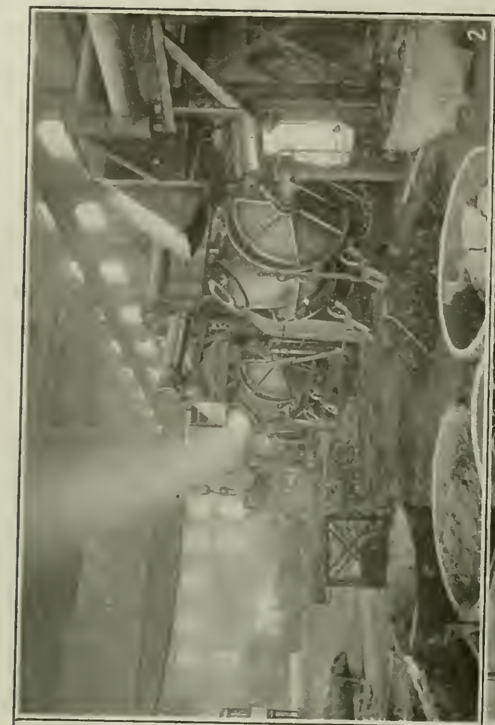
The works site consists of 330 acres and has a frontage on Lake Erie of about a mile. This frontage immediately adjoins that of the Canadian Furnace Co., and is somewhat to the eastward of the entrance to the canal. In addition to the acreage mentioned, the company acquired extensive water rights on the lake front and convenient to the canal basin, where there is a deep-water frontage, to meet the requirements of lake transportation. Railroad facilities are provided by the Grand Trunk Ry., a branch line of which passes the north boundary of the refinery site.

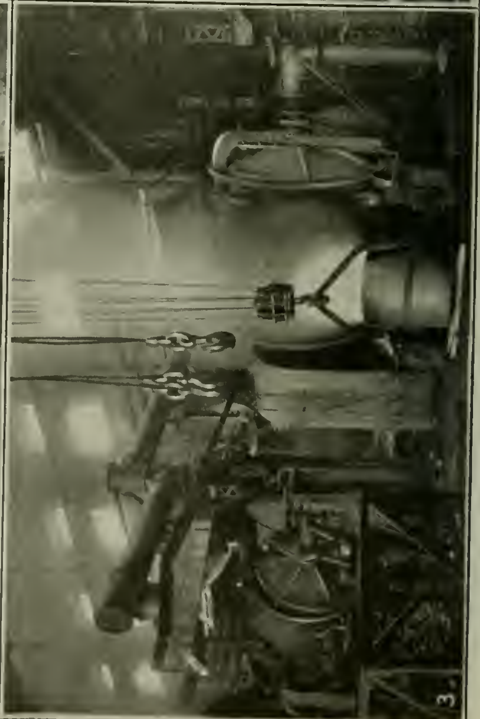
The site is almost level, and about 8 ft. above the lake, except along the shore, where sand dunes about 300 ft. wide and 30 ft. high have been formed by wind. The ground consists of 1 to 2½ ft. of peat, on top of from 1 to 10 ft. of blue clay, which lies directly on a limestone bedrock, which provides excellent foundations.

There are, in all, 31 buildings of steel-and-brick con-

---

*Consulting Engineer, International Nickel Co., 43 Exchange Place, New York.





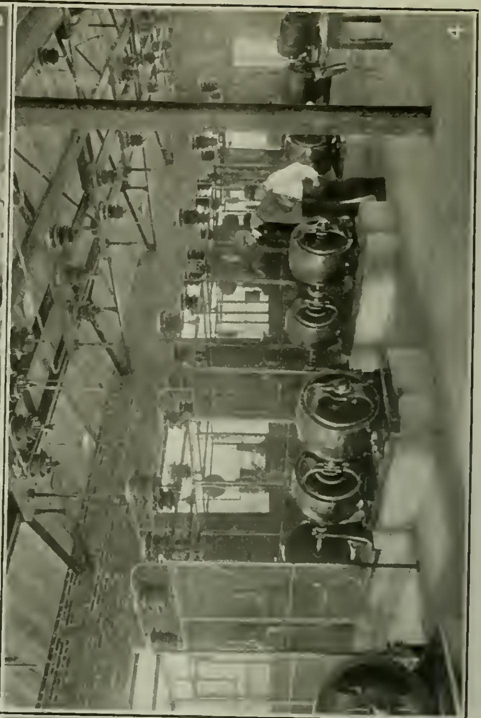


FIG. 1. VIEW OF MAIN BUILDING, SHOWING CASTING OF COPPER. FIG. 2. COPPER CONVERTERS OPERATED FROM PULPIT ON EXTREME LEFT. FIG. 3. COPPER CONVERTER WITH IMPROVED DRAUGHT HOODS AND EFFICIENT MOTOR HOUSING. FIG. 4. SUB-STATION FOR COTTRELL INSTALLATION

struction, plans for which were begun in October, 1916. The land was so near the high-water elevation of the lake that the area to be occupied by the buildings and streets was raised about 3 ft., sand being obtained from the dunes by steam shovels and spread over the site, this work following the clearing of trees and brush and the removal of peat. Foundations of all buildings and equipment were carried down to bedrock, and were built, to a great extent, in winter under severe climatic conditions, when the temperature was frequently 10° or more below zero.

The plant was designed with a view to securing maximum efficiency, by the introduction of mechanical and metallurgical apparatus, and was arranged to reduce the labor required for operation to a minimum. All equipment is of permanent character, so that charges for maintenance will be as small as possible. The buildings are of steel frame and brick walls. The roofs are of special wood construction, and are covered with Johns-Manville salamander roofing.

INTERIOR OF CHANGE HOUSE

The design of the works provided for a complete power plant, a water-supply system, a separate sewerage scheme for storm water and sundry drainage, an electric-conduit distribution system for power and lighting, as well as piping systems for steam, oil, and compressed air. All piping and cables are carried underground, so that there are no obstructions between the buildings.

The various units of the plant are served by both standard-gage and narrow-gage railroad tracks for facilitating the unloading and handling of materials.

The water supply is obtained through a 4-ft. square concrete conduit, over 3000 ft. long, extending from the Welland Canal to the center of the plant, under the power house. This conduit was built in a trench blasted out of the solid rock, so that a gravity supply of water, up to 50,000,000 gal. per day, can be obtained. This system made it possible to place all pumps in connection with the water supply in the basement of the power house, giving important advantages of control.

The area of the works site between buildings has been graded so as to provide adequate means for the disposal of storm water. A series of sewers, connecting with large trench ditches excavated through the property, has been arranged, the water finally discharging through a concrete culvert which passes through the sand dunes into Lake Erie. The sanitary pipe service flow is at such a low level that an ejector-chamber pumping station is provided, from which sewage is discharged to a disposal plant situated in the sand dunes. This plant is constructed on the activated sludge process, which provides for the aëration and clarification of sewage, resulting in an effluent free from objectionable matter. This sewage plant is the only one of its kind in the district, and was installed on the recommendation of the Provincial Board of Health of Ontario.

A number of illustrations are given in this issue which show the disposition of the main-process buildings, power house, warehouse, administration buildings, and laboratory. Several change houses have been provided, supplied with modern lockers, shower baths, and other improvements. A hospital, in a detached building, has an examination room for the reception of patients, for the administration of first aid, and a completely equipped operating room with sterilizers and other modern appliances. Particular attention was paid to this department, the nearest hospital being at Welland, six miles away.

The question of comfort and health of the employees has been given every consideration. A staff house is provided for the employees and a clubhouse for the accommodation of the unmarried men and executive heads. The clubhouse contains both residential and recreation facilities, and both buildings are situated at the entrance to the works, amid the pleasant surroundings of well laid-out lawns, flower beds and shrubs. The chief officials have houses of attractive design which were built by the company, to the west of the canal in the main residential district of Port Colborne.

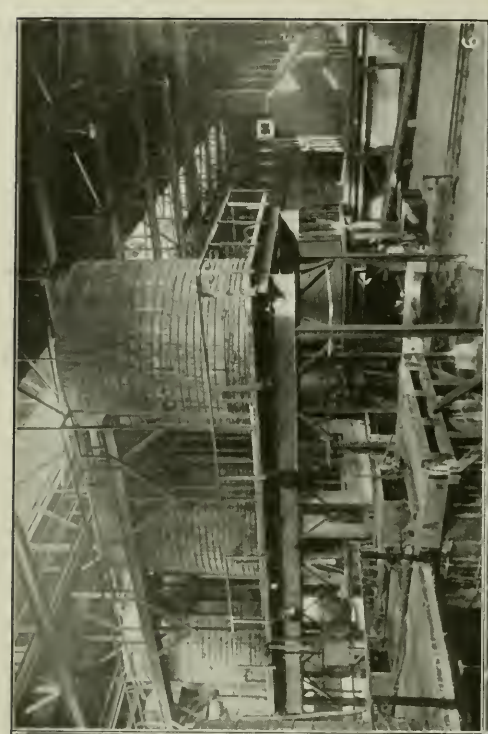
DETAILS OF THE METALLURGICAL PLANT

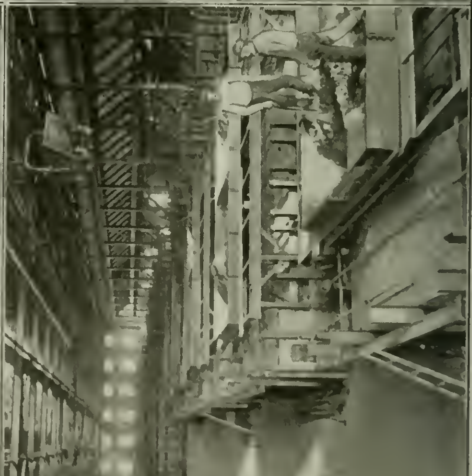
The largest process building is 746 ft. long and 125 ft. wide, divided into two bays, and containing the major portion of the heavy machinery and metallurgical equipment, among which are three cupolas, three reverberatory furnaces, two slag furnaces, and three converters. Here the matte received from the smeltery at Copper Cliff undergoes initial treatment. The method of handling the raw materials is of interest. Matte, coke, and fluxes are brought in on an elevated trestle of reinforced concrete. This trestle connects with bins of similar construction at the back of the process building, and is of sufficient strength to take standard railroad equipment. The materials are dumped from the cars into the various bins, from which they are drawn at the main floor, where arrangements are made for making up and weighing the furnace charges.

The matte, which consists of 55% nickel and 24% copper, is smelted with salt cake, the nickel separated and the copper bessemerized in 84 x 126-in. Allis-Chalmers converters. Electric tilting gear is used, and the converters are controlled from a pulpit conveniently situated across the aisle. One 50-ton, one 35-ton, two 20-ton, and two 5-ton cranes are installed in this building, all of which were manufactured by the Dominion Bridge Co., of Montreal.

Among other machinery of special interest are three electrically driven direct-connected turbo blowers of 7500-cu.ft. capacity and 20-oz. pressure. These are used for cupola service and were furnished by the Rateau-Battu-Smoot Co., of New York, and are situated in an annex to the main building where good light, accessibility and cleanliness are easily obtained.

Flues for the various furnaces are arranged to insure minimum heat losses and obstruction in the building,





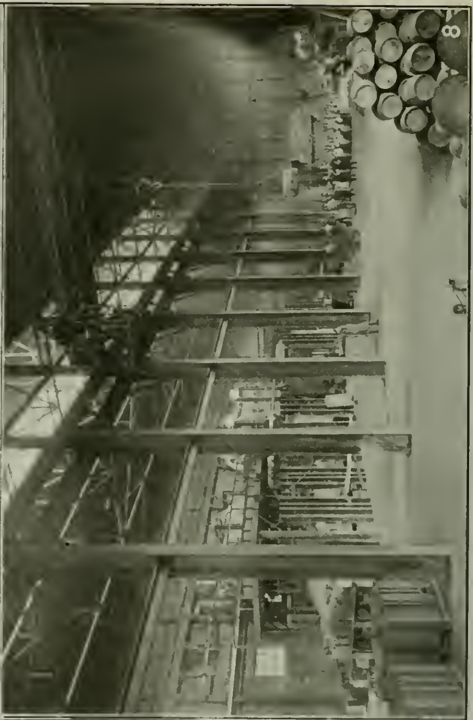


FIG. 5. CUPOLA BUILDING LOOKING NORTH. FIG. 6. INTERIOR OF LEACHING BUILDING. FIG. 7. INTERIOR OF CALCINING BUILDING. FIG. 8. INTERIOR OF REFINERY BUILDING

and are jointly connected to a concrete chimney 350 ft. high and 12 ft. at its smallest diameter. One of the most modern Cottrell electrostatic precipitation plants for the treatment of flue gases is provided, consisting of seven treaters, conveniently placed in relation to the main flue so that any portion or all the gases can be subjected to the process or discharged directly to the base of the chimney.

Among other process buildings are those devoted to leaching and roasting, the former part of the process being carried out in a structure 420 ft. long by 90 ft. wide. The roof trusses span the entire width of this building, so that the whole area is free from columns.

Ball mills are used for reducing the nickel sulphide previous to its being chemically treated in concrete tanks, which occupy the major portion of the area of this department. These reinforced-concrete tanks are elevated about 3 ft. from the floor, and, on account of the nature of the product handled in them, were cast at one pouring. The supports, post girders, and sides of the tanks are made in one monolith, without construction joints, for the length of 150 feet.

Mechanical Handling of Material Perfected

Special attention was paid to lighting and ventilation in this department, and the handling of materials is carried out mechanically by means of an overhead telpher system arranged to reach all parts of the building, together with electrically driven distributing machines for charging the tanks. To facilitate the handling of the product between the leaching and roasting departments, these are connected by three overhead bridges, the overhead telpher system being arranged for service in both departments. Weighing sections are provided at these overhead bridges to facilitate the quick and accurate determination of the quantities of the products handled.

The building in which the roasting furnaces are installed is 380 ft. long, 110 ft. wide, and has one clear span of 90 ft. in which the 10 mechanical and hand-calcining furnaces were installed. Extending the entire length of the building a space of 20 ft. is used for a reinforced-concrete overhead coal bunker. The coal is received on standard railroad cars and dumped in a hopper below the track outside of the building, from which it is fed, by a reciprocating gate feeder, to a coal crusher. After being reduced in size, it is hoisted with a bucket elevator and discharged to a belt conveyor extending the entire length of the coal bunker. A traveling tripper is provided to unload the belt at any desired point.

Details of Flues and Dust Chambers

The flues from the roasting furnaces are carried below the floor level and connected with a large dust chamber of the wire-hung type. This dust chamber is 300 ft. long by 60 ft. wide and is divided, lengthwise, by a center wall, to form two large flues, each of which is nearly 30 ft. wide and 24 ft. high. The bottoms of the flues are of concrete, and the top is of brick arch construction sprung between steel crossbeams. Crosswalls, 8 ft. high, are provided every 32 ft. of the length of the dust chamber, thus making a series of pockets.

The entire area of the dust chamber is hung with wires placed on 4½-in. centers, 500 miles of wire being used for this purpose. The wires are suspended on special frames, which are, in turn, connected with an operating device outside the chamber, conveniently arranged so that the dust caught can be periodically precipitated. The dust collects in the pockets previously described, access to which is provided by steel doors which permit the use of small cars for handling the product. The flue gases, after passing through the dust chamber, are discharged into the base of a concrete chimney of the same size and construction as that already described in connection with the main-process building. It may be added that these concrete chimneys were built by the General Concrete Construction Co., and, although heavily reinforced, are designed as gravity chimneys for a wind velocity of 100 miles per hour. They are lined throughout with fire brick and have terra-cotta caps; the design of the base called for extra heavy construction, owing to the large number and area of the flue entrances.

Nickel Refinery Is Most Complete Plant

The nickel-refinery department received particular study in connection with the working out of the details of equipment and the arrangement of the installation. One part of the building is used for the storage of chemicals and other products, and contains an elaborate system of bins, and measuring and weighing devices, for the preparation of furnace charges to go to the nickel-refining furnaces, which are in the main portion of the building. These furnaces are of special design, owing to the high temperatures which exist under the operating conditions desirable. They are equipped with oil burners, and a special grade of fuel oil is used.

Power-Plant Feature

The power plant shows evidence of careful planning, and the design indicates that future conditions have been anticipated. The equipment at present installed provides for ample plant extension, and space has been reserved for future enlargement of the boiler house and turbine room. The building is of the usual brick, steel, and reinforced-concrete power-house design.

The main power-house boiler room contains four Babcock & Wilcox standard water-tube boilers, each of 4319 sq.ft. heating surface, set in two batteries. These boilers are built for a working pressure of 160 lb. per sq.in., each being fitted with B. & W. superheater, which raises the temperature of the steam about 100°. B. & W. chain-grate stokers are also a feature of the equipment.

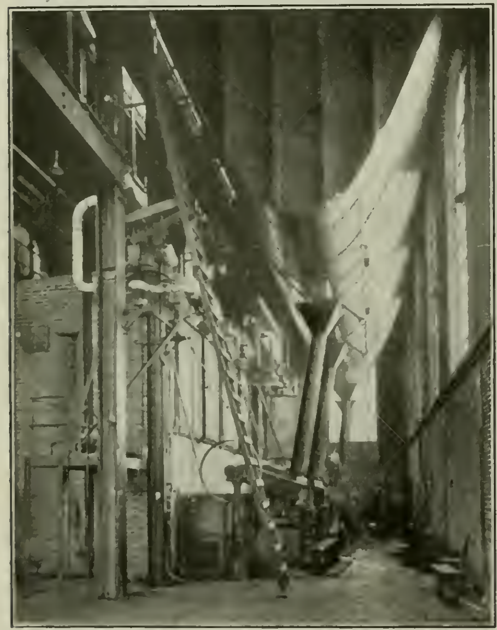
Two B. & W. boilers of special design are installed for utilizing the waste heat from the reverberatory furnaces in the nickel refinery. These boilers are built for an output of about 400 boiler-horsepower each, and are of particular interest, as their design represents the latest development in this phase of engineering, resulting from extensive investigations by the Babcock & Wilcox Company.

Coal is received from the cars in a track hopper, crushed in a Jeffrey crushing roll, elevated, and conveyed overhead to a suspended bunker, from which it is fed as required to the stokers. The ashes are removed from the ash pits by ash cars running in an underground tunnel to the elevator and ash-storage bin, from which they are dumped into cars for removal. One

6 x 175-ft. reinforced-concrete chimney conveys the products of combustion from the boilers in the power house. The waste-heat boilers are served by two 5 x 100-ft. reinforced-concrete chimneys.

TURBINES AND GENERATORS

Two Ridgway-Rateau high-pressure turbines furnish power for the direct-connected d.-c. generators, each of 1000-kw. capacity. These turbines operate under 150-lb. initial steam pressure and 28-in. vacuum and run at 1700 r.p.m. The power house also contains two other turbo-driven high-pressure blowers, which supply air for the converters. Like the turbo-generators, these units are of Ridgway-Rateau make. The turbo-blowers are each of 15,000-cu.ft. capacity, and deliver air at 15-lb. pressure. They are connected to high-pressure condensing turbines operating at 8500 r.p.m. and were designed by the Rateau-Battu-Smoot Co., of New York.



A VIEW OF THE BOILER ROOM

The superseding of the reciprocating engine by the turbine in large power plants has facilitated the elimination of the cumbersome blowing engine. The high rotating velocities obtainable today are especially suitable for the operation of centrifugal blowers, and the turbo-blowers at this plant are much more economical of space than blowing engines of similar capacity would be. The impellers are built up around a large-diameter shaft with dovetail radial slots milled in it. The impeller blades are of nickel steel and tapered in section, being much thinner at the tip than at the root, and are driven into these slots. Distance pieces are inserted between the blades in several stages. All turbines are equipped with Frahm tachometers, supplied by James Biddle, of Philadelphia.

Two No. 7 Westinghouse LeBlanc jet condensers, with individual air and circulating-water pumps, serve the turbo-generators. Each unit is fitted with a 31-hp. steam turbine, and a reduction gear for the pump drive. These condensers are each capable of handling 17,500 lb. of condensate per hour, and maintain a 29-in. vacuum with 40° cooling water. For the turbo-blowers, two similar No. 5 units are installed. They are fitted with 21-hp. steam turbines, and are capable of handling 11,000 lb. of condensate per hour at 29.05-in. vacuum with 40° cooling water.

The main switchboard supplies the plant with direct current at 250 volts. Lighting and other 110-volt services are supplied by means of a three-wire service, operated by two 20-kw. motor-generator balancing sets. I. T. E. circuit breakers, Weston indicating ammeters, and Sangamo wattmeters are installed on the generator and feeder panels.

FEED-WATER EQUIPMENT

The feed water is heated by exhaust steam from the various plant auxiliaries in Webster-Lea units. The heaters were supplied by Warren Webster & Co., of Camden, N. J., and the Lea meters by the Yarnell-Waring Co., of Philadelphia. Two units were installed, one for 5000 hp., equipped with Lea recorders and having a capacity of 275,000 lb. per hour, and the other similar in construction to the first, having a capacity of 1500 hp., or 100,000 lb. per hour. Both are of extra heavy construction, and were designed to withstand a back pressure of 10 lb. per square inch.

A two-inch Venturi meter measures all feed water, and the feed pumps are of Lea-Courteny make, direct-connected to Terry steam turbines of standard type. Owing to the provision for the horizontal parting of the casing when necessary, the interiors are easily accessible for repair; and, as no oil comes in contact with the steam, an oil separator is unnecessary.

AUXILIARY EQUIPMENT

In a plant of this size facilities for repairing machinery are not only advisable but necessary, and ample provision has been made. The machine shop is of good size, and has space to contain a large amount of equipment. Although the installation is not fully complete, and all of the machinery is not yet installed in permanent position, a good idea of equipment may be gained from a description of the various units.

A 12 and 28-in. McKabe double-spindle lathe, with a 24-ft. bed, is provided for the heavy turning, and a Willard engine lathe serves for the finer and smaller repair jobs. A Hamilton drill and a Niles-Bement-Pond radial drill are also provided. A Bertram double punch and shear, a Kelley shaper, and Racine hack saws form part of the equipment. The machine-shop building is about 175 ft. wide and 200 ft. long, with two side bays and a center aisle for a crane runway, and it also serves to house the forging equipment and a complete electrical repair shop. All repairing is done here. Armatures and field coils are rewound, and a complete stock of repair parts is kept on hand.

A separate building houses a carpenter shop, which also serves as a cooperage in which all the barrels required for shipment purposes are assembled.

In a plant of this magnitude it is wise to make adequate provision for the workmen's health. The sanitary features indicate that a considerable amount of care and thoughtfulness has been given to the question.

All water used in the plant is chlorinated, not only the drinking water, but that used in plant operations as well. The water supply is obtained through a 4-ft. square intake from the Welland Canal, and is passed through the pumps and chlorinated, and then goes to an elevated tank, where time is given for its complete purification. Mention has previously been made of the sewerage system.

For workmen engaged in laborious occupations, provision must be made for the changing of wet and dirty clothing and the donning of comfortable and warm apparel for street wear. Four change houses have been built, with a total of 600 lockers and with hot and cold showers and lavatory accommodations.

DETAILS OF OPERATIONS

The Port Colborne refinery began operations last June, and when at full capacity will be capable of a yearly production of about 15,000,000 lb. of nickel and 8,000,000 lb. of copper.

The engineers responsible for the installation have given special attention in the design and construction of the plant and to the possibilities of expansion, and have arranged the equipment in such a way that additions to machinery and equipment can be made in an efficient manner.

The plant was built at a cost of over $5,000,000. The result impresses the visitor and makes him feel that not only is Canada—and Ontario in particular—to be congratulated on the introduction of nickel refining upon a permanent basis, but that credit is also due to the Foundation Co., of Montreal and New York, as the main contractor responsible for the construction, and to The International Nickel Co. for the broad and liberal attitude shown in having this plant built under the stress of war conditions.

Hoisting-Rope Accidents*

Ten mine accidents, which resulted in 12 deaths, were reported in 1917 as occurring on the Rand by the government mining engineer as being due to the breaking of hoisting ropes, chains, or couplings. In eight cases it was the rope that broke, in one instance it was the coupling, and in the other it was a badly made short splice that pulled out. The coupling and two of the ropes broke owing to a jam in the haulage; in other ropes it was due to damage resulting from bad coiling, defective leads, or being run over. In the other two cases of rope fracture the supervision was at fault, and the ropes should not have been continued in service. Of 29 instances of ropes (or couplings) breaking during the year, 24 occurred in the use of hoisting ropes, and six of these resulted in casualties. Twelve were caused by overwind or runaway, and fifteen were due to derailment, jam or collision, in shaft or tip. In one case where the connection was broken, owing to an overwind, the safety catches successfully held the cage. One rope broke on account of its jumping its sheave, and the remaining one because it was worn out, mainly through internal corrosion. The following circular was issued to managers of mines:

"It has been found that wire ropes of compound construction subjected to corrosive agencies, as is particularly the case when these ropes are employed for baling acid water, are likely to deceive engineers as to the strength remaining in them. This is especially the case if the absolute thoroughness of the examination is at all departed from. Where reduction of diameter, or circumference, of the rope has taken place incommensurate with the external evidence of wear, the part of the rope under examination should first be fully loaded and, secondly, relieved of all load. Any noticeable difference in circumferences under these circumstances and the slackening of the outside wires when the load is off will indicate that internal corrosion is present. The extent of corrosion inside the strand can only be estimated by the slackness of the outside wires. The corrosion between the strands can be further examined by untwisting the rope or displacing the strands sufficiently with a marlin spike. Engineers are apt to imagine that reduction in size of a rope may be due to some relatively unimportant collapse of the hemp core. In a test at the Mines Department mechanical laboratory of a 1.28-in. diameter rope, the hemp core was entirely removed for about six feet of the length. The specimen was gradually loaded up to 30 tons, but, beyond a slight increase of the lay from 10½ in. to 11 in., subsiding after the test to 10¾ in., there was practically no alteration in the shape or size of the rope. No observer unacquainted with the circumstances would have imagined that the core had been removed or even disturbed. In recent tests of corroded ropes the following results were obtained:

RESULTS OF TESTS OF CORRODED ROPES

Original Diameter	Original Breaking Load (Pounds)	Diameter at Test (Inches)	Breaking Load at Test (Pounds)
1.5 in. (wires 0.099 in.)......	222,208	1.41	191,960
1.5 in. (wires 0.099 in.)......	222,208	1.40	166,660
1.5 in. (wires 0.099 in.)......	222,208	1.30	137,260
1.5 in. (wires 0.099 in.)......	222,208	1.23	66,880
1.5 in. (wires 0.102 in.)......	220,000	1.22	97,260
1.25 in. (wires 0.115 in.).....	148,700	1.23	137,660
1.25 in. (wires 0.115 in.).....	148,700	1.00	78,920

"In all the above-mentioned cases the outside wires were less than half worn, but the internal corrosion was excessive, most marked inside the strands. The wires were also brittle. Experience has shown that the remarks concerning corrosion on the certificate of biannual tests are taken as merely applying to the test specimen and are not considered as having a bearing on the state of the rest of the rope. This information, however, should not be neglected, and the condition of the rope adjacent to the place where the test piece was cut off should be ascertained. It is not usual for corrosion to occur only at one spot in a winding rope."

The **Peiyang Iron Works** has been organized for the purpose of working iron mines in the Province of Chihli, China. According to the Far Eastern Bureau, the company is capitalized at $4,000,000, of which the Chinese government will supply one-fourth, the civil governor of the province one-fourth, and merchants the remainder. The iron works will be established at Hsuanhuahsien. It is understood, also, that plans are under way in the Province of Anhui for the establishment of an iron foundry, to be called the Hua Chang Iron Foundry, for which $1,000,000 has already been raised. The office of the company will be at Penpu.

---

*Abstract of an article "Rand Mine Accidents Due to Ropes Breaking," in Oct. 19 issue of *South African Mining Journal and Engineering Record.*

The Compound Air Lift

By A. W. ALLEN

The efficiency of a simple appliance that can be constructed easily is sometimes the first point to be questioned, and this is often due to the fact that such a mechanism will usually work if badly designed, when it naturally fails to satisfy in the matter of economical result for power expended. The air lift is an example, and it is a well-known fact that the ease with which it may be constructed too often leads to the adoption of a type of design which ignores all the principles involved, and excess power is used as a corrective. In this paper a compound air lift is described, constructed from piping and fittings which will again be available for ordinary use when a pump is installed or the water is allowed to rise. Such an installation possesses many obvious disadvantages, but other instances may occur where it may be considered as affording the only way out of a difficulty—where nothing else but a few lengths of pipe and an assortment of fittings are available, and where power supply is limited to a comparatively low pressure of air.

THE compound air lift is suitable where objections may be raised against the construction of a sump of sufficient depth to satisfy the efficiency requirements of an ordinary single lift. It is also applicable when the available pressure of air is low. The depth of the various stages can be adjusted in this particular, but it must be remembered that a very low available pressure is likely to cause unnecessary complications in the arrangement by introducing too many units. This necessitates a proportionally large number of pipe fittings, and increases friction. Under such conditions the system is not recommended, although exceptional cases may call for exceptional methods of treatment.

The Fundamentals of a Compound Air Lift

A compound air lift is merely two or more simple air lifts arranged in series—the rising main of the first discharging into the sump of the second, and so on. A loss of fall at each stage is inevitable, and this also involves a small loss of power. The system can be arranged to duplicate or triplicate any of the ordinary designs in use; and the customary self-regulating features can be incorporated in each of the various units.

I once had occasion to utilize the compound air-lift principle under somewhat unusual circumstances. An old mine working had to be dewatered to drain an adjoining shaft. The ground was loose on all sides, the timbers were in a rotten and collapsing condition, and ancient-filled stopes would "run," and discharge débris at the least provocation. The old working had to be drained as far as possible by a system that made personal attention near the water level unnecessary.

A small compressor furnished air at a low pressure; and, even if a pump could have been made to do the work, there would continually have been the danger of interment of both the pump and anyone who happened to be attending to it. A compound air lift was therefore constructed which permitted the gradual lowering of the water to a level in proportion to the depth of successive submergences, and so personal risk was eliminated. Soundings disclosed the fact that timbers had collapsed to such an extent that only a narrow channel remained in one place. This was found sufficient, however, to permit the passage of the lift pipes.

A somewhat diagrammatic drawing of a compound lift of this class is shown in the illustration, but in actual construction it is, of course, possible to bunch the various pipes together, and so insure greater compactness than is indicated. Strainers attached to the foot of the lowest lift, and at other necessary points, are advisable, and should preferably be made of ample dimensions to obviate any throttling of the intake.

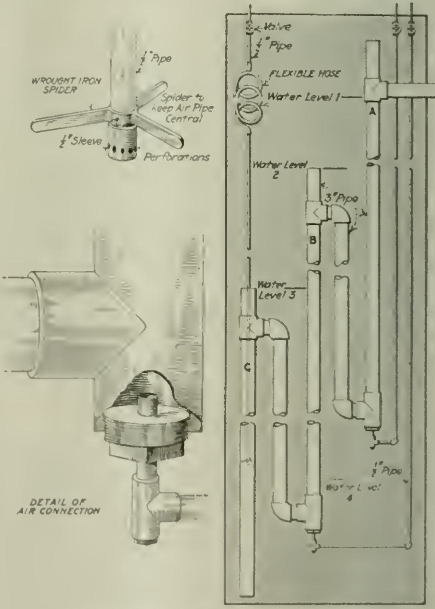


DIAGRAM OF COMPOUND AIR LIFT

The need for the constant shifting and readjustment of the pump, as the water lowers, can be avoided by constructing the apparatus complete and by placing it at the lowest point in the first instance; and then by pumping the water in stages. The various pipes can be assembled, and the added sections bolted or screwed together as the pump is lowered. Permanent air connections are indicated, but can be omitted when it is considered preferable, and flexible connections used instead. The permanent connections were available, in the instance under description, only when the pressure had been reduced by the help of the flexibly connected air pipe.

It will be noticed that the permanent air connections are attached through a plug at the lower arm of a T-piece in each case. This design was purposely adopted to minimize friction, as it was found that the extension of the air pipe into the rising main served no useful purpose and, furthermore, constricted the suction of the pump. By arranging the supply as shown it was found that there was no tendency for the air to escape other than where it was needed, except when an unnecessary volume was being used.

There is one disadvantage in the use of the flexible air connections and a loose pipe system, apart from the fact that the introduction of another pipe in the rising main increases the frictional resistance, and that is due to the fact that the air pipe may rest against the side of the lift pipe. This will result in a partial distribution of the air through the liquid. The objection may be of little account in the case of small lifts, but should be avoided in large ones. The ill-effects may be reduced by bolting a "spider," of three arms, to the outside of the air pipe, near the bottom, which will maintain it in a central position (see cut). The arms must be of such a length that the "spider" forms a *very* loose fit in the inside of the rising main. It is preferably made of wrought iron, and kept from slipping off at the bottom of the pipe by means of a sleeve which may be bored around its lower end, in the manner shown, in order to distribute the air more effectively.

Operation of Compound Lift With Flexible Air Connections

By reference to the diagram it will be noticed that four water levels are given. It may be assumed that level No. 1 shows the original position of the water. The flexible air connection is then put into the rising main *A* to a depth consistent with available pressure, and gradually lowered therein as the water is reduced in the shaft until level No. 2 is reached. The flexibly connected pipe is then withdrawn from rising main *A* and transferred to *B*. As soon as the second lift is in operation, water will be delivered so that lift *A* can be operated by means of the permanently connected air pipe. As soon as water level No. 3 has been reached, the flexible connection is withdrawn from air lift *B* and transferred to *C*. As soon as this is in operation, the permanent connection to supply air for lift *B* can be used. The final water level will be approximately as shown at No. 4, with the air pipe at the bottom of the lowest lift pipe.

Ratio of submergence to lift will vary in such installations according to local conditions. Economy in small lifts may demand a ratio of from 1½ or 2 to 1 of submergence as compared with lift. In other instances economical work is of secondary consideration, especially where air pressure is low, and a shallow submergence may be adopted.

The arrangement shown permits the easy escape of the air when lifting is accomplished. Spasmodic or jerky delivery of water usually indicates faulty conditions as to air volume or submergence ratio, which should be regulated as far as practicable to insure a more or less even stream from the discharge pipe.

U. S. Employment Service

Engineers, executives, men of college training and practical experience in business and technical fields are now being released from the Army, Navy and from other war work. The professional and special section of the U. S. Employment Service, a branch of the Department of Labor, has been organized for the benefit of employers in need of these men. The service is entirely free of charge.

The New York Office, headquarters for the eastern zone, at 16 East 42nd St., covers the following states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Ohio, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama. The Chicago office, headquarters for the central zone, at 63 East Adams St., covers all remaining states. Later, zone offices will be established to take charge of part of the territory now in the Chicago zone.

The United Engineering Societies, composed of the four great engineering organizations—the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers and the American Institute of Mining and Metallurgical Engineers—are now coöperating with the professional and special section in placing men in the engineering professions. In the event that the New York City Employment Bureau at the national offices of the above-mentioned societies cannot supply a man meeting an employer's requirements, the requisition is at once referred to the professional and special section, where thousands of graduates of engineering colleges and men of practical experience are available.

Support Asked for Potash Bill

As part of a campaign to secure the passage of the Potash Imports License Bill (Senate No. 5557), the American Mining Congress has issued a circular under date of Feb. 15 in which the present situation is outlined. After describing existing conditions in the industry and pointing out the shrinkage in the 1918 cotton crop as illustrating the need for potash, the circular states:

> We estimate the present American production to be at the rate of one-third present American requirements, and that next year it will be one-half. Should the Potash Imports License Bill (Senate No. 5557) become a law, we believe the price trend would be as follows:
>
> Crop season 1919-20—One-third United States potash at $3 per unit K_2O, $3; two-thirds imported potash at $1.25 per unit K_2O, $2.50; total for three units, $5.50; average per unit, $1.83.
>
> Crop season 1920-21—One-half United States potash at $2 per unit K_2O, $2; one-half imported potash at $1 per unit K_2O, $1; total for two units, $3; average per unit, $1.50.
>
> After 1921, United States potash will be available at $1 per unit K_2O.

Important Iron-Ore Districts have been discovered between Malili and Lake Toewoeti, in the island of Celebes, in the Dutch East Indies, according to *Iron and Coal Trades Review*. Iron ore had previously been found only in four fields in the islands, of which one, near La Rona, on Lake Toewoeti, had been explored seriously. The ore in the newly discovered area is roughly estimated to contain 50% Fe, and it has been calculated that the field contains fully 10,000,000 tons of ore. Samples sent to Batavia from East Celebes were tested and found to contain on an average more than 50% Fe, and almost 0.06% phosphorus.

The Mineral Industry in Venezuela

BY CHARLES F. Z. CARACRISTI[*]

A paper containing statistics of interest and value in regard to the production of minerals in Venezuela in recent times. The principal minerals dealt with are gold, copper, petroleum, asphaltum, magnesite and coal; and the production of other materials of secondary importance may result from greater publicity and sounder methods of metallurgy and industrial procedure.

THE following statistics have been compiled from official data and from information gathered from independent sources. Those for 1918 are approximately correct.

VENEZUELAN MINERAL PRODUCTION 1917 AND 1918

	1917	1918
Gold	$634,170	$471,900
Copper	1,966,760	855,440
Petroleum	145,984	211,200
Asphaltum	1,081,340	564,000
Magnesite	18,000	6,000
Coal	266,686	268,000
Totals	$4,072,940	$2,376,540

Aside from the coal, petroleum, and asphalt contracts, there are, in actual operation, 179 mining properties, 53 of which are subject to assessment work before titles can be granted, and 97 are merely filings of record that must be approved by Congress before they are placed in the probation class, i.e. before assessment work can legally begin. Recently, I have received good samples of cinnabar, and I understand that 11 entries have been made in various parts of the country. The government tax is so heavy on mining the metal, however, that its commercial exploitation is not possible. No doubt the law could be changed if the value of the deposits warranted.

Alabaster is found in the State of Yaracuy, the quality being equal to the Italian product. The colors are white, pink, red, and yellow. It remains to be seen if the quarries, which extend over a considerable area, are capable of yielding large blocks free of blemishes, and whether the product will stand transportation.

Potash has been reported as existing at various points along the coast, but samples submitted were found to consist of ordinary salt and about 3% of potash. Extensive areas of low-grade phosphate rock cover the Coro Peninsula, but the material has no commercial value. Its analyses are about the same as those of the marls that cap the Eocene beds of the coastal plains of Alabama. Diamonds are found in the placer beds of the Callio country. The iron deposits of the Rio Orinoco should be of interest, as there is a large area of iron-bearing territory; but, although much has been written on the subject, no serious study of the deposits has yet been made. It would not pay to embark on a mining venture such as this, where a large capital must be invested to insure favorable returns, unless the operating company had an absolute monopoly of the region by actually owning the land as well as the mines.

Mining in Venezuela is restricted to a few foreign corporations, and development is retarded by lack of confidence on the part of investors. It is not a mining country. The territory contains only small areas that are capable of producing minerals in commercial quantities and at a reasonable profit. The important items that offer future possibilities, and that, today, form the bases of actual production, are iron, magnesite, asphaltum, petroleum, and copper. I have failed to mention the gold output, because the future is somewhat problematic, on account of uncertainty as to the life of the deposits, the scarcity of labor, the terrible climate in the gold-producing regions, and the high cost of materials and supplies needed by those in charge. In the future, thanks to scientific sanitation, the greatest drawback may disappear.

Also, I failed to classify Venezuelan coal as a valuable mineral asset, because its quality does not stimulate a spirit of optimism, in view of the competition with crude oil in the local markets. Moreover, the coal is of no value for export. It is a lignite with from 5 to 13% sulphur and from 12 to 19% ash, low in fixed carbon and high in moisture and iron. The iron ores of Imataca (Orinoco River region) and the magnesite of the Island of Margarita may give promise for the future if the deposits fall into responsible American hands, and provided that contracts can be drawn that do not lend themselves to blackmailing lawsuits, as has been the experience in the past. In this connection the President of the republic recently spoke sternly to the Venezuelan judges; but I fear that something more than mere words will be necessary to destroy the prevailing habit on the part of irresponsible "tin-horn" lawyers and state judges from conspiring together to levy bribes and blackmail from foreigners. Strangers have no right to dictate to the country that grants them hospitality and an opportunity to acquire wealth, but it would seem that, if the trouble and controversies between foreigners and natives were subjected exclusively to the jurisdiction of the federal courts, as they are in certain cases in the United States, or left to a consular court, great benefits would result and many international issues would be avoided.

REGRETTABLE CONDITIONS PREVENT DEVELOPMENT

The trouble does not come from the federal government, but from the greed, perversity, and ambitions of individuals operating in conjunction with court functionaries and politicians. This condition is highly regrettable, because it prevents the immediate development of many mining enterprises and other foreign ventures in Venezuela as in other Spanish-American countries. There can be no extensive developments until investors are protected by the federal government, and until laws are passed with that end in view. Of course, I am speaking in the interest of small enterprises, and not extensive monopolistic ventures that have the capital, influence, and other moral and physical requirements to insure the support of the governments and to force respect and protection.

---

[*] Geologist and consulting mining engineer, Macuto, Venezuela.

In 1917 gold was produced in Venezuela as follows:

STATISTICS OF GOLD PRODUCTION IN VENEZUELA FOR 1917

	Grams	Value
The Eldorado Gold Mining Co.	77,871	$46,722.60
El Marne	71,300	42,780.00
La Salvacion	88,350	53,010.00
El Diamente	72,972	43,783.20
Gold Fields of Venezuela	249,461	149,676.60
Carabobo	28,505	17,103.00
Belgica	93,000	55,800.00
El Remo	17,332	10,399.20
Dos de Octubre	13,590	8,154 00
Marruecos	6,943	4,165.80
Alto Cuyuni	46,112	27,667.20
Cara al Sol	56,750	34,950 00
Lo Increible	82,736	49,641 60
Riqueza	53,382	32,029 20
Placer gold extracted by Indians and Venezuelans that is of free exploitation (amount shipped abroad)	98,647	59,188.20
Totals	1,056,951	$634,170.60

The production for the year 1918, from the data I have in hand, is approximately 786,500 gm., valued at $471,900, produced by the Gold Fields of Venezuela, Ltd., the Eldorado Gold Mining Co., the Increible, the free placer zone, and a few other producers. The war conditions greatly disturbed the industry, and four producers suspended operations in the Callao district.

Venezuela Bonanzas Do Not Always Materialize

Lo Increible is a local concern that sold shares at a fabulous price on the most glowing reports and by means of the most attractive samples that were ever seen in this country. Widows and orphans forfeited their all to get into the "bonanza." The property is in the hands of foreign interests; and, honestly and scientifically operated, is a fair proposition and should pay dividends for some time to come. The most important gold-mining company is without doubt the Gold Fields of Venezuela, Ltd. The Eldorado Mining Co. also has good properties.

Lo Increible company has installed a cyanide plant to work over its slimes, but I believe this was entirely unnecessary, as the sulphides readily decompose in this climate; and, after two years or less, the tailings can be worked over, oxidation having taken place in the meantime. Of course, if the quartz is to be treated at once, there may be some reason for the plant; otherwise it has been capital invested without any real necessity, as 80% of the gold is free.[1]

The New Callao Mining Co., Ltd., of London, has not operated its properties since 1916, except for the performance of some prospect work during the first three months of 1917. The Gold Fields of Venezuela, Ltd., of London, is a consolidation of various English corporations.

Commercially profitable quartz has been encountered in the Lagunas and the San Antonio mines. Large quantities of low-grade ore have been found elsewhere, but it cannot be beneficiated under existing conditions. The company has already blocked out 140,000 tons that will assay, on an average, 12 gm. of gold per ton. The quartz veins run east and west, with a southerly dip. At the mine La Unda the vein runs north and south, with a westerly dip. The company has completed the installation of a new cyanide plant, and is using a continuous counter-current decantation process. The plant has a capacity of 50 tons per 24 hours and has cost the company $14,000.

El Amparo Mine, Ltd., of London, went into voluntary liquidation in 1918. It was the owner of the La Paz concessions.

Copper Output Shows a Decrease

The copper exports for the years 1917 and 1918 follow:

VENEZUELAN COPPER MINING IN 1917 AND 1918

	1917, Tons	1918, Tons
South American Copper Syndicate, Ltd., London	48,542	21,386
La Cumaragua Company (local company)	580	.....
Sindicato Buria (local syndicate)	36	....
Sindicato Aleman, Caracas	11	...
Totals	49,169	21,386

A discrepancy will be found between my figures and those of the Ministry of Fomento. This is due to the fact that, in the first place, I am using tons of 2000 lb., whereas the government uses metric tons. In the second place, I add the figures for shipments that do not appear in the government statistics, and am basing the statistics for 1918 on steamship invoices, as no government reports are available.

The Aroa mines of the South American Copper Syndicate of London, situated in the State of Yaracuy, are of considerable value, and production has been retarded only because of the difficulty of obtaining ships for the transportation of the ore. This company has a good plant and a small smeltery for the reduction of ore to matte. The district should have a good future, if the reduction of copper can be carried on successfully in an electric furnace, as plenty of water power is available for the purpose. This company owns its own railway and wharves at the port of Tucacas; but, although the harbor is safe against storms, it lacks depth, ships are forced to anchor nearly a mile from the shore, and loading has to be done with barges.

La Cumaragua company is a local concern which has spent plenty of money without tangible result. The copper-bearing vein has not been found, and carbonates are being extracted from the blocked zone. The ore occurs in pockets, and resulted from the leaching of the surrounding territory and the precipitation of the copper in pockets of iron as a replacement. The company has a good plant, and I have no doubt that proper prospecting, under professional advice, would discover the ore veins. The property lies in the possible ore belt and on a quartz vein that at other points contains copper. To the east, the same veins that carry copper to the west substitute it for iron pyrites. The change is very gradual, the iron increasing and the copper decreasing, until the copper disappears.

Pretensions of Land-Owners Complicate Operations

The Syndicate Aleman, of Caracas, owns the copper-zinc prospects known as the Santa Ysabel, south of the town of Villa de Cura, in the State of Aragua. The work done is not sufficient to justify an opinion, although good ore is in sight. Much money has been spent by the syndicate and its predecessors in work of questionable value. The books of the two companies show that $32,000 has been expended in prospecting, but the work actually executed could easily be duplicated for less. What happened in this case is just what happens elsewhere. The two syndicates thought that they would serve the ends of sure economy by employing an inexperienced friend to manage their property. This friend, as is usual, knew nothing about mining, so much was wasted. The prospecting was done in an oreshoot where two veins bisect each other; and, as the ore was abundant, all the prospecting was done around this vein, without making any effort to find anything in the extension of the veins themselves. I shipped 11 tons of this ore to the United States; it assayed 4.61% copper and 10.22% zinc, and this may be considered the average for the oreshoot. Indications of the existence of similar ore extend over an extensive area, but the difficulty rests in the fact that one is faced with perpetual opposition, the pretensions of the landowners being such that lawsuits form the favorite pastime of many ambitious persons in these regions.

---

[1] The comment made by our contributor is likely to lead to a mistaken impression as to the advisability of adopting cyanidation. Although the pyrite may oxidize rapidly, this does not necessarily mean that cyanidation is not preferable to any further attempt to recover the gold from the slimes by simple methods. —Editor.

The Syndicate Aleman had some assays made, with the following results: Copper, 3 to 8%; zinc, 12 to 14%. Some work was done on a nearby property known as El Rosario, but the copper and zinc content proved low, and the work was abandoned. Last year J. C. Price, the manager of the Bolivar Railway Co., did some development on his mine in the Aroa district known as Camburito, and the samples (five tons), which were shipped abroad, gave good returns. Some work was also done in 1918 on a prospect on the Caribbean coast at Charco Pato, and copper carbonates were extracted. Development work was also done on a prospect near Carupano.

The republic has officially recognized 27 copper claims, with an area of 7500 acres, in addition to 10 claims pending, with a surface area of 5000 acres.

MAGNESITE PRODUCED IN 1917-1918

In 1917 the American Carbon Co., of New York, produced 1800 tons of magnesite from its property on the Island of Margarita, and, in 1918, it produced 600 tons. It shipped 1000 tons in 1917 and none in 1918. The Magnesite Products Corporation, of New York, during the months of September, October, November, and December, 1917, produced 560 tons, which it has ready for shipment; and suspended operations because of lack of shipping facilities.

PETROLEUM IN VENEZUELA

In 1889 I examined the oil fields of South America for the late Secretary of State, James G. Blaine, and the late Daniel O'Day, of the Standard Oil Co., and then, years after, I published a portion of my deductions in *Mineral Industry*, Vol. 8. In this report I referred to Venezuela as a possible oil producer, and stated specifically that petroleum would be found in the region of the Rio Catatumbo, particularly on the eastern bank on the lands then owned by Don Silvestre Martinez; on the Rio Zulia, Sardinarte and Tara, and "in fact, good indications exist in the entire State of Tachira, in Venezuela, and the northeast section of the Department of Santander, Colombia, in the valley leading from the Lake of Maracaibo to the city of Cucuta." I mentioned the oil in the Motilenes Mountains, and near the town of Casigua in the State of Falcon. I concluded the synopsis report to which I refer with the following sentence: "From a commercial point of view, the Maracaibo district seems to possess the best outlook of the oil fields of Venezuela." I look upon the success of the recent developments in this region with a feeling of personal pride; however, there are other oil fields in Venezuela of considerable importance that have since been located.

I estimate the petroleum output (based on customs report on shipping tonnage arriving and departing in the service of the Caribbean Petroleum Co.) for 1918 at 26,400 metric tons. The commercial value of the oil produced for 1917 is $145,984 and $211,200 for 1918.

The completion of the great refinery at Curacao by the Dutch Shell Co. has given an outlet to Venezuela petroleum. The Caribbean Petroleum Co., under its contract with the government, is paying rentals on 60 petroleum claims with an area of 71,000 acres. This company's holdings are the most promising in the Maracaibo district, and it has a monopoly of that region. It is helped by the new mining law and the well-known policy of the government not to grant new concessions in this branch of mining. The company pays the government of Venezuela a rental of $5754.50 annually, and 20c. per ton for the petroleum extracted. The V. F. Oil Syndicate has 125 acres; F. J. Arraiz has 247 acres; and the Bermudez Co., 16,250 acres; the Colon Development Co., 1000 acres; and the Venezuela Oil Co., Ltd., 547.50 acres. The total area is about 4000 acres.

ASPHALTUM AN IMPORTANT VENEZUELAN INDUSTRY

ASPHALTUM PRODUCTION IN VENEZUELA FOR 1917 AND 1918

	1917		1918	
	Tons	Value	Tons	Value
New York & Bermudez Co...	52,991	$1,059,820	28,200	$564,000
The South American Co	68	1,360	50	1,000
Riopauji Mines	1,008	20,160		
Totals	54,067	$1,081,340	28,250	$565,000

The value placed on asphaltum at the points of production is $20 per ton, and of petroleum, $8 per ton.

The Caribbean Petroleum Co. and the New York & Bermudez Co. are under the same management and are reported to be controlled by the Standard Oil Co. They form a monopoly in both products, so far as production in this country is concerned.

The success of the Caribbean Co. is due largely to the diplomacy and marked ability of Lewis J. Proctor, its manager, who has been able to harmonize the many difficult interests that always appear in a country like this, and to secure the sympathy of the people.

The asphalt concessions cover an area of 17,250 acres and are nine in number, including Guanoco Lake, that is controlled by the New York & Bermudez Co., and has an area of 12,000 acres, the rest of the lands being in the leases of the South American Company.

COAL PRODUCTION FOR 1917 AND 1918

During the year 1917 the coal mines that are the property of the national government and operated by it produced 22,686 short tons of lignite, divided as follows: mines of Nariqual, Capiricual, and Tocoropo, 17,379 tons; and the mines of Coro or Falcon, 5307 tons, the total output having a value at the mines of $10 per ton, or $226,860. This high price is due to the fact that, owing to the war, coal could not be imported.

The production in 1918 was approximately 26,800 tons—20,000 tons produced at the mines of Nariqual, Capiricual, and Tocoropo, and 6800 from Falcon, or the Coro Peninsula. The value of the coal at the mines was about the same as the previous year, or $268,000.

Coal sold in Caracas, La Guayra, and Puerto Cabello at $20 per ton, and it was difficult to obtain it in large quantities at any price. For the use of the railways it is briquetted, and in that form is not as objectionable as in crude state. The coastwise steamers that use this coal exclusively waste at least 60% of it for want of forced draft. The coal almost immediately disintegrates into a fine powder, and a roasting process goes on inside the fire box before combustion begins. The residue is a gummy substance that partly burns and partly clinkers against the grate bars, and closes what little air space is left. Under such conditions, one can well imagine what percentage of British thermal units contained in the coal are utilized. Burned under the boilers in the form of "powdered" coal, it gives splendid results, as proved by its use in a rotary kiln in Caracas.

In 1917 I investigated a coal field at Parapara, in the State of Aragua. Although the coal is far better than that which is being actually used, the geological formation is so broken that it would be a dangerous venture to attempt to work the mine, even were it not 60 miles from the nearest railway. Besides, the country is low and cannot be drained; and the mines cannot be operated at great depth, because of flooding.

In 1917 the government granted to A. C. Payne, of Philadelphia, a concession to build a railway, without subsidy, to some mines situated in the State of Zulia. Mr. Payne represented the Caribbean Coal Co., and under the grant it is purposed to work some coal deposits in the Guajiran Peninsula. These properties are known as Santa Rosa and El Filon del Espejo, and it is claimed that good coal has been found. For many years an attempt has been made to float a similar enterprise in London and New York, having in view the building of a railway from Rio Hacha, in Colombia, to the coal fields of the Guajira and the Sierra Nevada de Santa Marta. Good coal is found in the Andes in the State of Tachira, and on the Rio Meta, on the upper Orinoco.

I wish to express my thanks to Dr. G. Torres, Minister of Fomento, and Professor Francisco Azerm, Director of the Bureau of Mines and Mining, for their kindness in supplying me with data covering operations of the year 1918.

On Reconquered Soil*

The population of the liberated parts of France and Belgium can never show enough gratitude to Herbert Clark Hoover, the American engineer who was president of the Commission for the Relief of Belgium, to whose services as administrator of food supplies they owe the fact that they did not die of hunger during the long years of war.

Hoover is a well-known mining engineer, a member of the American Institute of Mining Engineers, the Mining and Metallurgical Society of America, the Society of Civil Engineers of France, and of other technical bodies. He is the author of some extremely interesting studies on the valuation, organization, and administration of metal mines, and we often consult his work entitled "Principles of Mining," which is considered an authoritative treatise on the subject.

When the Académie des Sciences Morales et Politiques presented to Mr. Hoover the Audiffred prize, appreciation was expressed in the following terms:

"The Audiffred prize has been presented to Herbert Clark Hoover, graduate of Leland Stanford University, California, a distinguished engineer who now represents the American Government as president of the Commission for the Relief of Belgium. On his appointment to this office Mr. Hoover immediately gave up his professional work so as to be able to concentrate all his energy on the care of the Belgian and French people in the invaded regions. He put so much ardor into his task that he earned the nickname of 'miracle performer.' With incomparable skill and calm tenacity he coped successfully with the situation created by the Germans, and succeeded in bringing relief to 10,000,000 souls. He imported more than four million tons of different supplies for Belgium and the North of France.

"Chosen as Food Administrator by the United States, he has aided the charitable work of his country to such a high degree that in the last 12 months he has been able to bring to Europe enough flour to feed 62,000,000 of the Allies. He has, besides, shown a wonderful spirit of resistance to the enemy. Remembering that 'man does not live by bread alone, but by the word of life,' he has added a real greatness to his valor and ability. We are happy to award the Audiffred prize for such wonderful devotion, which will surprise no one because we find it in an American who, like all his compatriots, was drawn toward suffering as by an invisible magnet."

Extending its work to the various nations delivered from the enemy's yoke, i.e., the Serbs, the Czecho-Slovaks, the Jugo-Slavs, and the Poles, the American Government, in agreement with the Allies, has just formed an inter-Allied committee for the relief of these countries. Naturally, President Wilson has appointed Mr. Hoover as director of this committee.

Negligence Toward Mine Driver

By A. L. H. Street*

Plaintiff, while driving a mule train in defendant's mine, was injured through collision with a truck which timber men, engaged in their separate department of work, had left on the track without warning to plaintiff. He sued for damages, and the Washington Supreme Court holds that he was not debarred from recovering on the theory that the plaintiff and the negligent timber men were "fellow servants," within the rule of law exonerating an employer from responsibility for injury to one employee when caused by negligence of a fellow servant (Asbury *vs.* Hecla Mining Co., *175 Pacific Reporter, 179*). Being engaged in different departments of work, they were not "fellow servants."

It is also decided by the court that plaintiff is not to be regarded as having assumed the risk of the accident, he having suddenly come around a curve and suddenly encountered the danger, without any reason for supposing that the timber truck had been left on the track.

---

*From *L'Echo des Mines et de la Metallurgie*, Jan. 31, 1919.

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Calibration of Base-Metal Thermocouples

By C. S. Crouse*

Notes on keeping base-metal thermocouples and pyrometers in a condition for accurate temperature control, and a description of the equipment required. It has been found that the scientific adjustment of such apparatus has resulted in marked improvements in the treatment of steel; and, as other industries are interested in temperature control of such a kind, the paper should prove generally timely and informative.

There are so many industries at this time in which accurate temperature control, obtained by means of pyrometrical equipment, is required, that a description of suitable apparatus and data as to the method in use for calibrating base-metal couples should be of interest.

In general, there are three methods of calibrating such couples: (1) Calibration at a single point such as the freezing point of salt; (2) by immersion with a standard, in a bath of molten metal, such as tin; (3) by immersion with a standard couple, in a special furnace, the couples being checked against the standard, which is done by taking successive readings, after the temperature of the furnace has become constant, with a millivoltmeter, or a potentiometer reading directly in degrees.

The first process is more of a laboratory method than a commercial one, owing to the difficulty of keeping the salt chemically pure, the slowness of the process, and other drawbacks. The second method is of practical application on a commercial scale; but it is with the third method that this paper is concerned.

Method of Operation

In the plant which furnished the basis for the accompanying data, electric-resistance furnaces are used for the heat treatment of large-gun forgings, and it is desired to control the temperature to within 10° from the range of from 1000° F. to 1600° F. The furnaces are vertical, the couples being introduced into them through iron pipes slightly larger in diameter than the couple and extending through the wall of the furnace. The couple is thrust in until the hot junction is in contact with the forging, when the space between the couple and the pipe is plugged with clay. It is important that the plugging be complete, because if air leaks in around the couple it will cool it, and thus vitiate the reading. Lead wires run from the couples to Leeds & Northrup recording potentiometers, with a compensator for the cold-junction temperature.

The base-metal couples consist of one wire of iron and the other of constantan, and are made up in the plant, the wire being bought in rolls and cut to about 4-ft. lengths. The two wires are then twisted together for a few turns and the ends welded in an oxy-acetylene flame. This forms a small bead, which is the hot junction of the couple. The cold junction, as stated, is at the pyrometer. No couples are left in continuous service for more than a week without calibration, which process is explained in detail in a succeeding paragraph.

The company owns a platinum couple and one of platinum-rhodium. They have been calibrated to within 5° F. at the Bureau of Standards. It also operates a small, vertical-resistance type electric furnace, with a capacity of seven couples at an immersion of about 25 in. Two rare-metal couples are necessary so that there will always be one available in case the other is away being recalibrated.

Calibrating the Couples

The procedure in calibrating follows: Two iron-constantan couples are placed in the furnace with one of the rare-metal couples, care being taken to see that the immersion of all is the same. The couples are inserted through a hole in the asbestos cover, the remaining interstices being carefully plugged up with shredded asbestos. The furnace is then brought to a steady heat, generally between 1400° F. and 1500° F., and held there about a half hour, after which calibration begins.

The cold junction of the rare-metal couple is directly above the asbestos cover of the furnace, and a thermometer is placed at this point to register the temperature of the cold junction. The cold junction of the base-metal couples is extended, by means of lead wires, away from the furnace; and a thermometer, which is immersed in oil, is placed there. Oil immersion is adopted in preference to exposure to the air, because after oil once comes to room temperature it will not vary with air current, thus giving more nearly the actual temperature of the wire.

Lead wires from the couples connect to a multiple-throw switch, which in turn connects to a Leeds & Northrup Type K potentiometer. This instrument is accurate, and excellent results are obtained with it. The galvanometer of the instrument is then balanced on the standard cell, and readings are taken as rapidly as possible (to avoid any temperature changes in the furnace) on the rare-metal standard and the two base-metal couples successively. After a complete set of readings is obtained, another set is taken as a check on the first.

The readings are taken in millivolts, which are converted to degrees Fahrenheit, and the error, if any, for the base-metal couples is estimated. The couples are then tagged with their respective numbers and correction, and put away as secondary standards. These secondary standards are recalibrated from time to time, depending on the use they get, as may seem necessary.

An Example of Calculations Needed

A sample calculation follows:

Pt + Pt-Rh couple reading = 7.066 m.v.

Figuring from the standardization sheet furnished with the couple by the Bureau of Standards, it is found that 7.066 m.v. = 777.072° C.

Pt + Pt-Rh cold-junction temperature = 87° F. = 16.775° C.

---

*Engineer of tests, Ordnance Department, U. S. A., 204 Pierpoint St., Rochester, New York.

777.072° C. + 16.775° C. = 793.847° C. = 1460.924° F., which is the corrected reading for the rare-metal couple.

Iron + constantan couple reading = 44.236 m.v.

Iron + constantan cold-junction temperature = 74° F., which is converted, by tables furnished for this purpose by the Leeds & Northrup Co., into 2.130 m.v.

44.236 m.v. + 2.130 m.v. = 46.366 m.v. = 1471° F., which is the corrected reading for the iron-constantan couple. The conversion from millivolts to degrees is done with the same table used before.

Rare-metal couple reading = 1461° F.

Base-metal couple reading = 1471° F.

As the base-metal couple reads 10° F. higher than the true temperature, it is said to have a correction factor of (+) 10° F.; or, in other words, any temperature measured with this couple must be reduced by 10° F. to obtain the true reading. The secondary standards are used to do the bulk of the couple calibration, thus saving deterioration on the rare-metal couples and the consequent necessity for recalibration at the Bureau of Standards.

USE OF POTENTIOMETER

As stated, the couples in actual use in the furnace are checked against the secondary standards, and the procedure is not so painstaking as in the former case. Six couples and the standard are placed in the furnace, which is then brought to heat, and readings are taken, first on the standard, then on No. 1 couple. This is checked, and the operation is repeated until all the couples are calibrated. The proper correction is then made for the error in the standard, and the couples are tagged with their respective numbers and corrections and put away ready for use. The Type K potentiometer is not used in this case, there being employed, in its stead, a portable potentiometer, with a compensating cold-junction coil, which reads directly in degrees Fahrenheit. This potentiometer is, from time to time, checked back against the Type K potentiometer to see that it is holding its accuracy. If it is found to be "off" an allowance is made for the amount.

ELECTRIC FURNACE IN CALIBRATING LABORATORY

It has been argued that this method of checking couples is not accurate, and that they should be checked in the furnace and under the conditions in which they are used. This is because the couple may not be homogeneous throughout its length—a condition which would be likely to affect the readings under dissimilar conditions. For instance, if the couple were homogeneous for the first 1 ft. of its length back from the hot junction, and not for the next 1 ft., it is manifest that different readings would be obtained should 6 in. or 2 ft. be exposed to the heat of the furnace.

This condition is overcome, or at least rendered negligible, because the depth of immersion of the couple under working conditions and in the check furnace is approximately the same. This being the case, even though the couple be not homogeneous, the same relative reading is obtained under both working and checking conditions.

COMPLETE RECORDS ARE KEPT

A record is kept of the length of service of each couple between calibration dates and, on the same card, the different correction figures obtained at each time of checking. The deterioration of couples at the plant mentioned is probably not as great as would be the case if gas- or oil-fired furnaces were used, owing to the fact that there are no gases in an electric furnace to attack the couple chemically, the only deteriorating element being the heat. The results of the observation of a number of couples over a period of months, however, seem to show that there is a point up to which the couples show no deterioration, and after which deterioration is rapid. The couples do not seem to deteriorate in any regular ratio or manner, but after about 25 days of service they cannot be relied on without frequent calibration.

RESULTS OF THE TESTS

The results obtained may be outlined thus: Of 52 couples on which observations were taken, 15 showed deterioration and 37 did not. Of the 37 that failed to show deterioration, 35 were in use less than 25 days. Of the 15 couples that did show deterioration 13 were in use 25 days or more. Of these 15, six were again placed in use for a few days, and further marked deterioration was found on recalibration. The above-mentioned couples were calibrated on an average of once every seven days, and an error of not more than 5°, over a number of calibrations, was not considered as deterioration, because this amount is within the allowable calibration error.

Each furnace is equipped with six rows of nichrome ribbon, through which a three-phase, 220-volt, alternating current passes, the resistance offered by the ribbon furnishing the heat. The upper and lower three rows of ribbon act independently of each other, thus necessitating two potentiometers to the furnace. Short couples are inserted with their hot junction as near these ribbons as possible, and these give a ribbon temperature, whereas couples touching the work in both the upper and lower zones of the furnace give the work temperature. Thus each recorder registers on two couples, one ribbon, and the other work, the change from one to the other being made by means of a split cylinder in the potentiometer and taking place every 45 seconds. As a result there are two curves on each chart, one giving the ribbon temperature and the other the work.

While the charge is coming to heat, the ribbon curve shows the higher temperature and both show a regular rise, whereas after the charge is at heat the work curve will be the higher, as a general rule, and show a straight line, while the ribbon curve will be jagged, due to the fact that the power is continually going off and on, and the ribbon, as a consequence, is cooling down and heating up again. The mass of the forging prevents it from cooling during the comparatively short time that the power is off.

CONTROLLING THE TEMPERATURE

The temperature is controlled by a finger and movable disk, an arrangement incorporated in the potentiometer itself whereby the current will go off at any desired temperature and go on again when the temperature drops below that desired.

This automatic power control works on the ribbon temperature. In other words, when the ribbon shows a certain temperature the power goes off, and when it shows a certain lower temperature the power goes on, this gap being capable of regulation, thus keeping the forging at the desired temperature. Every morning these recorders are checked up as to straightness of recording pen and balance of galvanometer needle; also, whenever a charge is at heat the potentiometer itself is checked against a standard portable instrument, and very little fluctuation is found. This checking is done by reading, with the same couple, first on the recorder and then on the standard instrument, and, as the furnace is at heat, this practically eliminates the error due to temperature fluctuations.

Of course, in reading the chart on the recorders an adjustment must be made for the correction factor of the particular thermocouple in use at the time.

In addition to the four couples, two in each zone, which must be in each furnace to serve the recorders, one or more check couples are used which register on a Leeds & Northrup multiple-point potentiometer. This is used exclusively as a check on the recorder readings and is, in turn, checked in the same manner as are the recorders.

All of the equipment is in charge of a technical graduate, who devotes most of his time to this work, and an assistant, who devotes all of his time to it, but the expense is amply justified by the close temperature-control obtainable and the resultant excellent effect of the treatment on the steel.

Manganese-Ore Production in 1918

Reports made to the Geological Survey by operators of manganese deposits up to Nov. 30, 1918, indicate that the highest rate of production of all grades of ore was attained during the third quarter of 1918 and that shipments declined rapidly after the armistice was signed. During 1917 the quarterly rate of production of ore containing more than 35% of manganese reached a maximum of 50,906 tons in the third quarter, and the total production for the year was 128,053 tons. In 1918 the rate of production continued to rise, reaching 90,738 tons in the third quarter, and the present estimate for the year is 294,000 tons. Shipments of ore containing 10 to 35% of manganese attained the maximum of 283,180 tons in the third quarter of 1918, and the present estimate of shipments for the entire year is 831,000 tons.

The increase in the shipments of high-grade ore during the third quarter of 1918 is almost entirely to be attributed to the increase in the output of the mines of the Philipsburg and Butte districts, Montana, for the shipments from every other state, except Georgia and Tennessee, were less for the third quarter than the maximum, which in most districts was attained during 1917 or early in 1918. The shipments from the Philipsburg district steadily increased from 1916, when the manganese deposits there were first exploited, to the third quarter of 1918, when 35,998 tons of ore was shipped. Recent investigations by a geologist of the Geological Survey show the existence of large reserves of ore in that district. The first shipments from the Butte district were made in 1917, and the output of that district during the third quarter of 1918 was 24,097 tons.

As most manganese deposits are exploited by surface workings, and lack good transportation facilities, and as the concentrating mills at many others require an abundant supply of water, the rate of shipment varies with the season, a fact which, considered in connection with the railroad embargoes that prevailed early in 1918, explains the relatively low rate of shipment during the first quarter of 1918 from California, Virginia, Arkansas, and Georgia.

The shipments of low-grade ore from the Cuyuna district, Minnesota, during the third quarter of 1918, were 329,416 tons, the highest on record, whereas those from the Leadville district, Colorado, were 19,859 tons, which shows a great decrease from the maximum, 31,000 tons, shipped in the first quarter of 1918.

The imports of manganese ore for the eleven months ending Nov. 30, 1918, reported by the Bureau of Foreign and Domestic Commerce, were 469,919 tons, of which 329,360 tons was received from Brazil, 79,390 tons from Cuba, and 29,275 tons from India. The imports of ferromanganese for the eleven months ending Nov. 30, 1918, were 26,991 tons.

DOMESTIC MANGANESE AND MANGANIFEROUS ORE SHIPPED IN NINE MONTHS ENDED SEPT. 1, 1918

State	Ore Containing 35% Mn or More		Ore Containing 10-35% Mn		Ore Containing 5-10% Mn	
	Number of Shippers	Gross Tons	Number of Shippers	Gross Tons	Number of Shippers	Gross Tons
Alabama	1	411	3	307		
Arizona:						
Bisbee district	6	10,643	1	929		
Other districts.	15	3,315	(a) 5	(a) 4,776	(a) 1	(a) 6,082
Arkansas: Batesville district.	16	6,865	15	7,748		
California	36	17,520	1	31		
Colorado:						
Leadville district	1	1,150	(b) 12	(b) 80,663	(b)	(b)
Other districts	1	67				
Georgia	9	5,082	8	7,554	2	1,084
Michigan			1	16,940		
Minnesota:						
Cuyuna district.			10	452,757	4	182,300
Mesabi district.						
Montana:						
Butte district	7	53,083				
Philipsburg district	23	94,310				
Other districts	2	90				
Nevada	14	17,474	(a) 3	(a) 56,630		
New Jersey.	1	64	(c)	(c)		
New Mexico:						
Silver City district	1	120	2	18,135		
Other districts	6	2,151				
North Carolina.	1	315				
Oregon	1	176				
South Carolina.	1	100	1	850		
South Dakota	1	31				
Tennessee	17	2,376	9	1,798		
Texas..	1	308				
Utah	11	4,639				
Virginia	20	8,611	14	7,624	2	4,802
Wisconsin.					(d) 1	(d) 193,418
Totals	192	228,901	(ac) 83	(ac) 595,708	(ad) 8	(ad) 188,186

(a) Ore from Arizona, Colorado, and Nevada, used for fluxing, not included in totals for United States. (b) Fluxing ore not reported and not included in totals. (c) Residuum not reported and not included in totals. (d) Ore from Wisconsin containing approximately 5% manganese not included in totals.

Export of Yunnan Tin from Hongkong*

The heavy demand for South China tin which prevailed during 1918 resulted in the largest export of tin from Hongkong—the entrepôt of the trade—in its history, and led to agitation for increased output, according to Consul General George E. Anderson, writing from Hongkong under date of Nov. 19, 1918. The matter is one of extreme importance; for, though most of the tin now produced in South China comes from a few deposits in Yunnan Province, the field generally is so great and the deposits of ore in Yunnan, near Mengtze, are so rich that there would be a large addition to the world's supply of this metal if certain surmountable conditions should be overcome.

All of the tin now produced in South China, with the exception of inconsiderable amounts from various small workings, comes from the Ko-Chiu mines, near Mengtze, in the southern part of Yunnan Province. Up to a short time before the war, these mines were worked entirely by native methods, and, in fact, most of the actual mining at the present time is according to those processes. In 1912, however, certain German interests, combined with Chinese capitalists, put in more modern equipment, and since that time most of the output of the mines has been smelted in these plants. The tin is then shipped to Hongkong, where it is refined. Practically the whole of the output follows this course and is exported only through Hongkong.

At present the production depends entirely upon the amount of water available for washing the ore. The tin is extracted during a comparatively short season, beginning in February and ending in May. When there is a prospect of a wet season the amount is comparatively large. During the last extraction season a special effort was made, and the wet season which followed enabled production to reach the maximum point under present conditions.

At various times attempts have been made to secure sufficient coöperation among the tin interests and among the Chinese officials to establish a system of waterworks, which experts report could readily be done at a comparatively low cost. Five years ago an American engineer worked out a complete plan for such an enterprise, but nothing came of it.

About two years ago an attempt was made by the Anglo-French-China Corporation to buy the ore and ship it elsewhere for smelting and refining. The plan was a failure, for the reason that the mine owners demanded prices which made the scheme impracticable. The industry is in the control of a strong syndicate, which in turn has close relations with the Ko-Chiu smelters and with the refiners in Hongkong. There was strong opposition to the proposal to ship the ore before smelting, because it would mean the ruin of the works at Ko-Chiu and its trade in other lines and because the government would lose a revenue of about $500,000 annually.

A second attempt was made by the Straits Trading Co., of Singapore, a year ago, with no better results. Agitation is now being carried on with a view to securing the export of such ore as the mines turn out or can turn out over and above the amount which, with the available water supply, can be washed during the current season and which the smelters cannot handle. The export of unwashed ore would be too expensive to be successful, but it would be possible to transport the original ore to the Ta Tung Lake district, where it could be washed and concentrated, and whence it could be exported. Although such a method would probably interfere materially with the course of the trade through Hongkong, it would increase production indefinitely.

The exact output of the Ko-Chiu mines cannot be accurately ascertained, as the work is carried on without proper superintendence, is scattered over a wide area, and is in the control of various owners. The customs returns show the export of a little less than 12,000 short tons of the metal in 1917; the returns so far as available indicate an output in 1918 of perhaps 14,000 short tons. The mines are by far the most important and most profitable enterprise of the sort in South China, if not, indeed, of the whole country.

Despite the high price of tin in the United States and Europe, the return to the Yunnan mine owners during the war was not at all exceptional, and at times was rather below normal. The high value of silver in exchange with gold reduced the return to the operators in silver (in which metal costs are made and dividends declared) to a little more than half the return the gold values would normally indicate, or, in other words, the price actually realized in silver was little below normal. On the other hand, the prohibition of the export of silver from Hongkong and Tonkin was a serious handicap to the industry, for Yunnan depends upon these two sources for its supply of silver. With the impossibility of securing payment for tin exports to Hongkong by the importation of silver from Honkong or through exchange sources from Tonkin, Yunnan mine owners and other Yunnan traders were compelled to import silver from Shanghai at a premium which at times ranged from 2 to 12%, thus reducing the earnings of the mines by that amount. Under fixed exchange or at a fair rate of the silver dollar, such as that obtaining under fixed exchange in the Straits Settlements—with whose product of tin the Yunnan product competes—the return to Yunnan mine owners the last two years would have done much to set the whole business world of southwest China on the road to prosperity. Under present conditions it has merely served to prevent commercial disaster.

---

*Commerce Reports, Jan. 9, 1919.

Three Years To Finish Alaskan Railroad

With labor and material now available, the Government is preparing to rush work on the Alaskan railroad. Secretary Lane asked Congress on Feb. 8 for $13,800,000 to complete the job. The Alaskan Railroad Commission estimates it will require three years. The appropriation of $13,800,000 asked includes $4,000,000 of the original estimate of $35,000,000 for the construction of the road, and a deficiency appropriation of $9,800,000, representing the increase in the cost of materials. It is estimated the road can be finished for $44,800,000. Though work never was stopped, it was slowed down materially by the war. Several thousand applications have been received for work on the road. The bulk of the heavy work, such as grading, is virtually complete now.

International Nickel Co., Port Colborne

ADMINISTRATION BUILDING (LEFT), REFINERY, LABORATORY, AND CLUBHOUSE OF INTERNATIONAL NICKEL COMPANY, PORT COLBORNE, ONTARIO

LODGING HOUSE (LEFT), TIME OFFICE, AND ADMINISTRATIVE BUILDINGS AT INTERNATIONAL NICKEL COMPANY PLANT

MACHINE SHOP AND REFINERY (RIGHT) OF INTERNATIONAL NICKEL COMPANY, SHOWING AMPLE SPACE FOR POSSIBLE PLANT EXTENSION

POWER PLANT OF INTERNATIONAL NICKEL COMPANY, LOOKING NORTH

Alfred McLean Hamilton

The many friends of Alfred McLean Hamilton, who died at San Antonio, Tex., on Nov. 25, 1918, at the age of 39, as a result of heart and lung affections of a year's standing, will be interested in the following summary of his career:

Born in Montreal in 1879, he was educated in the Montreal High School and McGill University, being graduated from the latter institution in 1905 with the degree of B.Sc. in mining and metallurgy. While at McGill University, Hamilton was interested in athletics, and was made captain of the football team which won the Canadian intercollegiate championship. As his occupation in life he selected metallurgy, and made the most of all opportunities to gain knowledge and experience aside from that which the university could furnish, spending his summer vacations at smelting works in Mexico and Montana, and working at hard labor in any department which might be open to him.

ALFRED McLEAN HAMILTON

Soon after graduation, Hamilton obtained a position in the Washoe smeltery of the Anaconda Copper Mining Co., which, however, he gave up during the next year to identify himself with the enterprises of the American Smelting and Refining Co., in Mexico. In the service of that company he advanced rapidly, occupying in the last years of his life the position of manager of the plants at Velardeña and Aguascalientes, Mexico.

The greater portion of the twelve-year period during which Hamilton was in Mexico was disturbed by revolutions and counter-revolutions, with many murders, executions, raids, and hold-ups by bandits, with which all students of recent Mexican history are familiar. During this period Hamilton had more than his share of these troubles, and frequently came into immediate personal contact with raiding bandits. At one time six men were lined up against the wall of the plant under his charge and shot. On several occasions he was held up by bandits who rode into the plant and at the pistol point compelled him to open the safe. Once, when the key to the safe was in the hands of another person, he was subjected to a great deal of abuse, and it looked as though his life might be forfeited for his failure to produce the key. It is probable that his life was saved at various times by his quick wit and ability to humor his tormentors. A favorite device of his in this connection was to call upon some one to bring a camera; whereupon he would induce the bandits to mount their horses and pose for a picture. A picture did not always really result, as sometimes the camera had neither plates nor films.

During these troubled times it was a most difficult task to keep the plants in condition to operate. The people in many instances were starving, and arrangements had to be made for the planting of corn. The railroads were unable to furnish cars for the movement of supplies of ore, coke, and other materials, so that it was necessary to undertake for company account the rebuilding of hundreds of cars and many locomotives in the shops of the smelting works. It was difficult to do enough of such work to keep pace with the activity of the revolutionists in burning cars and blowing up locomotives. Other handicaps were the many and various taxes levied by the constantly changing Mexican governments.

It will be seen that though Hamilton's career was short, it was filled to the brim with the hardest and most wearing kind of work, and his unflinching loyalty to his company is shown by his sticking at it through so many years, in spite of all the discomforts and the actual physical danger to which he was subject much of the time. This loyalty to his superiors was matched by his loyalty to the men who worked under him, and in whom he was able to instill much of his own spirit. He saved the life of a Mexican workman at Velardeña during one of the revolutionary outbreaks, and this man has since shown his appreciation by loyally protecting the property of the company when it became necessary for the company to take away all of its American employees. Hamilton's whole period of active service is a most conspicuous example of unflinching courage and energy in carrying out instructions and accomplishing results.

Copper Mining in Papua*

The Laloki copper mine, in Papua, which was once owned by the Great Fitzroy Co., has been held under option from the debenture-holders. Recently, says the *Australasian*, there has been a revision of the agreement, with the result that the existing Laloki Co. has the right to pay £10,000 in June, 1920, in part payment for it, £10,000 in June, 1922, and the balance in June, 1925.

The directors, in the chairman's report just issued, point out that the mine is situated about two miles from Sapphire Creek and 18 miles from Port Moresby. Its elevation is about 400 ft. above Sapphire Creek, and it has been found necessary to construct a suitably graded road to permit of the carriage of stores and ore. The construction of this road is now proceeding. Two large steam tractors, capable of hauling 20-ton loads, have been purchased; and, when the road is completed, cheap

---

*Abstracted from the *Queensland Government Mining Journal*, Nov. 15, 1918.

facilities will be available for the transport of ore. Owing to the rough character of the country in which the mine is situated, it has hitherto cost upward of £6 per ton to pack and cart material to Port Moresby. Under the altered conditions, it is hoped to deliver ore to Port Moresby for about 15s. per ton. The board also has discovered a suitable route for a railway to the field, and is in touch with the Commonwealth government on the subject. A good deal of development work has been done at the mine, and, as the 230 ft. east crosscut has disclosed a run of from 8 to 10% copper ore, it is purposed to make shipments of this material. The revenue so obtained will help to carry out development and other work. Experiments have shown that the ore can be cheaply roasted, the calcined material leached, and the copper and zinc electrolytically deposited. A high extraction of the metal contents of the ore is expected with a utilization of its sulphur contents. The board states that it has abandoned the Elvira option on the field.

Income Tax Due

Work on collecting the $6,000,000,000 that it is estimated the new War Revenue Bill will yield has been started by the Bureau of Internal Revenue. The income-tax provisions of the bill affect every single person in the United States with a net income of $1000, and every married person whose net income is $2000 or more. In addition to these exemptions, taxpayers are allowed an exemption of $200 for each person dependent upon them for chief support, if such person is under 18 years of age and incapable of self-support.

Income-tax returns must be filed with the local collector of internal revenue on or before Mar. 15. Failure to file such return will result in a fine of not more than $1000 and an additional assessment of 25% of the amount due. Heavier penalties are prescribed for wilfully refusing to make return on time or for making a false or fraudulent return.

Payment of the tax may be made in full at time of filing return or in four installments on or before the following dates: Mar. 15, June 15, Sept. 15, and Dec. 15. Failure to pay on time will render one liable to a fine of not more than $1000 and an additional assessment of 5% of the amount unpaid plus 1% interest for each full month during which the tax remains unpaid.

Economizers in Steam-Boiler Plants

Under the title "Exact Data on the Running of Steam-Boiler Plants—No. 1, Economizers," is published[1] a comprehensive treatise on the subject by D. Brownlie, J. Compton, and H. W. Royse. It is the intention of the authors to present a series of articles dealing with general methods of steam-plant operation, based on 10 years' experience in the investigation and reorganization of steam-boiler plants in Great Britain. Though the statements made refer to British plants, it may be assumed that similar conditions prevail in this country, and several of the points emphasized in this first paper are well worth consideration.

The chief advantage and the main point of interest in connection with economizers is the saving of fuel, and, although it is generally stated that this amounts to from 15 to 25%, investigation showed that 155 plants equipped with economizers obtained an exact average saving of 11.4% in fuel cost. This low average is not due to the fault of the economizer as an appliance but to the fact that the economical generation of steam on a scientific basis is not understood, and economizers generally are not installed on correct lines. Properly utilized, it is stated that the economizer, under average conditions, should effect a saving from 17½ to 20%. Other advantages of the economizer are the reduction of the strain on the boilers by the provision of a high-temperature feed water, preventing unequal expansion and contraction, and also that there is always a large reserve of hot water for any sudden demand for steam. Furthermore, the evaporative capacity of the boilers is greatly increased.

Among the disadvantages to be considered is the serious choking of the draft caused by the cooling of the gases. The draft in a chimney, other things being equal, is dependent on the mean temperature of the gases in the chimney and is caused by the difference of the density of the hot gases in the chimney and the cold air outside. Theoretically, if more economizers are installed, the draft would be so seriously diminished that hardly any coal would be burned. The reason is that the chimney, as a draft producer, is a wasteful method of creating a draft, and, for its efficiency, depends on a great waste of heat. If this heat is utilized to the full by the economizer, the draft is curtailed and it is impossible to burn the necessary amount of coal to maintain the evaporation, in spite of the assistance of the economizer. Hundreds of boiler plants are forced, for this reason, to open the bypass dampers and allow a portion of the hot gases to go straight up the chimney to waste, so as to maintain a draft to burn the amount of coal required to keep up steam. Therefore the mere installing of economizers in some cases may be of little real advantage. This difficulty is, however, of little or no practical importance when a mechanical draft is employed.

Another disadvantage of the economizer is the formation on the inside of the tubes of a hard deposit of scale from impurities in the feed water, which prevents the conduction of the heat from the hot gases, and this is likely to cause the tubes to be burned out. But this condition may be avoided by softening the water and delivering it to the economizers at not over 5 or 6° of hardness, which is sufficient to eliminate all incrustation troubles. A further source of trouble is the corrosion of the pipes which is caused by the condensation of the acid flue gases on the outside of the tubes at the lower end where the cold water enters. Flue gases contain sulphurous acid from the sulphur in the coal, which condenses because of the great difference in temperature. This corrosive action is intensified by excessive sulphur in the coal and the moisture in the flue gases due to damp flues or excessive amounts of steam being used for steam-jet furnaces. One means of preventing this is to make sure that the feed water does not enter the economizer at less than 100° F., and this may be done by providing an automatic circulating arrangement that will continuously take a small portion of the water from the hot end and mix it with water from the cold end.

---

[1] Reprinted from *Engineering*, Nov. 1, 1918.

Details of Practical Mining

Frequently unknown beforehand, conditions encountered in diamond drilling that often result in the loss of equipment call for ingenious methods on the part of the drill operator. A following article describes some of the experiences met in putting down a drill hole. Two unsuccessful attempts were made to recover the apparatus, but a third trial resulted in the saving of the entire equipment.

The sketch and description of a "Simple Mine Cageway Gate" suggests safe practice in underground operations, and such a device need not be confined to hoisting shafts, as may be intimated. Safety regulations in most mining districts demand that all openings to chutes and raises be guarded, as well as openings to shafts, and such a device will be found to have considerable application in this particular. By means of offsetting either end of the suspension straps, the gate may be made self-closing.

The underground loading or shoveling machine represents one of the recent developments of mechanical endeavor in the mining field, and considerable success has been obtained by the various models that have been placed on the market. Particular conditions are encountered in underground operations, and it is not strange that the requirements needed for a successful underground loader should be different than those that are demanded in other work.

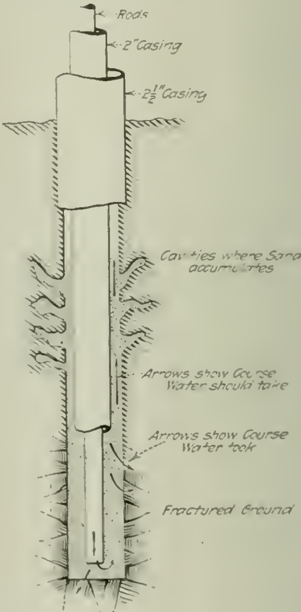
Diamond-Drill Troubles

Some of the difficulties encountered in diamond drilling are told by Maxwell C. Milton in the January issue of *Ax-I-Dent-Ax*, the safety publication of the U. S. Smelting, Refining and Mining Company.

A diamond-drill hole put down at the Mammoth mine, Kennett, Calif., occasioned considerable trouble to the drill men. The first 160 ft. of drilling showed typical conditions; the rock was somewhat soft for 90 ft., and was cased. Below this the rock was firm and casing was discontinued. At about 170 ft. the rock became decomposed, the feldspar being reduced to a clay-like substance which held the hard quartz crystals loosely in place, and trouble began.

As the hole progressed through this material the wash water flushed out the soft clay, releasing the quartz grains, which were washed out of the hole with difficulty. This condition did not make drilling unduly dangerous so long as the wash water continued to circulate freely. As the rock became harder at 220 ft., the hole was continued without casing.

At 327 ft. the rock seemed to be badly fractured, and this condition allowed the wash water to run out from the bottom of the hole as fast as it could be pumped in. Technically speaking, the men "lost the water." At once all the sand held in suspension settled around the rods, and they began to bind. During this critical time the power went off for about 15 min. and the bit was stuck. All the usual devices for turning the rods with wrenches and pulling with the combined power of the machine and jacks were resorted to without success. In fact a pull was put on the rods nearly equal to the strength of the threads between lengths of rod. At this stage, the company faced an investment loss of $900 in equipment and $800 in labor, and the hole still lacked 50 ft. of being deep enough to reach the favorable horizon for ore.


Rods
2" Casing
2½" Casing
Cavities where Sand accumulates
Arrows show Course Water should take
Arrows show Course Water took
Fractured Ground

CONDITIONS ENCOUNTERED AT A DIAMOND-DRILL HOLE AT KENNETT, CALIFORNIA

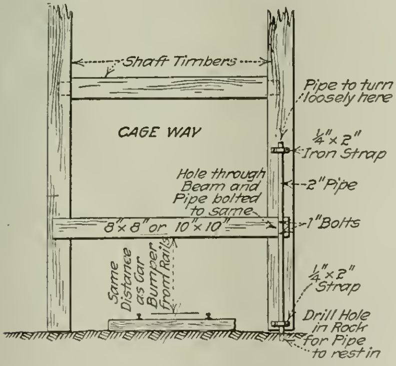
The next step was to go down with casing on the outside of the rods in an effort to shut out the sand coming from 170-ft. and 220-ft. levels, and to drill out the accumulations around the bottom of the pit. However, the casing seemed to aggravate the bad conditions started by the rods. The accompanying sketch shows the conditions that, from the evidence, existed. The cavities made by the wash water which acted as reservoirs for the quartz sand are especially to be noted. During this time only one shift operated, so progress was slow and much of the time was spent in getting through the sand. However, by hard work the 2-in. casing was forced down to 312 ft., where the water was lost again. Losing the water in firm rock is not necessarily dangerous, but in this sandy material it obviously made the work distinctly hazardous. The chances for sticking the casing increase greatly with the increase in bearing surface and to some extent with the additional weight the machine has to handle. As everything was working under a strain, it was not altogether remarkable that something should break and that the casing with bit No. 2 should become stuck.

The company now had an investment in the hole of $2500. It was a question of whether to stand this loss or risk more in an attempt to rescue the bits and equipment, and the latter was finally decided upon. The third hole was started with 2½-in. casing over the other two. This time the men got down after several weeks of extremely hard work and with many narrow escapes from sticking the third bit. With the perversity of inanimate things, a bad hole was made worse. The weather changed suddenly. Snow followed rain, temporary pipe lines to the drill tried to freeze, and electric service (the primary power), was interrupted at critical times, but the equipment was saved.

A Simple Mine Cageway Gate

By Roy H. Poston*

An easily constructed mine cageway gate that may be made by the mine carpenter in a short time is illustrated in the accompanying sketch. The first cost is low, the upkeep inappreciable, and its use may be well adapted to the small or temporary mine.

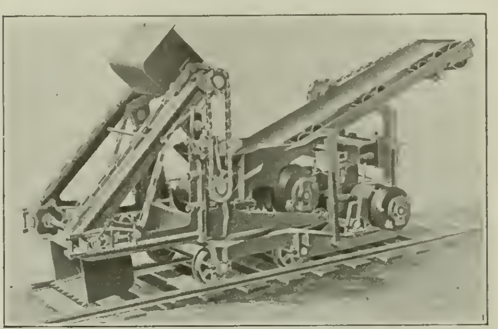

Shaft Timbers
Pipe to turn loosely here
CAGE WAY
¼"×2" Iron Strap
Hole through Beam and Pipe bolted to same
2" Pipe
8"×8" or 10"×10"
1" Bolts
Same Distance as Car Bumper from Rails
¼"×2" Strap
Drill Hole in Rock for Pipe to rest in

CAGEWAY GATE FOR SMALL MINES

A Continuous Twin-Scoop Loader

Among the types of underground ore-shoveling or ore-loading machines of recent development is the McDermott Continuous Twin-Scoop Loader, which has been placed on the market by the Wellman-Seaver-Morgan Co., of Cleveland, Ohio. The operation of this machine differs somewhat from other types of loaders, and certain distinct advantages are claimed. The shovel principle is eliminated; the material is not thrown onto the conveyor belt or into a car, but is first delivered to a hopper; the movement of the scoop is continuous, not reciprocating, and the loader and car remain stationary during the digging and filling operations.

As shown by the illustration, the machine consists of twin buckets operating on an endless chain, a hopper and a conveyor belt, which carries the ore to the receiving car. The scooping mechanism is so pivoted that it can dig to the side as well as in front of the machine, and the ore reaches the car, being delivered to the conveyor through the hopper, regardless of the angle at which the scoop is working.



THE McDERMOTT CONTINUOUS TWIN-SCOOP LOADER

The machine is self-propelled and of such dimensions that it may be easily transferred from place to place in the mine. The three main parts—truck, digging head, and conveyor—are dismountable and are readily reassembled, so that no trouble is encountered in transporting the loader through the shaft or from level to level. Adverse conditions and restricted space incident to underground mining have been kept in mind in the design of the McDermott loader, as it is compact, durable, and simple to operate.

The operating levers are placed at one side of the machine and in a position which enables the operator to have full view of the shovel movements. The loader is fitted with motors wound for 230 volts d.c., providing power for all of the operations. The motors are of the entirely closed type, and all chains and gears are protected with suitable guards. The entire framework is of steel; the digging head is mounted on a large ball bearing, and all parts are protected as much as possible against dirt and water. All chains are provided with take-up, and the digging edge of the bucket is fitted with renewable tooth sections. The general dimensions of the loader are as follows:

DIMENSIONS OF McDERMOTT CONTINUOUS TWIN-SCOOP LOADER

Maximum over-all length	15 ft., 9 in.
Maximum over-all height	5 ft., 6¾ in.
Maximum over-all height (buckets in lowest position)′	6 ft., 7½ in.
Maximum over-all width (machine in operation)	4 ft.
Gage of truck wheels	24 in.
Maximum rated capacity, with full buckets	1.75 tons per minute
Average capacity	45 tons per hour
Weight of complete machine	8,000 lb.

At the Caspian mine, Palatka, Mich., one of these shovels handled from 75 to 100 tons of iron ore, using three men, during a period ranging from two to four hours. In comparison with hand shoveling, it is stated that in similar ore, on a basis of one man shoveling 15 tons per day, the removal of an equivalent tonnage of ore would require the labor of six men for this total; a saving in labor of four and a half men's time.

---

*St. Francois, Missouri.

Correspondence and Discussion

Porphyry Intrusions of the Michigan Copper District

After reading Thomas S. Woods' article, "The Porphyry Instrusions of the Michigan Copper District," in the Feb. 15 issue of the *Journal*, I feel that I should state a few of my own observations on copper deposits, which have led me to draw somewhat different conclusions than those made by Mr. Wood.

The acid intrusive rocks, generally monzonites and monzonite porphyries, which are the mineralizers of most of the copper deposits in the United States and Mexico, are so characteristically marked by kaolinized feldspar and the development of sericite, due to the mineralizing solutions which they bear and the oxidization of the cupriferous pyrite, that it is impossible in most cases to get an unaltered piece of rock by means of which to identify the intrusives within considerable distance of any of these large copper deposits. On the contrary, the acid intrusive rocks of the Michigan copper district have an unaltered appearance, show good fresh phenocrysts of orthoclase and plagioclase feldspar, and I do not think that any trained observer, either miner, prospector, or geologist, would spend any time on the copper-bearing possibilities of the acid intrusive rocks of the Keweenaw Peninsula, although possibly the acid intrusives at the Indiana mine, which in places show a bleached kaolinized appearance, would indicate that they were a portion of a mineralizing magma.

The series of bedded basic flows and acid and basic conglomerates outcropping south of Lake Superior form the Lake Superior copper district, and they also outcrop north of Lake Superior and again in the Arctic Circle, where they have been explored on the Copper Mine River by men employed by one of the large copper companies. And it is interesting to note that in the Arctic Circle a period of sedimentation at the top of the series has laid down sandstones and shales similar to the Nonesuch formation. In all of these places the beds show some copper. Therefore, I conclude that the basic flows carried the copper and not the local acid intrusives of the Lake Superior copper district.

But I think that the heat given off by deep-seated portions of these barren acid intrusive rocks caused circulation of alkaline waters through the traps and assisted in deposition and concentration of copper in the porous amygdaloid tops of the flows and in some of the conglomerates, so that at present some of these porous channels are ore deposits. Most of the amygdaloid tops of the flows, though they are slightly copper-bearing, show that there has been intense circulation of waters and a deposition of numerous minerals, such as calcite, quartz, laumontite, prehnite, datolite, and zeolites. Again, there are amygdaloid tops from which these waters have been dammed off, leaving the amygdules empty of all minerals.

The fissures and faults in the Michigan copper district have occurred at possibly three different periods. The first series were the large slide strike faults occurring on the beds, and they follow the strike and dip. The second series were the faults that accompanied the intrusive acid magma and possibly had some bearing on the water courses, which redistributed the copper. The third series were post-mineral. Two large faults of this last series are noticed near the Portage Lake district, one just south of Houghton, and the other in the northern part of the town of Hancock, near the Quincy mine. The displacement of the latter fault was found by Marvin about 40 years ago, although he did not find the fault. S. S. LANG.

Bessemer, Mich., Feb. 22, 1919.

Flotation Queries

I was much interested in the short article by Tom L. Gibson, of Grant, Colo., on p. 889 of the *Journal* of Nov. 16, 1918. It contains some timely questions on flotation. How many times in the last few months have I heard just such questions? From the viewpoint of a flotation operator a few more questions might not come amiss: Why is it that No. 7 is the best working cell in the mill? One also hears, "Your froth is fine, but I think you are using too much cake," or "No. 9 is dead; let's poke it up a little." Did you ever see the superintendent come down the stairs in the morning, smoking his cigarette, and say to the operator, "Your water level is too high in No. 3 and No. 5; better lower it a little"; and did you ever see him follow it up with a look at the valves to see that your air was all on? Did you ever see the manager throw out a bottle of 100/N acid because you were using too much lime? How closely can you gage your alkalinity by putting a drop, or two or three drops, of phenol into half a beaker of solution? Is it necessary to test the acidity of your ore after the flotation plant is once started? Did you ever work a shift with the mill superintendent, when he asked you to change some one of your conditions about every 15 minutes (results judged invariably entirely by the eye)?

In the wee small hours of the graveyard shift, when watching for the "beautiful bronze sheen" which sometimes overtakes your froth in floating copper ores, the following questions trouble me: Did you ever see a cyanide superintendent depend upon an ocular demonstration for the amount of his protective alkali? Are all flotation plants run somewhat loosely because they usually treat the base metals? Are not the flotation people depending too much upon the "ocular demonstration" for results? Could some of the refinements of the cyanide process be passed along to the flotation process with good results?

FLOTATION OPERATOR.

Ely, Nev., Feb. 5, 1919.

Empire Concentrating Table

In the Sept. 2, 1916, issue of the *Journal* there was an article by John Gross on the "Empire Long-Stroke Table." The information contained was interesting to operators and engineers, and I believe that they would be glad to know what progress has been made with the Empire table up to the present.

As is the case with most new ideas, the perfection of this table required considerable time and expense. A few mechanical difficulties and weaknesses developed in early operation, and because of the expense involved in the correction of these troubles, and for other reasons, it was decided to discontinue its manufacture. Since then, however, the mechanical difficulties referred to have been overcome.

The Empire table has a remarkable capacity, and, happily, it does not object to being crowded when occasion arises. The large capacity is due mainly to the long stroke imparted to the deck, and to a peculiar panning action that keeps the ore bed loose. The long stroke causes the deck to travel about twice the horizontal distance that other tables do; yet the reciprocating motion of the deck is easy, and greatly below the speed of other tables. From tests and observations it has been determined that the panning action of the deck is largely responsible for the high recoveries made with the Empire table and, to a less degree, for its capacity. The looseness of the ore bed permits of the easiest and quickest separation of mineral from gangue.

The Empire table is not made to handle slime. Its field lies in the concentration of ores that do not require crushing finer than 40 mesh, and it will handle any feed from this size to ¼ in. The St. Joseph Lead Co., of Bonne Terre, Mo., has been using the Empire concentrator for some time, with excellent results, as shown below.

OPERATION OF EMPIRE CONCENTRATING TABLE

Speed, 168 r.p.m.; Stroke, 3⅛ in.; Size of Feed, 2 mm.

	Tons	Pb Assay Per Cent.
Feed	50	9.78
Concentrates	5.5	78.5
Middlings	8.4	4.92
Tails	36.1	.48
Rejects	44.5	1.32

Inasmuch as the Empire table requires less floor space than many others, and can handle a large tonnage, give a high extraction, and produce high-grade concentrate, its adoption will, no doubt, steadily increase.

DONALD H. FAIRCHILD.

Foster Bldg., Denver, Colo., Jan. 20, 1919.

Ball Milling and Flotation

Frederick G. Moses has written an interesting and valuable paper entitled "Colloids and Flotation," which has been published by the Bureau of Mines as Technical Paper No. 200. Mr. Moses discusses many points in his paper worthy of further consideration. He does, however, make a statement with which I cannot agree. For instance, in speaking of the flotation experiments carried on at Inspiration, he writes as follows:

> Another discovery that was made at the mill of the Inspiration Copper Co. is of interest in this connection. It was found that better flotation results were obtained with pulp from the Marcy ball mills than with the same ore ground in pebble mills. Gahl has offered the explanation that iron from the iron balls used in grinding mills went into solution in the pulp and gave the right flotation conditions. This explanation seems reasonable, in view of the facts set forth herein, because the iron may have the effect of rectifying the surface-energy conditions necessary for good results, but another explanation could be offered.
>
> In order to get a clearer insight into the discussion that follows, a series of tests made in one of the well-known gravity concentrators may be mentioned. The company discovered that the pulp from a ball mill gave better results with a gravity concentration machine than when the ore was ground to the same fineness in other types of fine-grinding machines.
>
> As is well known, the pulp that is discharged from the trunnion of a center-discharge mill, such as the Hardinge, is classified before being discharged. Pulp of a certain density can support particles of not more than a certain maximum weight. The sulphides are heavier than the gangue, and must be more finely ground in order to be discharged from the mill. In the peripheral-discharge mill, the mineral particles are discharged regardless of their size. Hence, the sulphide particles in the pulp discharged from the Marcy mill at Inspiration were probably larger than those in the pebble-mill discharge.
>
> The relation of the size of sulphide particles to flotation results will now be discussed. As previously shown, for good flotation a certain relation must exist between the surface energy of the water, the oils, and the ore. As the surface energy of a substance is dependent on its surface tension and the amount of surface exposed, the amount of surface energy would be different for the same sulphides, depending on whether they had been crushed in a Marcy mill or in a pebble mill. Now, it would seem that the requisite conditions of surface energy for producing the most desirable surface-energy resultant would be when the particles are of the greatest size. This is more evidently true if one remembers that the best conditions for non-adsorption of the water by the sulphide is to have pure water and massive sulphide.

Although I agree with Mr. Moses that the sulphide particles from a grate type of mill are discharged regardless of size, on the other hand, this statement is only half the story: The ball mill in this case was not a *final* machine but was an *intermediate* machine.

When ore is ground in a closed circuit with a ball mill and a classifier, the size of the sulphide particles sent to the flotation machines is not determined so much by the type of mill employed as upon the classifying conditions under which the pulp has been classified. The governing factor as regards size of sulphide particles in ball-mill practice, in which a classifier is used, is determined by the *classifier* and *not by the type of ball mill.*

Evidently, then, Dr. Gahl's assumption that the iron balls exerted an influence on the flotation results is correct.

A. P. WATT.

New York, Feb. 14, 1919.

Graphite Industry in Alabama

In the article "Graphite Industry in Alabama" on page 306 of the Feb. 15 issue of the *Journal*, purporting to give the address of graphite companies operating in Alabama, the address of this company is given as Sylacauga, Ala. This is incorrect, the offices of this company, since its incorporation, having been in this city.

DURO-FLAKE GRAPHITE CO.,
P. S. HAY, Treasurer.

Montgomery, Ala., Feb. 25, 1919.

1918 Production of Carnotite

In regard to the article which I contributed to the Annual Review number of the *Journal*, I beg to advise that I was mistaken as to the 1918 production of carnotite. It seems that the information received from time to time during the last year in regard to the output of this ore was misleading. In reality, there was a total production of 8450 tons, averaging 2% uranium oxide and 3½ to 4% vanadium oxide.

Foote Mineral Co., H. C. MEYER.
Philadelphia, Penn., Feb. 20, 1919.

Post-War Readjustments in Collecting Mineral Statistics

WASHINGTON CORRESPONDENCE

Prior to the war, practically all statistics of domestic mineral production which were obtained by the U. S. Geological Survey were upon an annual or semi-annual basis, a frequency adequate in peace times, when industries changed only slowly under the operation of the law of supply and demand, but entirely inadequate for war times, when rapid developments and readjustments take place in many if not most of the important industries under the stimulus of greatly increased demands, the cutting off of imports to save shipping, and other causes.

During the war fuel statistics were collected by the Fuel Administration in coöperation with the Survey, and statistics for certain mineral derivatives were collected by the War Industries Board, but the Geological Survey remained the principal source of statistical information on mineral production.

To meet the needs of war administration, the statistics of production for most of the mineral substances of particular importance in the war situation were changed to a monthly instead of an annual basis; a few, such as copper, lead, zinc, and aluminum, were reported weekly, mainly for the guidance of Government purchasing agents. In many instances statistics of stocks and commitments were also added. This large increase of statistical work was accomplished without increased appropriations by diverting the time of geologists from more purely geologic work.

Most of the frequent statistics were for confidential Government use, but weekly spelter, quarterly manganese, monthly petroleum, and weekly coal and coke returns were made public, together with occasional reports on graphite, quicksilver, and magnesite.

It has been the belief of those in charge of this work that many of the country's mineral industries would benefit by more frequent and fuller statistical returns than were obtainable before the war, and the producers in certain industries have been asked to state their position in regard to the usefulness to them of more frequent statistics and their willingness to furnish them. The majority of quicksilver producers have expressed a preference for quarterly instead of annual statistics of production, and the quarterly basis will be maintained. Many of the smaller copper and lead producers desire the publication of monthly figures of production, but the large producers are almost without exception opposed to such publicity. Producers are generally opposed to publication of stocks in their hands or in transit, although some express a willingness to furnish such statistics if the Government also publishes stocks in the hands of consumers. The latter is a large statistical task.

A number of the larger producers of spelter have expressed their unwillingness to continue any longer the weekly reports of production and stocks that were made public throughout the war, so that during 1919 the spelter statistics will revert to the old annual basis. Statistics of coal and coke production will continue to be published weekly during the life of the Fuel Administration, but thereafter, unless the provisions of the Sundry Civil Bill as reported by the House are modified, they must return to the pre-war annual basis, a frequency wholly inadequate for an industry which lies at the foundation of the economic structure of the country. According to present plans, production statistics for other mineral commodities will be reported with the following frequency: Monthly statistics will be published for crude petroleum; quarterly statistics will be published for manganese ores, bauxite, and aluminum, but, for the latter, value only can be obtained. Semi-annual statistics will be published for nickel, tungsten, and molybdenum. Other commodities will be reported annually, as before the war.

Scope of War-Minerals Relief Narrowed

WASHINGTON CORRESPONDENCE

Manganese, chrome, pyrites, and tungsten are the only war minerals which may be made the basis of a claim against the Government under the provisions of the validation of contract law. Payments under the act must not exceed $8,500,000. With these important changes from the original proposition, the Senate and House each agreed without serious objection. The section of the law covering the war-minerals claims, which was drafted by Senator Henderson, of Nevada, and to which the conferees finally agreed, reads as follows in its entirety (The draft of this section reproduced on p. 370 of the *Journal* of Feb. 22 met with opposition after an agreement upon it had been reached by the conferees):

Sec. 5. That the Secretary of the Interior be, and he hereby is, authorized to adjust, liquidate, and pay such net losses as have been suffered by any person, firm, or corporation, by reason of producing or preparing to produce, either manganese, chrome, pyrites, or tungsten in compliance with the request or demand of the Department of the Interior, the War Industries Board, the War Trade Board, the Shipping Board, or the Emergency Fleet Corporation to supply the urgent needs of the nation in the prosecution of the war; said minerals being enumerated in the act of Congress approved Oct. 5, 1918, entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply."

The said secretary shall make such adjustments and payments in each case as he shall determine to be just and equitable; that the decision of said secretary shall be conclusive and final, subject to the limitation hereinafter provided; that all payments and expenses incurred by said secretary, including personal services, traveling and subsistence expenses, supplies, postage, printing, and all other expenses incident to the proper prosecution of this work, both in the District of Columbia and elsewhere, as the Secretary of the Interior may deem essential and proper, shall be paid from the funds appropriated by the said act of Oct. 5, 1918, and that said funds and appropriations shall continue to be available for said purpose until such time as the said secretary shall have fully exercised the authority herein granted and performed and completed the duties hereby provided and imposed: Provided, however, That the payments and disbursements made under the provisions of this section for and in connection with the payments and settlements of the claims herein described, and the said expenses of administration shall in no event exceed the sum of $8,500,000: And provided further, That said secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this act: And provided further, That no claim shall be allowed or paid by said secretary unless it shall appear to the satisfaction of the said secretary that the expenditures so made or obligations so incurred by the claimant were made in good faith for or upon property which contained either manganese, chrome, pyrites, or tungsten in sufficient quantities to be of commercial importance: And provided further, That no claims shall be paid unless it shall appear to the satisfaction of said secretary that moneys were invested or obligations were incurred subsequent to Apr. 6, 1917, and prior to Nov. 12, 1918, in a legitimate attempt to produce either manganese, chrome, pyrites, or tungsten for the needs of the nation for the prosecution of the war, and that no profits of any kind shall be included in the allowance of any of said claims, and that no investment for merely speculative purposes shall be recognized in any manner by said secretary: And provided further, That the settlement of any claim arising under the provisions of this section shall not bar the United States Government, through any of its duly authorized agencies, or any committee of Congress hereafter duly appointed, from the right of review of such settlement, nor the right to recover any money paid by the Government to any party under and by virtue of the provisions of this section, if the Government has been defrauded, and the right of recovery in all such cases shall extend to the executors, administrators, heirs, and assigns of any party.

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States: Provided further, That in determining the net losses of any claimant, the Secretary of the Interior shall, among other things, take into consideration and charge to the claimant the then market value of any ores or minerals on hand belonging to the claimant, and also the salvage or usable value of any machinery or other appliances which may be claimed was purchased to equip said mine for the purpose of complying with the request or demand of the agencies of the Government above mentioned in the manner aforesaid.

House Gets Complaint on Tin

WASHINGTON CORRESPONDENCE

A complaint, based on the action of the War Industries Board with regard to tin, has been brought to the attention of Congress by Representative Moore, of Pennsylvania. He was permitted to insert, as a part of the record of proceedings of the House, a letter on the subject written by William W. Justice, Jr., vice-president of the N. and G. Taylor Co., of Philadelphia. The letter is as follows:

The pig-tin committee of the War Industries Board arranged in an inter-Allied agreement for the purchase of a quota of pig tin for this country. All arrangements were distinctly a war measure, and a quantity of pig tin was bought, on the authority of the War Industries Board, for American consumers, and the medium through which this pig tin was brought to this country was the Steel Products Co. (the export end of the United States Steel Corporation).

We are led to believe that the questionnaire sent out by the War Industries Board, and the data secured by them, were neither complete nor thorough, and, based on certain incomplete figures which they procured, they proceeded to buy for this country from 10,000 to 12,000 tons of Straits pig tin at a Government cost to the consumer of 72½c. per lb. With the cessation of hostilities—in fact, prior to that—the open-market price of pig tin started to fall, and the present open-market price is something less than 54c., as against a Government monopoly price of 72½ cents.

The War Industries Board insists that the American consumers be forced to use this 72½c. pig tin, and consume the entire quantity before they will allow the American consumers to benefit by the open-market price of the world. In other words, the consumer has to carry the burden, and it is this very un-American plan of forced monopoly, insisted on by Mr. Armsby, that we wish to call to your attention as a serious menace to our industry.

We are asked to compete with the tin-plate markets of the world for export trade. The British manufacturers have access to lower costs of pig tin; the American manufacturer has not. When pig tin was being bought at 72½c. the fixed price of finished tin plate was $7.75. The Government insists on holding up the cost of the raw material to 72½c., and has allowed the price of the finished tin plate to go to $7.35.

We believe that the purchase of these 10,000 tons of pig tin through the United Steel Products Co. should be looked on as a war measure. No longer is need evident for tin regulation, and the sooner a free market is established the better. The logical solution is to let down at once the bars on imports. The loss incurred on the tin now held by the Steel Products Co. should be charged to profit and loss account of the war, and not be borne as a burden by the American manufacturer.

No redress is seemingly to be secured through the War Industries Board, which naturally is loath to go to Congress and ask for the assumption on the part of the Government of the four or five million dollars represented by the difference between the cost of the pig tin that it bought and the present market. We have had letters from a number of tin-plate manufacturers agreeing with our position, and we urge you to give your attention to this situation, which has been given considerable publicity in the trade papers.

The injustice of the situation is so apparent that we beg your careful consideration and action.

Salvage of Machinery

We are glad to give immediate publicity, as requested, to the matter dealt with in the following communication:

UNITED STATES SHIPPING BOARD
EMERGENCY FLEET CORPORATION
Philadelphia, Penn.
February 12, 1919.

Mr. Bradley Stoughton,
Secretary, American Institute of Mining Engineers,
29 West 39th St., New York City.

My dear Mr. Stoughton:

I hope to be able personally to be in New York some time during the meeting next week of the Institute, and to bring before some of the engineers a matter in which I believe they might be of considerable assistance both to the United States and to the mining and metallurgical companies with which they are connected. In case, however, I am unable to be present, I am going to ask you to call to the attention of those interested the fact that the Government has, through the Emergency Fleet Corporation, a very large quantity of machinery of a most varied character for salvage. The greater part of this equipment is new (such as machine tools of all kinds, pumps, cranes, electrical equipment, air compressors, piping, and similar material), and there is also a quantity of shipyard material which for some time will be increasing, the greater part of which has been used during the past two years. The disposal of this material is, of course, a serious problem for the Emergency Fleet Corporation, and it is desired to accomplish it in such a way that the Government's interests will be protected so far as possible, and also with due regard to the market conditions in the various lines of manufacture involved.

It is naturally desired to move as great an amount as possible of this excess material to foreign countries; and mining engineers, therefore, who have foreign connections, might well be advised of the situation. The greater part of the excess material can be made ready for exceedingly prompt shipment from warehouses widely scattered throughout the country.

Although it is not the policy of the Fleet Corporation to make an undue sacrifice in the matter of price, particularly on new machinery, it is the desire of the Corporation to liquidate its holdings in excess material in as reasonable a time as possible; and I think it would, therefore, be to the distinct interest of purchasers of equipment to make it a practice to first inquire if the material desired is available in any of the warehouses of the Emergency Fleet Corporation before placing orders through ordinary channels. The more quickly the market can be relieved of this material, the sooner will normal conditions return, and I feel that the interest of the Government, the manufacturer and consumer, will all best be served by engaging in a coöperative way to absorb this property.

Mr. G. Woolfolk, late in charge of various activities of the War Industries Board, is to handle the salvage end of the Emergency Fleet Corporation, and to him, at 140 North Broad St., Philadelphia, Penn., all inquiries should be addressed.

I would appreciate it very much if you would call this matter to the attention of the engineers when some convenient opportunity presents itself.

Yours very truly,
W. MURRAY SANDERS,
Acting manager, Division of Cancellations, Adjustments and Salvage.

Objection by Senator Walsh, of Montana, lost to the Henderson potash bill the only opportunity it had of being considered in the Senate. Even had the matter been permitted to come up for discussion, it is believed that its chance to pass would have been small. The consumers of potash, who include farmers, are understood to be a unit against restricting the free importation of foreign potash.

February Mining Dividends

Dividends paid in February, 1919, by 18 United States mining and metallurgical companies making public reports amount to $8,088,946, as compared with $12,577,611 paid by 21 similar companies in February, 1918. Canadian and Mexican mining companies paid $1,568,500 in February, 1919, as against $1,606,497 in 1918. The only holding company which paid in February was the White Knob Copper and Development Co., which disbursed $10,000, or 5c. a share.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Zinc, Lead & Sm., pfd	U. S.	$1 50	120,810
Anaconda, c. s. z	Mont	1 50	3,496,875
Barnes King, c.g	Mont.	10	40,000
Caledonia, l s	Ida	01	26,050
Chief Cons., l s	Utah	12½	110,528
Cresson Cons., g	Colo.	10	122,000
First Nat. Cop	Calif.	15	90,000
Golden Cycle, g	Colo.	03	45,000
Homestake, g	S. D.	50	125,580
Internat. Nickel, pfd	U. S.-Can.	1 50	133,689
Iron Cap, c	Ariz.	25	36,225
Miami, c	Ariz.	1 00	747,114
Mohawk, c	Mich.	2 00	200,000
New Jersey Zinc	U. S.	4 00	1,400,000
United Eastern, g	Ariz.	05	68,150
United Verde, c	Ariz.	1 50	450,000
United Verde Ex., c	Ariz.	75	787,500
West End Cons., g.s	Nev	05	89,425

Canadian and Mexican Companies	Situation	Per Share	Total
Amparo, g.s	Mex.	$0 04	80,000
Coniagas, s	Ont.	25	100,000
Granby Cons., c	B. C.	2 50	375,000
Greene Cananea, c	Mex.	1 50	750,000
Hollinger, g.s	Ont.	05	246,000
Rambler-Cariboo, l.z	B. C.	01	17,500

Total dividends in the first two months of the year were as follows, the figures for 1918 being given in parentheses: United States mining and metallurgical companies $17,383,568 ($20,021,013); holding companies $330,000 ($330,000); Canadian, Mexican and Central American companies, $3,149,572 ($4,036,627).

Chronology of Mining, February, 1919

Feb. 1—Fire broke out in Belgrade mine of Pickands, Mather & Co. at Biwabik, Minn., one miner being suffocated.—Ore-storage warehouse opened at Picher, Okla., by Tri-State Operators' Association.

Feb. 3—Conference begun on Jan. 31 between copper company employees and Secretary of Labor terminated in Washington.—Steel plant of Nova Scotia Steel and Coal Co. shut down temporarily.

Feb. 4—Application of Butte & Superior company for modification of injunction in Minerals Separation case denied by U. S. District Judge G. M. Bourquin at Helena, Mont., leaving status of case unchanged pending decision of U. S. Supreme Court.—Bounty on Canadian iron ore advocated to Canadian government at Ottawa by deputation from various northern Ontario districts.—Temiskaming shareholders agree on purchase of Dolly Varden and Wolf silver mines, in British Columbia.

Feb. 6—Wage reduction at Great Falls and Anaconda smelteries ordered by Anaconda Copper Mining Co.

Feb. 7—Strike ordered in Butte district by I. W. W.—Utah Copper Co. reduces wages of miners and millmen approximately 75c. per day.—Consolidation announced of controlling interests in Rochester Mines and other Rochester, Nev., companies, eliminating pending litigation between Rochester Mines and Rochester Elda Fina.—Sixth annual meeting at Butte of Montana section of American Institute of Mining Engineers.

Feb. 8—Clark and Sultana mines at Ironton, Minn., closed down.

Feb. 10—Strike declared at Jerome, Ariz., when copper companies reduced wages 75c. per day.—Wages reduced in Clifton-Morenci-Metcalf district of Arizona.—East Butte smeltery at Butte, Mont., shut down.—Joint meeting of Founder Societies in Engineering Societies Bldg.. in New York.

Feb. 11—Report on gold situation submitted to Secretary of Treasury by committee appointed on Nov. 2.—Anaconda concentrator closed, owing to Butte strike.—United Verde and United Verde Extension companies issue joint ultimatum warning striking employees to return under penalty of indefinite shutdown.—Smelteries in Salt Lake Valley, Utah, reduce wages 65 to 75c. per day.—Annual meeting of Idaho Mining Association begun at Boise.

Feb. 12—Anaconda acid plant closed, owing to Butte strike.

Feb. 13—Hearing of potash producers begun before Senate Committee on Mines and Mining.

Feb. 14—Mines and smelteries of Verde district, Arizona, closed down upon failure of men to report for work. Cuyuna Mille Lac mine, at Ironton, Minn., closed.

Feb. 17—Butte strike called off after men have been out nine days.—First locomotive fired on Montana Southern Ry. of Boston & Montana Development Co.—Annual meeting of American Institute of Mining Engineers begun in New York.

Feb. 18—Meetings held in Pittsburgh by Associated Manufacturers of Merchant Pig Iron and by American Pig Iron Association.

Feb. 28—Trustees' sale of plant and mines of U. S. Manganese Corporation at Harrisonburg, Virginia.—Validation of contracts bill signed by President.

Mining Regiment Sails for Home

After several delays and consequent disappointments the 27th Engineers sailed from St. Nazaire late on Mar. 4 on the S. S. "Dakotah," with the expectation of reaching New York about Mar. 16. A cablegram to this effect was received from Colonel Perry on the day of sailing, so the regiment's arrival is now confidently awaited.

As the 27th nears home, it is gratifying to note that the Comfort Fund has practically attained its goal of $20,000, the total receipts to date falling short of that amount by only a few dollars. There will be ample need for the balance on hand, as in addition to providing a welcome for the returning men, there will doubtless be many expenditures for incidentals between now and the time when the regiment is mustered out.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including interest	$19,745.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2 00
W. L. Strauss	10 00
Employees Braden Copper Co., Chile	34 00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5 00
Carl J. Trauerman (second contribution)	5.00
Carl Tombo	6.00
Charles Le Vasseur (monthly)	5.00
February interest	16.44
D. W. Hall	10.00
Total	$19,996.90

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

Editorials

The 27th Engineers sailed from St. Nazaire for New York on Mar. 4, and will probably arrive here about Mar. 16. There will be a lot of good mining engineers and miners who will soon be wanting jobs. We hope that all of our friends, and their friends, will immediately give consideration to this important matter.

The Lead Producers' Committee

THE Lead Producers' Committee for War Service has published a pamphlet, giving a brief history of the activities of the several organizations that were formed by the lead producers of the United States, both to aid the Government in its purchases of pig lead and, later, to take charge of the distribution of the supply, this historical sketch having been prepared at the request of the historical branch of the General Staff of the War Department. Prepared by Arthur K. Mitchell, secretary of the committee, it gives a concise and accurate account of what was done by the lead producers, beginning with April, 1917, and ending with December, 1918. It makes a very gratifying record.

This was a case in which the whole business was left to the producers themselves. There was neither Government regulation nor official price-fixing. The entire expense of the work was borne by the producers. They secured for the Government its supply of lead on very economical terms. On numerous occasions the producers generously sacrificed themselves in the interest of the Government. Whenever an agreement conditional upon future conditions had been drawn, the producers lived up to it so long as it was in favor of the Government, but if it turned in favor of themselves they waived their rights. With the Government it was a case of "heads I win, tails you lose."

With this generous and excellent management, so much of which was due to the intelligent leadership of Clinton H. Crane, president of the St. Joseph Lead Co., the lead producers had the satisfaction of seeing their industry enter into the chaotic post-war period in a far better condition than any other of the major metal industries. The history of the lead industry during the war will always be a shining example of the advantage of trusting to the patriotism of people, even if they be interested, and letting the men of an industry do the things that they, best of all, know how to do.

American Mining Congress

THE American Mining Congress was organized in Denver in 1896 for the purpose of securing Federal aid for the mining industry through the creation of a Department of Mines with a member of the President's Cabinet for its head. That aim has not been attained, and the question might well be asked, "Have the results which it has accomplished been worth the efforts expended?"

A complete answer to the question would be a recitation of its activities and a biography of J. F. Callbreath, who has been its secretary, its heart and soul, ever since its organization. Did space permit, it would be our pleasure to print in full Mr. Callbreath's address before the California chapter of the congress at its organization on Jan. 15, 1919, in which he followed the history of the organization from 1896 to the present. In a short editorial we can do justice to neither Mr. Callbreath nor the organization, but in passing we cannot refrain from pointing to a few of those activities that have had a material influence upon the industry.

The conception of a Department of Mines did not meet with sufficient support to carry it through, but a few years later a Bureau of Mines was suggested. At first this met with scant support, and when, finally, a bill authorizing it did pass Congress, it was necessary to redouble efforts in order that this bureau might be of benefit to Western mines.

Congress has continued to support the Bureau of Mines in its ever-widening field of activities, and is responsible to no small extent for the benefits which that Bureau has extended to the mining industry. This organization has always opposed the action of the Federal Government in exercising control over water powers and mineral rights within the several states and territories, claiming that, with the formation of the state government, Federal control should cease. Failing to convince the East of the justice of the attitude of the West, it has fought valiantly for provisions in the leasing bills that would make it possible to develop the resources of the West, and it now points with some justice to the coal situation on the Pacific Coast, where, with quantities of good coal near tidewater in Alaska, none is available for Pacific Coast cities.

Ever since 1913, when an income-tax bill was before Congress, the American Mining Congress has taken an active part in an endeavor to see that mines were taxed no more than their just proportion. Our legislators refused for a long time to recognize the fact that the receipts of a mine, less expenses, did not equal income. They refused to acknowledge that a mine was a wasting asset, and that income was not always income. This is not now the case, and it is not so, largely because of the incessant efforts of Mr. Callbreath and his associates to show legislators the justice of their contention. Not only in this particular, but in the making of later laws and interpretations, have the members of the Mining Congress performed notable service in guiding the work of committees and the decisions of the department.

In reference to the war-minerals relief measures, the Mining Congress has taken a strong stand in behalf of those who have lost money through their efforts to mine certain minerals the production of which was represented by Government authorities as essential to our winning of the war.

The latest plan of the Mining Congress proposes to increase its influence by dividing its work into eight subdivisions, each to be in charge of a specialist familiar with the ores or minerals coming particularly under his supervision. It is hoped that, with each branch of the industry in the care of one who knows it thoroughly, all branches of mining may coöperate to advantage when any one particular industry needs Federal aid. The financing of the congress for this purpose is a rather formidable undertaking, but Mr. Callbreath enjoys difficult situations, and, if the idea receives any appreciable support from the industries affected, he will carry it through.

Standardization of Salaries

ONE of the difficulties early encountered by the U. S. Railroad Administration was that presented by the wide variation in the salaries of the various technical engineers in its employment. The Board of Wages and Working Conditions undertook the task of classifying these engineers and fixing their salaries, but gave it up as a bad job. Finally the problem of grading the engineer employees of the railroads was taken up by the American Association of Engineers, and that body succeeded in evolving a fairly consistent schedule, which has been recommended to the administration.

The duties and responsibilities of the higher officials vary so much that nothing was attempted where the services rendered were worth more than $5000 per annum. In the case of lower-salaried men—and these make up the greater portion of the engineering staff—the committee chose a title, then stipulated the nature of the work performed under that title, and suggested a suitable salary. Whether the particular salaries are proper today, or would be at some other time, is a matter of no great moment. The important point is that the committee arrived at a comparative value of the services performed, and classified the men accordingly.

This regulation of salaries brings up the suggestion that each one of the engineering societies should fix or standardize the salaries of its own members. Is such a thing possible or desirable?

There is something abhorrent to the technical graduate in the idea of a union that has for its main object, or even for one of its objects, the fixing or maintenance of wages. It is inconsistent with the popular idea of "every one for himself, and the devil take the hindmost," or, to put it in less homely terms, it is inconsistent with the American idea of independence. Every graduate knows when he comes out of college that he will be valued at little more and receive little more than a common laborer, but he also knows, or thinks, that there is no technical position in his chosen field to which he may not attain if he works hard and honestly.

A union or association of junior engineers might be formed and might be of material assistance to the younger members of the profession in standardizing their salaries. That such a protective organization has never been formed may be due to the lack of its need, or, possibly, to the inability of those who do need it most to form such an association. The better men, the men who make such a thing a success, advance step by step, and are soon out of the class needing help. Such men would have little more than an academic interest in the association that rendered them little assistance on their way up.

It is doubtful if engineers are yet ready to undertake the standardization of their own pay and employment; though, as a matter of good business management, it may be done for them in the case of large organizations employing many engineers. On the other hand, when a young man has worked night and day for years to put himself through college, it is with some irony that he reads the advertisements under "Position Vacant." The first one may indicate that rock-drill men are wanted at $5.50 per eight-hour shift. The second advertisement may call for an assayer and chemist—one who is familiar with cyanidation and flotation, can make accurate surveys, and understands mine bookkeeping—at a salary of $100 per month at the start. That means $4 per day for a 14-hour day, and seven days a week. The beginner, at this juncture, may well conclude that there ought to be a union among mining engineers, a union that would see to it that brains were paid at least as much as brawn. And it does seem unfair that acquisition of a college education should place a man at a financial disadvantage as compared with one who has had a few months' training at some purely mechanical operation.

If these two jobs were to be permanent—if the work and the compensation in both were to remain indefinitely the same—there would be a real need of protecting the numerically smaller class. But they do not remain the same. The miner will hardly get more, war times excepted, and the six-hour day is not yet in sight; but the assayer-chemist-surveyor-bookkeeper has something to work forward to. He may get into the mine; he may become a shift boss, a foreman, a superintendent, or, finally, manager of the property, and he retains his small salary only so long as that is the limit of his capacity.

One practical difficulty in the standardization of salaries for a group in a profession is that brains cannot be standardized, or, rather, they will not remain standardized. If they are only equal to a certain quantity of work, something that can be definitely measured, then a rate of pay can be apportioned, but a real live brain is constantly growing and expanding by imperceptible degrees, making itself more useful, though its daily task may not have cnanged.

Though standard compensation is possible, reasonable, and advisable in the junior technical staff of a large organization, such as that of a railway company, it is difficult to demonstrate that it would be practicable or of sufficient benefit to attempt it for any branch of the engineering profession as a whole.

The passage of the bills in Congress for release of the wheat market and the validation of war contracts, and the gradual crumbling away of the prices for iron and steel, are encouraging with regard to the readjustment of industrial conditions. The enlightened policy of the Army officials in putting the Government's stocks of copper in the hands of the producers for gradual liquidation is another good feature. One of the best things of all, however, was the firm and finely American stand of Ole Hansen in Seattle, who posted a plain signboard pointing the road that leads away from dissension and discord.

The Index for Vol. 106 of the *Journal* is now ready for distribution and will be mailed only to those who request it. Those who wish a copy of the Index, are requested to send for it promptly. A postcard will do.

BY THE WAY

"I have discovered a device, which I keep secret, by which I can locate the main gas strata underground," wrote the "discoverer" to the U. S. Bureau of Mines last year. "I am not financially fixed to carry the plans out very rapidly, but I managed to drill several wells with success in a new field. If I can get a chance to help the Government in this war, I will ask only a reasonable salary and expenses. I can detect these gas belts riding in an automobile or some other way as long as I can get over the field. In that way it doesn't take me long to get over the ground. I don't think any geologist can locate gas strata in a prairie or green field and tell whether he is over an oil belt or gas alone, but I claim I can."

The movement to compensate industrial accidents without suits to prove negligence of the employer is one of the most striking in the field of labor legislation in recent years. From indifference and even hostility hardly more than a decade ago, the principle has obtained acceptance in all but 10 states of the Union; and the day seems not far distant when the obsolete system of damage suits and charges and counter charges of negligence and contributory negligence will no longer be used in the disposition of industrial injury claims. The subject is brought up to date in Bulletin 243 of the U. S. Bureau of Labor Statistics, which supplements earlier publications and presents the action of the courts and legislatures during the years 1917 and 1918. Five new states came into the compensation fold in 1917 and one state was added in 1918, and amending and supplemental laws were enacted in more than 30 jurisdictions.

The old-style type of prospector yielded results, partly due to the fact that there were so many of him. Watch the scout patrols of some colony of ants, and you will observe many of them wandering around as if demented. But as soon as one makes a strike, the news spreads rapidly, and traffic is organized along certain routes, while vague and random prospecting still continues in the vicinity of the "famous mines" of sugar, rice, or whatever chances to be the temporary boom. Frequently the ant gets results simply because instinct governs, rather than orthodox theories as to the genesis of sugar deposits. The adherence to orthodox beliefs limits the field of the scientific prospector. A belief in the persistence of orthodoxy may even prove disastrous, as shown by an old yarn published in *Galaxy* of April, 1872. Two prospectors in the Reese River country, in Nevada, had just bought a ham, regardless of high prices. They boiled it and ate sparingly, it being doubtful if more could be purchased. When a Jewish neighbor came to call, however, they felt perfectly safe in inviting him to dinner. To their consternation, the ham began to disappear at an alarming rate. In a diplomatic way one partner in the grubstake brought up the subject of the Mosaic prohibition of swine's flesh. "Oi, Oi," said the guest, cutting off another chunk of ham, "Ven Moses wrote dot, he had a bunch of sheeps for sale, yet."

There has been more or less speculation (mental speculation) during recent years as to whether the prospector, now rare, will finally become extinct. He will, if the people with the coin decline to take any risks and the people with goods and scientific ability refuse to barter. But it is expecting too much to ask that the engineers and assayers should be the sole encouragers. An illustration of the old-time mining life is afforded by the story of E. C. Bassick and his experience in the little camp of Rosita, Colo. In earlier days Bassick had hunted for gold in Australia, finding little wealth and losing his health. In 1877 he was literally "bumming" his way around Rosita, prospecting in a dreamy, luckless way. One day he sat on the ground, doubtless cussing his luck, pounding aimlessly on a boulder that hundreds of experts had passed by with disdain. A chip of the boulder aroused his curiosity; and, with a handful of specimens, he hunted around for some person with money and good nature. Picking out the most promising individual, he offered a half interest (fifty-fifty, no less) for the sum of $25. Nothing doing. Somewhat discouraged, he trudged along and happened to see a load of cordwood being unloaded at the door of an assayer's shack. So Bassick hustled, made a bargain with the assayer, sawed the wood, had his specimens assayed, and thus obtained a means of strengthening his position in a financial deal. Within three years he had taken out of his mine about $450,000 and then sold it for $300,000 cash and $1,000,000 in stock.

The 'Andy Man

By D. E. Charlton

W'en there's a bit o' fixin' to be done abaout tha mine,
Repairin' to tha 'eadframe, pump or skip,
If tha job be temporary, I tell 'e this, m' son,
Thee can do it diffren' ways, but 'ere's a tip:

There's lots o' these 'ere shortcuts, an' tha chap 'oo turns 'is 'ead
To little things that's needed naow an' then,
'E will fin' 'imself a-thinkin' tha bes' way 'e can do
Tha fixing', an' 'e naws jus' 'ow an' w'en.

To keep tha w'eels a-gawin' sometimes takes a lot o' grit,
There's times a chap may 'ardly think it's worth
Tha trouble, fuss an' bother, but 'e'll stick through to tha h'end.
Min' you, 'e's tha chap we calls tha "salt o' h'earth."

'E may be in tha pump'ouse with a bit o' bloody pipe
A-tryin' some device to make tha h'air
'It tha drill bit all tha 'arder—depen' on it, m' son,
W'en 'e's through 'e naws 'e's done a job that's fair.

Thee may fin' 'im in a drif' h'end, 'is foot propped on a stull,
A-thinkin' h'up a way to 'old tha back,
That requires diffren' treatment. But 'e's it figgered h'out,
An' tha bloody thing will stan' without a crack.

'E ain't got no h'occupation as far as titles gaw,
But 'e's jus' w'ere you want 'im all tha time,
An' any job that mus' be done from dry room down to sump,
'E's tha 'andy man, as nawn, at ev'ry mine.

Personals

Have You Contributed to the Association of the 27th Engineers?

G. A. St. Clair, president of the Section Thirty Mining Co., of Minnesota, is in Florida.

Errol MacBoyle, of San Francisco, announces the removal of his offices from the Crocker Building to the Hobart Building.

Edward S. Davis, chief of the Fuel Oil Section, Bureau of Oil Conservation, after six months of service, has returned to Tate, Jones & Co., Inc., Pittsburgh.

Francis J. Webb, general manager of the Minnesota and Michigan properties of the Republic Iron and Steel Co., has returned from a visit to the main offices of the company at Youngstown, Ohio.

J. W. Pearce has assumed his duties with the engineering department of the Inspiration Consolidated Copper Co. at Miami, Ariz. Mail address is Box 131, Inspiration, Arizona.

W. W. Coleman, president of the Bucyrus Co., South Milwaukee, will be a delegate of the Milwaukee Association of Commerce to the National Foreign Trade Convention to be held in Chicago on Apr. 24 to 26.

Louis A. Wright expects to sail from Chile for New York about Apr. 1, hopes to arrive here soon after the middle of April, and plans to make a long stay in this country. His address will be 61 Broadway, New York.

Bulkeley Wells has been elected president of the Gold Point Consolidated Mines, Inc., recently organized to take over the Eureka-Idaho-Maryland, Gold Point, Union Hill, South Idaho, and other properties near Grass Valley, California.

H. G. Turner, South American representative of the Denver Rock Drill Co., has arrived in Lima, Peru, from Colorado, where he formerly was connected with the Sunnyside Mining and Milling Co He will make his headquarters in this city.

H. C. Dudley returned from France in January. He served as captain in the 36th Engineers at Gieveres, and was transferred at the beginning of September to the department of the chief engineer, First Army Mr Dudley has moved his office to 701 Lonsdale Bldg., Duluth.

Hoyt S. Gale, geologist of the U. S Geological Survey, is en route to Europe as a member of a commission sent by Secretary Lane to study reconstruction problems. Mr. Gale's special mission is the investigation of potash supplies available for the United States, and he will visit deposits in Alsace, Spain, and elsewhere.

Major Carl Stevenson, recently released from the gas and flame division of the U S Army, has returned to work in the engineering department of the Cleveland Cliffs Iron Co.'s Mesabi Range properties. Major Stevenson, prior to his enlistment, was head of the company's "Safety First" department and had also been connected with the educational department.

Capt. Percy E. Barbour has forwarded his resignation as Deputy Superintendent of the New York State police to Major George F Chandler, in command Captain Barbour has been attached to the Engineer Corps, U S. Army, for the last six months under a leave of absence He will become Assistant Secretary of the American Institute of Mining and Metallurgical Engineers

Herbert C. Hoover, who was recently named Director General of Allied Relief, under the commission sitting in Paris, has been appointed by President Wilson to be Director General of the American Relief Administration, with full authority to supervise the expenditure of $100,000,000 recently voted by Congress for European famine relief **Edgar Rickard** and **Theodore F. Whitman**, who have been directing the affairs of the Food Administration during Mr Hoover's absence in Europe have been appointed by the President to be joint directors, in the United States, of the newly created relief administration

Obituary

Herbert R. Dryfoos, president of the Cleveland Alloys Co Cleveland died on Feb 18 of pneumonia at his home

W. S. Henry formerly of the Backus & Johnston company at Casapalca Peru, died recently from acute influenza in New York Mr. Henry came to the United States intending to enlist in some branch of the service.

Norman M. Thornton, of Edmonton, Alta., died on Feb. 23 at the age of 38. He was recently in charge of the Mountain Park Collieries, in the development of which he had taken an active part. He leaves a widow and one child.

James Stobie, one of the early prospectors in Ontario, died recently at Ypsilanti, Mich. He was the first to find nickel ore in the Sudbury district, and discovered the Mount Nickel and Stobie mines. He acquired considerable wealth through his discoveries and contributed largely to religious objects. Mr. Stobie was engaged in farming during the latter part of his life.

T. Walter Beam died at his home in Denver on Feb. 1, after a short illness. He was born in Bellaire, Ohio, in 1854, and since 1871 had been engaged in mining in Colorado and elsewhere. He was one of the locators of the Japan mine, in Savage Basin, near Telluride, Colo., and was interested in the famous Eureka mine, at Sutter Creek, Calif., and the Nickel Plate property, at Hedley, British Columbia. He is survived by his widow, daughter and son.

George R. Sheldon, director of the American Locomotive Co. and of the Bethlehem Steel Co., died on Jan. 14, at Carbondale, Ill., from injuries received while inspecting a coal mine at that place. He was 62 years old. Mr. Sheldon was also president of the Electric Securities Co., treasurer of the Milwaukee Electric Ry. and Light Co., treasurer and director of the Detroit Edison Co., director of the Mechanics & Metals National Bank, the Union Electric Light Co., of St. Louis, the Cincinnati Northern Railway Co., the West Kentucky Coal Co., and the Wisconsin Edison Co.

Societies

International Mining Convention will be held in Vancouver, B. C., Canada, Mar. 17-19. Frank Probert, dean of the College of Mines of the University of California, who is now abroad, is expected to be one of the speakers. Burr Evans, of Placerville, Calif., will also address the convention.

American Society of Mechanical Engineers, New York section, held a meeting at the Engineering Societies Building, 29 West 39th St., on Feb. 24. Subjects of the evening were "The Application of Electrical Control to Gate Valves," illustrated by lantern slides, by Peter P. Dean, and "The Application to Industry of the Personnel Work in the U. S. Army," by Lieut.-Col. J. J. Swan.

Engineers' Club of Philadelphia will hold a special meeting on Apr. 23, when Arthur J. Baldwin, vice-president of the McGraw-Hill Co., of New York, will present an illustrated paper on "The Devastated Area and Its Reconstruction." The regular meeting will be held on Mar. 18, at Witherspoon Hall, and will be addressed by Dr. John A. Brashear, former president of the American Society of Mechanical Engineers.

American Association of Petroleum Geologists will hold the fourth annual meeting on Mar. 13 to 15 at Dallas, Tex Registration of members will begin on Mar 13 at 9 a m. in the Adolphus Hotel, and will be followed by an address of welcome by Mayor Lawther of Dallas, and other short addresses by Mark L. Requa, of the U. S. Food Administration; David White, chief geologist of the U. S. Geology Survey; I C White, state geologist of West Virginia; Ralph Arnold, chief of valuation section, Internal Revenue Department, U S Treasury; Beeby Thompson, consulting petroleum geologist, London, England; Professor Salisbury, University of Chicago; J A Udden, state geologist of Texas, and others to be announced later All petroleum geologists and engineers are invited to be present at the technical sessions Among the many papers to be presented at the technical sessions will be the following "Relation of Surface Structures to the Occurrence of Oil in North Texas," by Wallace E Pratt; "The Stratigraphy of Pennsylvania Formations of North Central Texas," by F. B Plummer, "Factors in the Valuation of Oil Lands," by Carl H Beall; "Laboratory Methods for the Examination of Well Cuttings," by E A Trager; "Relations of Sulphur and Cap Rock in the Coast Domes," by C R Eckes Further information can be secured by addressing W E. Wrather, secretary, 6044 Bryan Parkway, Dallas, Texas

Industrial News

Brown-Steel Co., Columbus, Ohio, has been incorporated to take over the steel department of the Columbus Mill and Mine Supply Co. of that city.

Chicago Pneumatic Tool Co. announces the removal of its Cleveland district office from Room 813 to Rooms 406-408 Engineers' Bldg., Cleveland. Ross Watson is district manager.

W. A. Butchart, Denver, Colo., manufacturer of concentration apparatus, has recently purchased the complete plant and equipment of the Enterprise Machine Co. The offices will be consolidated, and the business conducted hereafter at No. 1326-1330 Eleventh St. The former address was 605-607 Mercantile Building.

Beckwith Machinery Co., Arch St. and Parkway, Northside, Pittsburgh, has opened an office and warehouse at 1227 West 9th St., Cleveland, for the sale of the regular lines of mine, mill and construction equipment marketed by this company. The Cleveland office is in charge of E. D. Stoner, assisted by C. S. Daily.

Wellman, Seaver, Morgan Co., Cleveland, Ohio, at the annual stockholders' meeting in Cleveland, on Feb. 18, reëlected the retiring board of directors. At the directors' meeting the following officers were elected: Edwin S. Church, president and general manager; S. H. Pitkin, vice-president; George W. Burrell, second vice-president; W. H. Cowell, secretary and treasurer. The Cleveland and Akron works will be in charge of the second vice-president.

Pulverized Fuel Equipment Corporation, with offices at 30 Church St., New York, and in the Transportation Bldg., Montreal, Canada, has recently been organized to take over the business of the Locomotive Pulverized Fuel Co. to extend the business of the latter to cover the general industrial field, particularly metallurgical and central-power station installations. The officers of the new corporation will be: H. F. Ball, vice-president, executive; H. D. Savage, vice-president in charge of sales; V Z. Caracristi, vice-president in charge of engineering; Samuel G. Allen, secretary-treasurer.

New Patents

United States patent specifications may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Furnace, Melting and Pouring. Ignac Kormutt, Charleroi, Penn. (U. S. No. 1,290,242; Jan. 7, 1919.)

Furnace, Metal Heating. Walter S. Rockwell, New York, N Y., assignor to W S. Rockwell Co., New York, N. Y. (U. S. No 1,289,547; Dec. 31, 1918.)

Furnace, Oil. John W. Lewellen, Ridal, Penn. (U. S. No. 1,289,484; Dec. 31, 1918.)

Furnace, Tungsten-Reducing. Carl A Pfanstiehl, Waukegan, Ill., assignor to Pfanstiehl Company, Inc., North Chicago, Ill. (U. S. No. 1,289,896; Dec. 31, 1918.)

Gold Dredge Tumbler. George E Sibbett, Berkeley, Calif. (U. S. No. 1,289,561, Dec. 31, 1918.)

Ingot Charging Into Ovens, Apparatus for. Ernest Fuchs, Billancourt, France, assignor to Louis Renault, Billancourt, France. (U. S. No 1,290,163; Jan 7, 1919.)

Ingot Mold. William G Mathias, Ensley, Ala (U S No 1,290,627; Jan 7, 1919.)

Iron and Steel, Rust-Proofing Coating William H Allen, Detroit Mich (U S No 1,290,176; Jan. 7, 1919.)

Kiln. John B Owens, Metuchen, N J (U S No 1,289,530, Dec 31, 1918.)

Kiln. Halver R Straight, Adel, Iowa (U S No 1,290,848, Jan 7, 1919.)

Kilns, Controllable Draft for Tunnel John B Owens, Metuchen, N J (U S No 1,289,889; Dec 31, 1918.)

Kiln, Muffle. John B Owens, Metuchen, N J (U S No 1,289,890; Dec 31, 1918.)

Manganese Dioxide, Black Streak Depolarizing Agent Carleton Ellis, Montclair N. J., assignor to National Carbon Co., Inc., New York, N Y (U S No 1,289,707, Dec. 31, 1918.)

Metal, Process of Annealing. John H. Bennett, Worcester, Mass. (U. S. No. 1,289,092; Dec 31 1918.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Feb. 28

The Pacific Coast Gold Mines Corporation, of which W. J. Loring is president and general manager, is the new owner and operator of the Dutch-Sweeney-App mines, near Jamestown, in Tuolumne County. These properties have been operated by the Loring interests for three or four years. The former owner of the Dutch and the Sweeney was the Dutch-Sweeney Mining Co., and the App mine was owned by the Neville estate. The Pacific Coast company now owns the three mines and the Dutch-Sweeney mill. The improved mill, put into operation in February, 1919, consists of two sets of rolls, a belt conveyor, two Hardinge ball mills of 8-ft. diameter, and one 16-cell Minerals Separation flotation plant. The recovery by this process so far shows a loss of 4 to 20c. per ton on ore running $4 per ton. The Dutch-Sweeney is opened by a 2300-ft. shaft. A large tonnage of low-grade milling ore is available. The Dutch-Sweeney mines were fairly developed at the time W. J. Loring optioned the property, and a 20-stamp mill had been installed. It was more a problem of metallurgy than of development, as the ore common to Mother Lode deposits is usually low-grade, but in well-defined veins or orebodies. The App mine is situated on adjoining ground, and was opened and operated by Captain Neville in the early days of deep mining, though the depth during Captain Neville's operation did not reach 2000 ft. The App is a natural adjunct to the Dutch-Sweeney property.

The Recent Purchase of the Morgan Mine, in Calaveras County, by the W. J. Loring interests, and the resultant new installation of operating and treatment plants at this property, together with plant improvements by the same interests at the Dutch-Sweeney-App mines, in Tuolumne County, mark an advance in operation of Mother Lode properties. The Morgan mine is now owned by the Carson Hill Gold Mines, Inc., W. J. Loring, president and general manager. The capitalization is $1,000,000, divided into 1,000,000 shares, of which 700,000 have been issued. The purchase price was about $500,000 in cash. The property embraces 450 acres in Calaveras County, north of Stanislaus River, and includes the town of Carson Hill. The main portion of the property is situated on the true (or middle branch of the) Mother Lode. The Morgan mine is on the eastern branch of the Mother Lode, which joins the central branch at Carson Hill, and embraces about 12 acres. The property was optioned by W. J. Loring on Nov. 10, 1916, and assignment was subsequently made to the Carson Hill Gold Mines, Inc., which exercised the option on the Morgan, Union and Kentuck claims, together with all the other properties possessed by the Morgan Mining Co., the former owner. The purchase was consummated on Dec. 28, 1918. During the life of the option, about 4000 ft. of development work was done and a fine body of high-grade milling ore was disclosed. The equipment installed by the present owner consists of a mining plant and a treatment plant situated at Melones, on the north side of the river. The mill consists of 20 stamps of 1250 lb. each, a Hardinge pebble mill, silver-plated copper plates for recovering free gold, two Deister sand tables and four Overstrom tables for recovery of fine concentrates, and one Wilfley table for re-treating middlings. The ore is delivered by belt conveyor from the mine to a 700-ton bin at Carson Hill, thence transported by Sierra Ry. to the Carson Hill Gold Mines plant at Melones. The sand and slimes are elevated by centrifugal pumps to a launder, which conveys this material to the cyanide plant of the Melones Mining Co., a distance of 1200 ft. The sands and slimes are separated and treated by cyaniding; also the concentrates recovered. The cyanide plant is leased to Symons & Latham, who have a contract to treat the Morgan mine slimes, sands and concentrates.

GOLDFIELD, NEV.—Feb. 25

The Goldfield Development Co., which was stated in the last issue to have leased the property of the Goldfield Consolidated Mines, was organized Feb. 13, 1919, under the laws of Nevada with a capital of $125,000 and 2,500,000 shares of assessable stock. Directors and officers are Corrin Barnes, president; A. I. D'Arcy, vice-president and general manager, and for several years manager of the Wingfield properties other than the Goldfield Consolidated Mines, and also consulting engineer for the Tonopah Divide property; H. G. McMahon, secretary-treasurer; A. H. Howe, former secretary and treasurer of the Goldfield Consolidated; and Benjamin J. Henley, of counsel for the latter company. An agreement has been made for the purchase of part of the ground of the Goldfield Consolidated Mines, and a bond has been taken for part, the remainder being held under lease for five years. According to the secretary-treasurer, H. G. McMahon, the company expects to conduct considerable development work on its own account and to sublease blocks to outsiders who care to carry on leasing operations. This work is now in progress by both the Development company and the sublessees. The four main shafts of the old company are being operated, as well as the pumps and surface equipment. Data are being gathered for determining the advisability of milling the oxidized zone in the Combination mine, which extends from the Florence mine to the January shaft, a distance of 1200 ft. In this section the ore channel, from which much of the early-day high-grade ore deposits was taken, has a width of from 40 to 100 ft., with a depth of 380 ft. The value of this material has not as yet been determined, but, should it prove to be of sufficient grade, the whole will be caved and drawn from the lower levels.

SALT LAKE CITY, UTAH—Feb. 27

A Wage Cut of 75 Cents Per Day at Park City went into effect on Mar. 1 and at many properties in Tintic. Food prices at these camps are said to be falling.

Dissatisfaction Over the Wage Reduction of 75c. per day at the Garfield smeltery of the American Smelting and Refining Co. has caused a small number of employees to go on a strike. The company has been making every effort to furnish employment to the largest number possible, and the copper furnaces are at present operating at a loss. Closing down these furnaces would be in the nature of a gain for the company. Under existing circumstances it is difficult to see what the men expect to attain by striking. However, the majority of the employees appear to recognize the fact that a little patience on their part is not out of order during the difficult period of readjustment.

Reorganization of the Judge Mining and Smelting Co., the Daly West and the Park-Utah companies, which are affiliated and operating in Park City, has been effected following the death of H. Otto Hanke, of Cincinnati, president of the three companies, the same interests, however, remaining in control. G. W. Lambourne has been made president of the three companies, and the directors show a wider range of membership. The Judge company is working 600 men in all, and in connection with mining is operating an electrolytic zinc plant, from which regular shipments of spelter are being made. The Daly West is being rejuvenated, and it is stated that the working force, at present of moderate size, is to be brought up to 150 men. The Park-Utah is being developed. This ground is in a new section of the camp, and a crosscut is being driven at the depth of the Ontario drain tunnel to determine its possibilities.

The Bill Regarding Taxation of Utah Mines, as passed by the State Senate Feb. 21, has been amended to read that assessment be fixed according to a sum "not to exceed three times the net proceeds." This settlement of the question is felt by those interested in the industry to be in the nature of a compromise. It had been hoped that some more accurate method would be adopted, according to which, as is done in Arizona, the probable life of the property to be assessed is taken into consideration. This, it is stated, is not possible, according to the Utah constitution. In regard to the taxation of metalliferous mines in particular, it is stated by the senator proposing the bill in the original form, fixing taxation "at three times the net proceeds," that the state board of equalization would fix the taxation of these mines at "three times the net proceeds." The words "not to exceed three times the net proceeds" were put in at the suggestion of the Governor of the state.

PHOENIX, ARIZ.—Feb. 28

Employees Laid Off at Bisbee number less than 500, it is stated locally. Many of those who were working in shafts that shut down have been taken on at other properties. In addition, several hundred soldiers have returned to their former work in or around the mines. At Ajo, a system of part-time employment is in effect. It is also to be noted that many men drifted into the district with the coming of cold weather who customarily leave when it gets warmer.

The Strike in the Verde District has been called off as casually and unaccountably as it was called. A local newspaper office has been furnished with a "Notice to Mine Workers," signed simply by "Strike Committee," stating that, "Owing to circumstances over which we have no control, we, the miners of Verde district, have decided to call the strike off." Mine managers, when advised, stated that the committee's announcement "cannot be taken seriously" and there is intimation that the larger works will not be reopened till radical agitators have left the camp. When the mines closed it was declared that they would not reopen within six months. A committee of foreign miners sent to call on Superintendent Smith, of the United Verde, was advised that the mine could not resume operations within six weeks, even if reopening were decided upon at once, for the main hoisting shaft is under repairs and much of its machinery has been brought to the surface. The same situation is true at the smeltery, where the shutdown is being utilized for relining reverberatories, though smeltermen who wish are being allowed to remain rent free in the company's cottages. Many of the Mexicans are preparing to return to their own country, and have asked for special railroad rates. Official investigators for the Department of Labor estimate that more than 1000 men have left the camps, though the school enrollment has dropped off little, indicating that the families have been left behind. H. S. McCluskey, committeeman of the International Union of Mine, Mill and Smelter Workers, recently advised the men to return to work, stating that in southern Arizona there are now at least 10,000 idle men, "so that there is no place for the idle of the Verde district to go to better their condition."

DENVER, COLO.—Feb. 27

Blue-Sky Legislation for Colorado is to be the subject of much discussion in both branches of the Legislature at this time. Several bills have been offered for consideration, and there is a wide difference of opinion as to the exact nature and wording of such a measure. The Senate and House judiciary committees do not seem to agree on the manner of bringing about such legislation. The Senate favors a speculative securities commission, whereas the House does not approve of a plan to have the sale of stocks passed upon by a committee of three men. The House judiciary subcommittee on "blue-sky" legislation, comprising Representatives Dolan, Fairfield, Golding, and Stephenson, is considering a draft that will protect the honest promoter. The Girard-Fairfield bill calls for publicity with regard to the stock-selling operations of mining, oil, and irrigation enterprises, but does not create a commission. According to this proposed measure, agents must have certified copies of the prospectuses and statements filed by the company with the Secretary of State's office, and misstatements by the agents are punishable by heavy fine and imprisonment. The Senate judiciary subcommittee comprises Senators Hetherington, Peterson, and Starkweather These men favor the Knauss-Peterson bill, which provides for a commission consisting of the Attorney General, the Secretary of State, and a third member to be appointed by the Governor, who shall be secretary and receive a salary of $3600 a year. The bill limits the commission of agents and brokers, and seeks to prevent company sales that are carried out by promoters for their own individual gain. This committee has been advised that many persons have been deceived in the purchase of private stock when they believed they were buying company securities. To prevent the sale of this private stock under misleading circumstances, the subcommittee will suggest that such securities and stocks contain a statement such as: "This certificate is a transfer of ownership of the stock represented by it and not for stock sold by the company." The cautionary wording is to be printed across the face of the certificate. One argument against the proposed creation of a commission is the recent unsatisfactory development in connection with "blue-sky" legislation in Nebraska, where the protection of the public from the sale of fraudulent securities is vested in the Railway Commission.

AUSTIN, TEX.—Feb. 27

The Bill To Provide a New Mining Law for Texas, introduced at Austin on Feb. 5 as Senate Bill 186 by Senator R. M. Dudley, of El Paso, was finally passed by the State Senate on Feb. 20. The bill embodies the features of the draft made by a committee of the El Paso Mining Circle, this organization having appointed S. H. Worrell, dean of the Texas School of Mines and chairman of the committee that prepared the draft, and E. F. Knott to go to Austin to endeavor to have the new law passed. General features of the draft were given in the "Journal" of Feb. 28 on page 292. Various amendments were offered, including one, which was adopted, providing that claims for sulphur shall not be confined to 1500 ft. in length and 600 ft. in width, but any single claim for sulphur may cover as much as 200 acres. Another amendment to make the miner pay 5% royalty on his gross production was tabled. An amendment, which was adopted, provided for making the price of the mineral land acquired $250 instead of $25 per acre, payable after five years.

DULUTH, MINN.—Feb. 27

Miners Employed in State-Owned Mines in Minnesota will be put under the provisions of the Workmen's Compensation Law by the action of a bill introduced by Senator Fred Bessette, of Orr, Minn. The bill is sponsored by the State Auditor's office, which has control of the state-owned mines. A Senate bill advocated by the Department of Labor, providing that all employment agency fees shall come entirely from the employer, is meeting strenuous opposition.

Reduction in Ore Freight Rates to the head of the Lakes is being sought by independent operators on the Minnesota ranges, who are urging the State Legislature to memorialize Congress to this end. They have so far succeeded in getting favorable action from the Senate Railways Committee. Prior to 1912, the rate was 80c. a ton from the Mesabi, and from 90c. to $1 from the Vermilion Range. In the spring of 1912 the D. M. & N. and the D. & I. R. railroads voluntarily reduced their rate to 60c., and the Great Northern immediately followed. In June, 1915, in compliance with an order from the Interstate Commerce Commission, the rate on Mesabi and Vermilion ores was reduced to 55c. per ton, and in the spring of 1917 the same body authorized an increase to 63½c. One of the first acts of the U. S. Railroad Administration (W. G. McAdoo, Director General) on taking over the ore-carrying roads was an arbitrary raise to $1 per ton, effective July, 1918. It is now contended that this rate is entirely unreasonable, and that out of every dollar earned by the ore-carrying roads 51c. is used to bolster up weak lines in the railroad chain.

WEBB CITY, MO.—Feb. 27

The Community Drilling Corporation, recently referred to as in process of being organized by business men of Webb City, Mo., has for its object the development of the Webb City-Carterville mining district by a thorough drilling campaign. It is proposed that the drilling be conducted only on land under lease to the corporation, the latter to be reimbursed by royalties or cash payments in consideration of development done, sufficient to keep capital unimpaired. All drillmen and helpers are to be residents of the Webb City district while so employed. Drilling is to be done on contract. Leases are to run for at least 10 years, to allow sufficient time to prospect them and interest capital. Royalties recommended vary from 3 to 10% to the landowner, according to the "mill recovery." Added royalties varying from ½ to 5% may be purchased by the operating company. The committee on organization recommended that at least 200 holes be drilled.

HOUGHTON, MICH.—Mar. 1

Reduction of Wages amounting to 15% was announced on Mar. 1 by Calumet & Hecla and subsidiaries, reëstablishing the scale existing in April, 1918. The cut affects all classes of labor. Similar reductions in pay by other mining companies in northern Michigan make the total number of employees thus affected about 18,000. Two of the mines, the Mass Consolidated and the Franklin, cut wages several weeks ago when confronted with the proposition of doing so or closing down. The decrease had been expected by the men. Action had been postponed by the companies as long as possible in the hope that the cost of living might lessen materially in the meantime.

NEW YORK—Feb. 27

Producers of Phosphate Rock have organized the Phosphate Export Co., under the Webb law, for the purpose of handling the export business in their industry. The company has no capitalization, and includes as members the producers of rock running more than 75% phosphate. Headquarters will be maintained in New York and branches will be established abroad. Tonnage to be allotted to the concern will depend upon the foreign demand that may develop. S. B. Fleming, president of the International Agricultural Corporation, has been an important factor in organizing the new company.

BOSTON, MASS.—Feb. 27

Suit Against the Iron Cap Copper Co., operating in Arizona, has been brought by the Arizona Commercial Mining Co., in the Massachusetts Supreme Court. Two separate actions have been begun, one alleging illegal extraction of ore from veins apexing in Arizona Commercial ground, and the other alleging that Iron Cap refuses to share equally the expense of draining ground within its boundaries. The properties of the two companies adjoin. The Arizona Commercial company alleges that in the last six years it has spent over $250,000 in draining its own ground which automatically drained the lower levels of the Iron Cap. Under Arizona law, each company, when lying contiguous to the other and having a common ingress of water, is required to pay its proportionate part of the expense incurred in keeping the ground drained. Arizona Commercial alleges that it is entitled to at least $150,000 from the Iron Cap, and has attached the property of that company held by the State Street Trust Co. to the extent of $150,000. In the other action Arizona Commercial claims that the Iron Cap company, in the operation of territory between its two shafts, the Iron Cap and the Williams, has wrongfully extracted ore from veins that apex in Arizona Commercial's property. The plaintiff claims that more than 250,000 tons of ore from Arizona Commercial's veins has been mined, for which Iron Cap received over $3,000,000. The plaintiff has asked for an injunction restraining the company from further mining in this territory and from disposing of any of its assets. It has attached for $500,000 the property of the Iron Cap Copper Co. held in the State Street Trust Co. Hearing on both actions is set for Mar. 11. In its answer as trustee, the State Street Trust Co. sets forth that it has funds amounting to $67,061 belonging to Iron Cap. Officials of the Iron Cap company say they have been advised by what they believe to be competent authority that the suits brought by the Arizona Commercial are without basis. In fact, they say they have never prior to February of this year, received any intimation that the veins now being worked by the Iron Cap Copper Co. apex other than on their property, and they do not believe that they do.

VICTORIA, B. C.—Feb. 28

Production of Copper is the most important phase of the British Columbia mining industry both in respect of value of output and the number of men employed. Present market conditions have led here as elsewhere, to an unsettled state of affairs as to the immediate future of the industry. The managements of the several large mining corporations most affected have adopted the policy of taking the men into their confidence, clearly stating to them that refusal to accept lower wages means cessation of operations, at least until the reëstablishment of a more normal market, and placing on their shoulders to some extent the responsibility of decision. The smeltery employees of the Granby Consolidated Mining and Smelting Co., at Grand Forks, have agreed to continue at a wage based on the Butte scale. At Anyox, B. C., the chief industrial center of the Granby company, the attitude of the men is not yet definitely known. It is thought, however, that they are likely to adopt the same reasonable view as did those at Grand Forks. If this proves so, the operations of the company may not be seriously affected. The company has expressed its desire to do its utmost to keep the wheels moving. The Britannia Mining and Smelting Co. is meeting the situation by rather a different method, but by one which, in the last analysis, works out about the same. Men are being discharged, and the company's operations will probably be curtailed in a considerable degree. However, when the men are laid off they are given the option of returning to their jobs at a reduced scale. Many are accepting the proposition. Thus there is no reason for a competent man to be idle. There is no doubt that the relationship between manager and worker is changing in British Columbia. Those companies which have treated the representatives of the men as intelligent persons, and have taken the trouble to point out that with no income it is impossible to pay high wages, and to explain how it happens that there is no income at present, for the most part find their men standing behind them.

The Dolly Varden and Wolf Silver Mines, in the Alice Arm district of British Columbia, are to be taken over by the Temiskaming Mining Co., it was decided by the shareholders of the latter company at their annual meeting on Feb. 4. These mines have been handicapped for some time, it is said, owing to lack of finances, and the Temiskaming company has entered into an agreement whereby operations will be resumed. The railroad from the beach at Alice Arm to the Dolly Varden mine was practically rebuilt and nearing completion when the construction company went into liquidation, with the result that most of the mining properties and prospects of the district were tied up. Hopes were entertained, however, that an early adjustment of the railroad difficulties would be arranged, and negotiations to that end were undertaken. The Dolly Varden Mines Co. owns the Dolly Varden property, which is situated about 18 miles from tidewater on the west bank of the Kitsault River, and the Wolf property two miles further up on the east bank of the Kitsault. The Dolly Varden has been extensively opened up by underground development, and is therefore in condition to start shipping at any time. The orebodies have been proved by thousands of feet of diamond drilling. On the Wolf property a tunnel 35 ft. long has been driven in on the orebody, from the face of which a crosscut to the north 50 ft. and to the south 10 ft. proves the orebody for a width of 60 ft., with neither wall in sight. Several thousand feet of diamond drilling has been done, proving the orebody and showing it to be of good milling grade. The British Columbia Legislature has before it a petition relative to the 18-mile railway which has been constructed from Alice Arm practically to the Dolly Varden mine. The petition sets out that the Taylor Engineering Co. spent $425,000 on the railway, almost completing it, without being repaid by the owners of the Dolly Varden. It is detailed that the Dolly Varden company was incorporated in 1917 and that subsequently arrangements were made with the Taylor Engineering Co. for the railway construction. The latter, it is said, got nothing more substantial than promises to pay. Negotiations having been entered into by the Dolly Varden company for the sale both of mines and railway, the contracting company, which since has gone into liquidation, although assured that its interests would be protected, began to manifest some concern, it being alleged that there appeared to be a disposition to attempt to evade responsibility. The petition is an effort to obtain legislative protection for the assets of the railroad builders as represented by the road, to which they were unable to give the finishing touches.

TORONTO, ONT.—Feb. 27

Hollinger Consolidated Gold Mines' arrangement, under which the company will sell its gold to the Ottawa mint, instead of in New York practically assures a bonus of [illegible] on production. The mint will pay for the gold in New York funds, which is equivalent to giving a 2% premium over the valuation of the Canadian dollar. The precedent having been established in the case of the Hollinger, it is assumed that any other gold-producing mine in Canada will be accorded the same terms.

Dome Mines Shareholders are much exercised over the terms of the reported deal for the Dome Extension. Two years ago the Dome company had an option on the Dome Extension on the basis of 50 shares of the latter for one share of Dome. The new deal is to be 30 to 1, and Dome shareholders are wondering why the Dome Extension should have appreciated in value to such an extent, particularly in view of the fact that there appears to have been a considerable accumulation of Dome Extension stock by the interests in control of Dome. No work has been done on Dome Extension since the Dome dropped its original option. Under the terms of the new deal, Dome is to spend $3000 a month on the property. The ore removed may be treated in the Dome mill, and, after proper allowances for working costs, the revenue derived will go to the Dome Extension treasury. In the event of the development on the Extension ground proving satisfactory, and sufficient profitable ore being developed to warrant the deal, an examination will be made by an independent engineer, before the Domes Mines company proceeds to exercise the option it holds.

The Proposed Leasing of Oil Territory in northern Alberta by the Canadian government to the Shell Oil and Transport Co., stated to be a subsidiary of a Dutch company with extensive ramifications, is meeting with strong opposition in Western Canada. On Feb. 18 the question was brought up in the Alberta Legislature, and a resolution condemning the transaction was unanimously adopted. At a meeting of 150 oil men held in Edmonton it was stated that the area it was proposed to hand over to the Shell company included a territory 700 miles long and extending over the whole width of the province. Capt. James Anderson, representing a group of British investors, said that he had seen, when in London, the charter which it was proposed to give to the company, and stated that it was the intention of the latter to build pipe lines to the Pacific Coast and to Fort Churchill, on Hudson Bay, and send the oil to Europe. A strong protest against the consummation of the deal was forwarded to Ottawa, together with a message to the members of Parliament representing Edmonton, asking them to demand full particulars from the government regarding the matter.

SYDNEY, AUSTRALIA—Jan. 28

Broken Hill Mines are at present the only Australian producers of zinc ores, though many other mines are capable of producing them. The output in 1918, according to figures published, was as follows: Lead concentrates, 261,193 tons, averaging about 62% lead; zinc concentrates, 347,610 tons, averaging 47% zinc. The excess of zinc concentrates comes from the large amounts of "old" zinc sands and slimes worked up by three of the Broken Hill companies. Before 1914 the zinc-distillation works of the Broken Hill Proprietary Co. at Port Pirie was the only plant of that character in operation. It was a small plant erected more as a test than as a commercial producer of spelter. Spelter of good grade has been regularly produced at this plant at the rate of about seven tons daily. The property is now owned by the Associated Smelters, of Port Pirie, a combination of Broken Hill mines, to which the Broken Hill Proprietary Mines sold the plant about four years ago. The spelter department of the works has not been enlarged since it was taken over, though the lead department has been expanded until it is now capable of absorbing the whole of the output of lead concentrates. The cessation of exports of zinc concentrates to Europe naturally turned the attention of zinc producers toward establishing their own spelter works, and the successful manufacture of electrolytic spelter in the United States indicated that it would not be advisable to enlarge the existing Port Pirie spelter plant. The Amalgamated Zinc company, of Broken Hill, always the pioneer of progress in treatment of Broken Hill ores, tested its zinc concentrates in bulk, and found them amenable to the processes for making electrolytic spelter. Tasmania being the only state possessing considerable resources of hydro-electric power, though mostly undeveloped, a site was secured at Risdon, near Hobart, with good shipping facilities, and the first electrolytic spelter works of Australia were built and have been making excellent spelter for nearly two years. The plant was originally planned for a capacity of 100 tons of spelter daily. Mainly owing to the slowness of development of hydro-electric power by the Tasmanian government, the daily output is only about 10 tons. The two plants mentioned can today absorb about 12,000 tons of roasted zinc concentrates yearly, an amount entirely inadequate for the production of which they should be capable. The zinc sands resulting from the milling of the lead concentrates must either be made into zinc concentrates or stacked for future treatment, and it is found more economical to treat them as they are made. In consequence, stocks of zinc concentrates have been growing during the last four years at the rate of over 250,000 tons per annum, even after allowing for what was exported to the United States and Japan during the first years of the war. The Mount Read-Roseberry group of mines has been developed under the technical direction of Mount Lyell, being situated in practically the same district. Large quantities of zinc-lead ores have been proved and found suitable for the electrolytic-zinc processes. Until recently it was projected to erect large milling and flotation plants near these mines and, later, electrolytic spelter works in connection therewith. Ample water power was available but undeveloped. The Mount Lyell company several years ago had developed sufficient hydro-electric power from Lake Margaret for its own works and mines, and it was found that about 45,000 hp. could be developed from the King River, near the Mount Read mines. It has been announced, however, that under an agreement just made, all the zinc and lead concentrates made at the Mount Read-Roseberry works will be treated at the Risdon works. The latter are to be enlarged up to a daily capacity of 1750 tons of zinc concentrates. If this figure is correctly reported by the newspapers, such capacity would take care of the entire Broken Hill and Mount Read-Roseberry output, and leave room for some of the other mines at present idle for want of outlet. The Mount Read company would be saved the large outlay for separate electrolytic works, and the Risdon works would have a monopoly of Australian spelter, inasmuch as the owners of the Risdon plant are practically the same as those of the Associated Smelters, of Port Pirie. In view of the difficulties of developing sufficient hydro-electric power, and also of the fact that many works in the United States are closed, it seems unlikely that the ambitious scheme indicated will be realized before 1923 or 1924, entailing a delay of four or five years.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee) — Operations suspended owing to fire which broke out on Feb. 25 between 700 and 800 levels. Shaft bulkheaded at 700 so as to permit flooding to that level if necessary.

Mohave County

McCRACKEN (Signal)—Old 20-stamp mill, built about 1876, now being junked. Turned out much silver-lead bullion in pioneer days.

Pima County

AJO-CORNELIA (Ajo)—Sued by Tucson contractors for diamond-drill work. Ajo stockholders allege fraud on part of company officers and have appealed for investigation by State Corporation Commission.

LITTLE AJO (Ajo)—Diamond drilling in progress; in rhyolite at 200 feet.

BLACK PRINCE (Ajo)—Under investigation by Corporation Commission on charge of selling stock without authority.

Pinal County

RAY CONSOLIDATED (Ray)—New automatic man hoist installed at No. 4 man shaft in No. 2 mine.

Santa Cruz County

TRENTON-GEORGIA (Tuhac)—To be operated under leases by St. Louis company, headed by A. R. Grund, which lately took option on northern half of 100,000 acre Baca Float land grant. Mine in Santa Rita Mountains, and pioneer producer of lead-silver ores.

Yavapai County

GADSDEN (Jerome) — Operations resumed after week's shutdown.

GREEN MONSTER (Jerome) — Work stopped indefinitely until costs come down and conditions are more stable.

VERDE COMBINATION (Jerome) — Work resumed after one-week shutdown.

ARKANSAS

Marion County

BEULAH (Rush)—Arkansas Mining Co. operating mine and mill steadily. Hauling output to shipping point at Yellville.

DRY PROCESS MILL built at Yellville last year will be run on custom ore. Has been operated at intervals since completion.

NORTH STAR (Yellville)—Good-grade zinc carbonate again struck. Large body of milling ore developed.

ONWATA (Yellville)—Small concentrator recently put in operation. Several months' supply of mill ore on dumps.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Installing steel water tower 166 ft. high for fire protection. Capacity 50,000 gallons.

Calaveras County

CALIFORNIA CALAVERAS (San Francisco)—Superior Court petitioned to dissolve company; incorporated in 1907 with $2,500,000 capitalization. Principal stockholder, David T. Adams.

Plumas County

ENGELS (Engelmine)—To extend Indian Valley R.R. to upper camp. Installing large settling tank near flotation plant. Labor supply now abundant. Lower tunnel of Big Chief advancing rapidly.

Shasta County

AFTERTHOUGHT (Ingot)—Expect to resume operation of mill latter part of March. New reverberatory will be ready for operation about Apr. 1, and will be put into service promptly.

MOUNTAIN COPPER (Keswick)—Wages reduced to scale of July 15, 1918, average cut being about 50c. a day; 475 men affected. Miners reduced from $4.50 to $4; muckers from $4 to $3.50. Surface men suffer smaller decrease, because wages were not increased in same proportion.

Tulare County

YOU KNOW (Porterville)—Property on Cow Mountain reported sold by Creeks brothers to Douglas brothers and A. Burbach. Equipped with three-stamp prospecting mill.

Tuolumne County

MOUNTAIN LILY (Columbia)—Clean-up from development in last two months yielded lessees $4000. Property formerly producer.

COLORADO

San Juan County

EMPIRE STATE MINE AND REDUCTION (Eureka) — Recently incorporated under Colorado laws. Officers and directors: William Akers, Fred Kunz and William Gooch. Properties near Sunnyside mine. Considerable development work done, and payable lead-zinc ores, occasionally running high in silver, opened. Trial shipments made. Erection of 50-ton mill near Eureka considered.

CALEDONIAN M. AND M. (Silverton)—Has developed Peerless San Juan property, and is milling ore successfully and shipping concentrates regularly. Much commercial ore opened.

CHAMPION (Silverton) — Being developed under lease by Roy Crawford Hardin Morris and Dominic Giono. Commercial gray-copper ore carrying silver recently opened. Ore packed from mine to railroad, and shipped to smeltery at Durango. Vein from 3 to 4 ft. wide.

San Miguel County

PRIMOS CHEMICAL (Vanadium)—Reduction plant burned recently, entailing $100,000 loss. This was largest vanadium ore-treatment plant in Colorado. Cause of fire unknown. Rumored that mill will be rebuilt. Company had recently opened and equipped additional mining properties near by.

MICHIGAN

Copper District

FRANKLIN (Demmon)—Mass of copper estimated to weigh two tons found on 30th level north on Pewabic amygdaloid, being largest yet found in mine. Output increasing, 1300 tons daily being expected during first part of March. Regrinding mill of Hardinge type put into operation Feb. 28. Initial results satisfactory.

MINNESOTA

Cuyuna Range

IDA MAE (Crosby)—Hoisting 85 to 90 tons high-grade manganiferous ore per day.

NORTHLAND (Cuyuna) — Drifting to orebody on 169 level, and cutting station and pump-room on 189 level. Will be in ore early in March.

CUYUNA-MILLE LAC (Ironton)—Will deepen shaft 50 feet.

FEIGH (Ironton)—American Bridge Co. completed erection of steel headframe. Permanent hoist foundation completed. Considerable construction and installation will be done this spring.

JOAN NO. 3 (Ironton)—Shaft which was bottomed recently stopped temporarily.

ADBAR DEVELOPMENT (Trommald)—Cuyler Adams, of Duluth, has leased from Cuyuna Fee Co. N. ½ of N.W. ¼ of Section 4, 46-29. Consists of 80 acres of iron-bearing land and lies about two miles northwest of Crosby. Small shaft sunk and enough development done to indicate presence of considerable high-grade ore. Royalty based on sliding scale, with a minimum of 25c. for merchantable ore.

ALGOMA (Trommald)—Has 30,000 tons manganiferous ore in stock.

FERRO (Trommald)—Started sinking shaft again, from 150 to 275 level, after delays owing to waiting for pumps, concreting sump, and other causes.

MERRITT (Trommald)—Producing 450 tons manganiferous ore per day, from three shafts. Shaft No. 1 will be sunk from 120 to 220 level.

Mesabi Range

OLIVER (Eveleth)—Mild weather has permitted continuation of concrete work on Leonidas concentrator. Steel work being carried on, and some machinery already on ground. A 6500-ft. trestle is being filled at rate of 2500 ft. per month to make settling basin. At Spruce mine four shovels operating; also two at North Leonidas and two at Fayal, one on each of the high banks on east and west sides.

MONTANA

Silver Bow County

BUTTE & SUPERIOR (Butte)—Argument in Minerals Separation litigation, slated for Mar. 3, postponed until Mar. 19 by U. S. Supreme Court.

EAST BUTTE (Butte)—Smeltery started up again on Mar. 1, 24 hours in advance of opening hour announced to custom shippers.

NORTH BUTTE (Butte)—Output reduced to approximately 150 tons ore per day.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments for week ended Feb. 20 were: Prince Consolidated, 26 cars and Virginia-Louise, eight; for week ended Feb. 27, Prince Consolidated, 24 cars, Virginia-Louise nine and Harney (Stundt and Donohue lease) one.

Nye County

TONOPAH SHIPMENTS for week ended Feb. 22 were 7130 tons having gross milling value of $121,210. Shippers were: Tonopah Belmont, 2185 tons; Tonopah Mining, 1050; Tonopah Extension, 2136; West End, 819; Montana, 357; Tonopah Divide, 118; MacNamara, 170; Midway, 53; North Star, 75, and miscellaneous, 55 tons.

MacNAMARA (Tonopah)—Have about completed installation of filters, thickeners, classifier and other equipment which will double present capacity of mill for purpose of taking greater tonnage of Tonopah Divide company's ore. Present daily milling capacity is 85 tons.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—January production of copper was 1,366,136 lb.; December, 1,637,997 lb. Notice dated Feb. 26 announces temporary suspension of all production owing to market conditions. Will push development in Alpha mine. Drifts to west on 1100 and 1200 levels of Alpha still in shipping ore. Crosscut on 1300 level recently cut high-grade in face. Will unwater shaft to 1400 level preparatory to starting development on that level.

NEW YORK

Essex County

CHEEVER (Port Henry)—Iron-ore properties of this company closed down indefinitely.

UTAH

Juab County

UTAH APEX (Bingham Canyon)—Operating forces materially decreased following drop in price of lead.

PLUTUS (Eureka)—Crosscut from Chief Consolidated shaft on 1000 level opened rich ore in fossiliferous limestone (not the usual ore-bearing limestone of camp), and stoping ore about 50 ft. below where ore-bearing limestone was expected. Property recently acquired by Chief Consolidated.

EAGLE & BLUE BELL (Eureka)—Lead-silver ore of shipping grade, which was opened on 1875 level 400 ft. southeast of shaft, proved from 1700 to 1875 level and still going down. Drifting begun on 2000 level 20 ft. above water level to reach body from below. January shipments by company 45 cars, and 1918 shipments 714 cars.

Salt Lake County

TINTIC SHIPMENTS for week ended Feb. 22 totaled 145 cars.

MIDVALE MINERALS (Midvale)—Retreating dump from old United States mill; increasing mill capacity to 375 tons daily. New Dorr classifiers installed and new-type thickener.

Summit County

PARK CITY SHIPMENTS for week ended Feb. 22 were 4,648,000 lb. of crude ore and concentrates.

THREE KINGS (Park City)—Property including 150 acres adjoining Silver King Coalition and Silver King Consolidated has opened five-foot mineralized fissure on 500 level.

WASHINGTON

Stevens County

LEAD TRUST (Boundary)—To advance No. 2 tunnel to reach extension of orebody developed on No. 1 level. Equipment being installed, including 60 hp. boiler, 25 hp. engine and compressor.

UNITED COPPER (Chewelah)—Mill in experimental stage, and no definite changes made to date. Analysis of mill feed as follows: Gold, 0.005 oz.; silver, 2.1 oz.; copper 0.7%; insoluble, 75.6%; iron, 4.4%; sulphur, 1%, and lime, 3.2%. Possibility demonstrated of making concentrates averaging 62.50 oz. silver, 21% copper, containing 96.8% of total silver and 91.2% total copper. Ratio of concentration by assays of copper products is 41 to 1. Gangue is schist containing chalcopyrite and tetrahedrite. Mill now producing concentrates averaging 15% copper and 30 oz. silver. Present output about 300 tons concentrates and 60 tons crude ore per month, latter averaging 16% copper and 92 oz. silver.

CANADA

British Columbia

CANADA COPPER (Allenby)—Large part of machinery for new concentrator is at Princeton awaiting completion of branch railway to Allenby.

ROCK CANDY (Grand Forks)—Aerial tramway from fluorspar property to spur extension of Kettle Valley Ry. almost complete. Consolidated M. and S. Co. developing this group.

GIBSON (Kaslo)—Hydro-electric power plant nearing completion. Property includes seven claims, with surface plant. Ore chiefly milling grade, with scattered high-grade. Mill construction probable depending on securing of funds. Situation seven miles from railroad, company owning its own hauling equipment. William W. Elmer, engineer in charge.

SILVER BELL (New Hazelton)—Has made first shipment of high-grade ore.

CONSOLIDATED M. AND S. (Princeton)—Diamond drilling begun on Voight claims on Copper Mountain.

STANDARD SILVER LEAD (Silverton)—About 25 men on development. Mill running one shift and handling ore from Echo mine.

WAKEFIELD (Silverton)—Recently acquired by Clarence Cunningham. Development progressing.

NOBLE FIVE AND IVANHOE mines, in Slocan district, have resumed operations with full crews, after being practically closed down by influenza.

SILVERSMITH (Slocan)—Oreshoot recently opened on tenth level followed 305 ft., extending 100 ft. into ground hitherto undeveloped on any level. Mill operation prevented by weather and shortage of water; will resume about Apr. 1. Three cars of crude ore shipped last month.

LUCKY JIM ZINC (Zincton)—Arrangements made for one-month trial run of ore in concentrator built at Alamo, B. C., by Clarence Cunningham.

Manitoba

PINEROOT CLAIMS (Athapapuskow Lake)—Six claims owned by E. L. Masterson, Dr. Robertson, W. J. Young, and J. Maxwell sold to C. W. Greenlees, representing Duluth syndicate. Ore copper sulphide.

Ontario

CHARLEBOIS—AUTHIER (Boston Creek)—Purchased by George Morris, of Buffalo. Adjoins Cullen-Renaud on north.

COTTER (Boston Creek)—Officially stated that orebody over 28 ft. wide has been cut by diamond-drill hole at vertical depth of 492 ft. Average gold content of core, $12.42 per ton.

McCREA-O'NEILL (Boston Creek)—Claims adjoining Miller Independence on northwest sold to George Morris, of Buffalo, vendors retaining small interest.

MILLER INDEPENDENCE (Boston Creek)—Plan of operation changed. Instead of driving inclined shaft on main vein, will sink vertical central shaft south of vein, to depth of 550 or 600 ft., to cut vein which is dipping to south.

COBALT SHIPMENTS from seven mines week ended Feb. 21 totaled 575,000 lb. ore as follows: Penn Canadian, 104,299; Kerr Lake, 80,255; La Rose, 81,425; Buffalo, 80,000; Coniagas, 80,000; O'Brien, 63,996; Hudson Bay, 61,531 lb. Mining Corporation was only shipper of bullion during period.

ADANAC (Cobalt)—Shipped 100 tons medium-grade ore to Dominion Reduction Company.

KERR LAKE (Cobalt)—January production was 118,985 oz. of silver, as compared with 102,289 oz. in December and 204,611 oz. in January, 1918.

TRETHEWEY (Cobalt)—Annual statement shows production for 1918 of net value of $250,534; operating costs, $147,166; operating profit, $103,368. Mill treated 34,546 tons, containing 10.2 oz. silver per ton. Estimated silver contents of ore reserves was 159,172 ounces.

PARAGON HITCHCOCK (Elk Lake)—Crosscut on 100 level has cut narrow veins, one carrying niccolite and silver. Sinking continued to 300 level.

HUDSON BAY (Kirkland Lake)—Operations financed; work to be started soon.

TECK HUGHES (Kirkland Lake)—Increasing force, now having 80 to 100 employed.

DAVIDSON (Porcupine)—Shaft unwatered and sinking resumed.

DOME LAKE (Porcupine)—Developing new orebodies of much higher grade than formerly mined. New development on 600 level.

HOLLINGER (Porcupine)—Company sampling old tailings to see if re-treating will pay.

KEORA (Porcupine)—Two diamond-drill holes put down 800 ft., cutting five veins found on surface which continue strong at depth.

VIPOND-NORTH THOMPSON (Porcupine)—Arrangements effected to secure funds for early resumption of operations.

LUCKY CROSS (Swastika)—Control of property passed into new hands; plans being made for reopening in spring.

MEXICO

AMERICAN MINING PROPERTIES in northern Mexico ordered guarded by Mexican federal troops; 280 stationed at Santa Eulalia, Cusihuiriachic and Madera, owing to bandits' threat to destroy properties and kill American employees unless large sum was paid by March 1.

The Market Report

SILVER AND STERLING EXCHANGE

Feb. Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
27	4.7575	101⅛	47¾	3	4.7575	101⅛	47¾
28	4.7575	101⅛	47¾	4	4.7575	101⅛	47¾
1	4.7575	101⅛	47¾	5	4.7575	101⅛	47¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Feb. Mar.	Copper Electrolytic	Tin Spot.†	Lead N. Y.	Lead St. L.	Zinc St. L.
27	15 @15¼	66¾	5¼	5.05 @5.10	6.25
28	14⅞ @15⅛	66¾	5¼	5.05 @5.15	6.25 @6.30
1	14⅝ @14¾	67¼	5¼	5.05 @5.10	6.20 @6.25
3	14⅜ @14⅝	67½	5¼	5.05 @5.10	6.20 @6.25
4	14½ @15	68	5¼	5.05 @5.10	6.17½ @6.22½
5	14¾ @14⅞	68	5¼	5.05 @5.10	6.15 @6.20

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

Feb. Mar.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M.	Zinc Spot
27	75	70½	(a)	222	214½	29	22½	40
28	75	71½	82	230	218	28½	23	41
1								
3	74	70	81	230	221	28	23¼	40
4	74	70¼	80	227	218	28	23¼	38
5								

(a) No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Mar. 5, 1919

The last week is noteworthy for the largest transactions in copper since November, but the sales were made at a terrible sacrifice in price. The activity in lead continued during the first two days of the week, but then petered out. Zinc was dull and soft.

Copper—With the market on the basis of 15¼c. at the close of last week, some considerable buying by consumers was attracted. All producers, large and small, entered the market and competed eagerly for the business. Although sales on Thursday amounted to about 5½ million lb., and those of Friday to about 4½ million lb., offerings were in excess of demand, and the price was forced down to 14¾c. before the end of the day On Saturday there was some real pressure, and round lots were booked as low as 14⅝c. A similar condition prevailed during Monday. The big producers did not follow the market down and were unwilling to sell below 15c., delivered, equivalent to about 14⅞c., New York. On Tuesday the market stiffened a little, and some considerable sales were made. During the afternoon brokers were reported to be bidding quite generally 14⅝c. in behalf of consumers. On Wednesday, however, demand ceased about as abruptly as it had begun at the beginning of the week, and nothing but trifling business was done. The sales of electrolytic copper during the week, as reported to us, aggregated about 20,500,000 pounds.

A further conference with representatives of the War Department respecting the taking over of the Government's copper was held on Monday. Although a general agreement was reached, the settlement of all details and the drawing of the contract had not yet been done. Reports in the newspapers have been inaccurate.

Copper Sheets—The base price of copper sheets is 23½c. per lb. Copper wire is quoted at 18@18½c. per lb. f.o.b. mill, carload lots.

Tin—There is scarcely anything to report.

Lead—The active demand that developed last week continued during Thursday and Friday, but after the latter day business fell off decidedly. The St. Louis market has been relatively higher than New York, but during the last week the price there eased a little. There has been some gossip about better than 5¼c., New York, having been realized, but there is no confirmation of it, and no better price was obtained by any of the important producers. Bonded lead is continuously offered for export, and from time to time some orders are booked, apparently from consumers who prefer to buy directly from producers rather than from the governments, which perhaps are not liquidating their stocks in the simplest ways. We estimate the world's accumulation of pig lead at something over 300,000 tons, but, according to all indications, the market is being handled in a conservative and intelligent way, and there seems to be neither any tendency nor any necessity to make unnecessary sacrifices.

Zinc—The dullness that continues in this market is appalling. Curtailment of production is becoming more general, but perhaps is not yet as much as it ought to be. We imagine that the existence of the large accumulation of scrap brass must be a blight upon the spelter market for some time to come.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 lb.

Other Metals

Aluminum—Unchanged.

Antimony—The market was dull and unchanged at 7@7¼c. for spot. March-April shipments from China were offered at 6⅝@6¾c., New York, duty paid, and some sales were reported.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic 45c. per pound.

Quicksilver—Easier. We quote $78@80 at the close. San Francisco reports, by telegraph, $83, unsteady.

Silver and Platinum

Silver—The silver situation remains unchanged. London official price, 47¾d.; New York official price, $1.01⅛ for 999 fine.

Advices have been received from London of shipment of Mexican coin to China Further shipments are expected No silver was shipped to London last week from New York; shipments from San Francisco to the East for January, 12,900,000 ounces.

Mexican dollars at New York: Feb. 27, 77½; Feb. 28, 77½; Mar. 1, 77½; Mar. 3, 77½; Mar. 4, 77½; Mar. 5, 77½.

Platinum—Refined ingot, $97.50@100.

Palladium—We quote $115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 1—Blende, per ton, high, $47.80; basis, 60% zinc; premium, $45; Class B, $43; Prime Western, $42.50@42; sludge and slimes, $41@37.50; calamine, basis 40% zinc, $28@27. Average selling prices: Blende, $41.10; calamine, $31.18; all zinc ores, $40.62.

Lead, high, $57.75; basis 80% lead, $60@50; average selling price, all grades of lead, $54.60 per ton.

Shipments the week: Blende, 10,988; calamine, 550; lead, 1525 tons. Value, all ores the week, $552,140.

When the Prime Western grades were selling on $41@40 basis preparations were made by a number of mine owners to cease operations until market conditions were better. Then the price was boosted to $42.50 for these grades, and none ceased outputting that could make any margin of profit. Consequently, instead of reducing the production to approximately 8000 tons per week, it is 10,000 tons or over.

Of 98 zinc-smelting blocks in Kansas and Oklahoma, reported upon, 63 are in active operation, making approximately two-thirds of the smelting capacity producing spelter.

Platteville, Wis., Mar. 1—Blende, basis 60% zinc, $45 base for premium grade and $41.90 base for high-lead blende. Lead ore, basis 80% lead, $50 to $55 per ton. Shipments reported for the week are 1970 tons blende and 192 tons galena. For the year to date the totals are 15,365 tons blende, 717 tons galena and 73 tons sulphur ore. During the week 2369 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—Freely offered without finding buyers.

Manganese Ore—Conditions of surplus supply continue unchanged.

Molybdenum Ore—Molybdenite is nominally quoted at 85c. per lb. of molybdenum sulphide content, sellers being willing to accept that price.

Tungsten Ore—No business was reported A nominal quotation is perhaps $8.50@9.

Other Minerals

Pyrites—Spanish pyrites unchanged at 16.5c. per unit on the basis of 10s. ocean freight.

Iron Trade Review

NEW YORK—Mar. 5

Stabilized prices are regarded as the need, according to the "Iron Age." There have been three months of them, and the producers count on being able to maintain them without Government intervention. The plane might be lowered, but the suggestion is that the same strong hands that produce most of the steel of the country might definitely state the period in which n change would be made, as, for instance, up to July 1. Then buying, which could hardly have been expected at any price in the period of recovery from war shock and of readjustment, would materialize. Any cut, even a sharp one, which leaves also the impression of further recessions at early rather than future dates, would not be conducive to developing business.

Producers are, if anything, more outspoken in the expectation that labor readjustment will be necessarily long delayed This and the commonly overlooked fact that this country's industry will not move independently of the rest of the world promise little in the way of drastic price revisions.

February's production of pig iron was 2,940,168 tons, or 105,006 tons per day This is 1519 tons less than the daily output of January. On Mar. 1 there were 306 furnaces in blast, making iron at a rate of 101,475 tons daily, against 323 furnaces on Feb. 1, operating at 104,105 tons. In the month improved furnace operation was obtained, due probably to better coke. One group made 4000 tons more in the 28 days of February than in the 31 days of January, notwithstanding there was a net loss of four furnaces in blast by March 1.

PITTSBURGH—Mar. 4

Last Thursday there was a conference in New York between a few steel producers and George N. Peek, chairman of the newly formed Industrial Board of the Department of Commerce, which was created to carry out Secretary Redfield's plan of "price suggestion" whereby war-time prices for commodities would be "demobilized." Mr. Peek outlined the plan, but the steel makers present did not commit themselves. Judge Gary has now called a general meeting of the iron and steel industry to be held in New York next Thursday, Mar. 6, to consider the proposition. Though nearly all members of the steel trade individually express themselves as opposed to Secretary Redfield's proposal, there is scarcely room for doubt that the meeting to discuss prices proves welcome.

The majority of independent producers feel that there should be price reductions of considerable extent, either now or in the near future, but the Steel Corporation apparently does not favor reductions. This is a reversal of the alignment at the meeting on Dec. 9, 1918, when Judge Gary had to exert himself to secure assent to the proposition that reduced prices should be recommended to the War Industries Board. Though the suggestion was not entertained by the board, as it intended to disband, the suggested reductions became effective, averaging about $4 a ton on finished-steel products as a whole. The idea now is that there ought to be reductions of at least $5 to $10 a ton, to instill confidence in the minds of buyers. Undoubtedly steel prices will decline within a short time, but it cannot be forecast that the decline will occur immediately after next Thursday's meeting. The time of the reduction depends upon whether the steel producers conclude that it is better to forestall action by the Redfield board by making reductions at once, or prefer to hold prices until reductions are arranged by that board. It may be assumed that, if voluntary reductions were made, the board would call for additional reductions.

New buying of steel products has experienced a further decline, and there is also a decrease in specifying against old contracts, and the steel industry is faced with a further curtailment in operations unless something is done. Operations to date have been remarkably heavy, considering the general industrial inactivity, and still average fully 75% of capacity, which means that considerably more steel is being made than at any time previous to the war. Little of this steel is accumulating in the hands of producers, and how so much is absorbed by buyers is not known. Steel prices are firmly held all along the line. There are reports of price cutting, but investigation usually proves them to be incorrect.

Pig Iron—Despite the extreme lightness of demand, there has been enough inquiry for foundry iron to bring out definitely lower quotations, and this grade can be reported at $1 a ton decline at least. For basic, there has been no inquiry, except as to a lot of 14,000 tons for export on which it is reported one seller cut the regular price by $1 and another by $2, but this does not reduce the quotable domestic market. The market is quotable soft at $1 decline on foundry and at former prices for steel-making iron, as follows: Bessemer, $32.20; basic, $30; foundry, $30; forge, $29, f.o.b. Valley furnaces, $1.10 freight to Pittsburgh.

Steel—Scarcely any inquiry, and prices are nominally maintained at $43.50 for billets, $47 for sheet bars and small billets, $46 for slabs and $57 for wire rods.

Ferroalloys

Ferromanganese—One or two steel makers in Youngstown, who did not cover as far ahead as others, have been picking up resale ferromanganese in small lots for their current operations and have been able to do $150 seller work for 80%. Producers are asking $200 for 80% and $170 for 70%, delivered, against the war-time price of $250 for 80%, but they have been unable to make sales. Spiegeleisen is nominal at about $75, furnace, for 16%.

Coke—Less demurrage coke is pressing the market, but on the other hand operators have come down on regular lots, and will sell furnace grade at $4.50 in almost any tonnage. March adjustments on open contracts are likely to be made at this figure. Foundry is $5.50@6, depending on tonnage and brand, all prices being per net ton at Connellsville region ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan	75 630	88 702	101.125	36 682	44 356	48 438
Feb	77 585	85 716	101 125	37 742	42 792	48 027
Mar	73 861	88.082	......	36 410	43 620	......
April	73 875	95 346	......	36 963	47 215	
May	74.745	99 505		37 940	48 980	
June	76 071	99 500	......	39 065	48 875	
July	79 010	99 625		40 110	48 813	
Aug	85 407	100 292		43 418	49 077	......
Sept	100 740	101 125		50 920	49 500	
Oct	87 332	101 125		44 324	49 500	
Nov	85 891	101 125		43 584	48 969	
Dec	85 960	101 125		43 052	48 492	
Year	81 417	96 772	......	40 851	47 516	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan	23 500	(a)	110 000	92 238	125 000	106 619
Feb	23 500	16 763	110 000	78 700	125 000	95 700
Mar	23 500		110 000		125.000	
April	23 500		110.000		125.000	
May	23 500		110.000		125 000	
June	23 500		110.000		125.000	
July	25 904		119.913		134.913	
Aug.	26 000		122.000		137.000	
Sept	26 000		122.000		137.000	
Oct	26 000		122.000		137.000	
Nov	26 000		122 000		137 000	
Dec	(a)		118 447		133 167	
Year	24 628		115 530		130 507	

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85 500	67.702	293 227	248 557
February	92 000	66 801	311 525	223 963
March	(a)		318.875	
April	(a)		329 905	
May	(a)		364 217	
June	(a)		331 925	
July	(a)		360 347	
August	(a)		380 900	
September	(a)	......	343 905	......
October	(a)	......	335 543	......
November	(a)	......	323 550	......
December	(a)	......	267.736	......
Av. year	(a)		330 138	

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6 782	5 432	6 684	5 316	29 00	37 227
February	6.973	5 057	6 899	4 784	29 00	28 675
March	7 201		7 001		29 00	
April	6 772		6.701		29 00	
May	6 818		6 704		29 00	
June	7 611		7 511		29 00	
July	8 033		7 750		29 00	
August	8 050		7 750		29.00	
September	8 050		7 750		29 00	
October	8 050		7 750		29 00	
November	8 050		7 750		31 20	
December	6 564		6 324		40 00	
Year	7 413		7 222		30 10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7 836	7 272	7 661	6 922	54 000	56 045
February	7 814	6 623	7 639	6 273	54 000	46 150
March	7 461		7 286		54 000	
April	6 890		6 715		54 000	
May	7 314		7 114		54 000	
June	8 021		7 791		54 000	
July	8 688		8 338		54 000	
August	8 985		8 635		54 000	
September	9 442		9 092		54 000	
October	8 801		8 451		54 000	
November	8 491		8 111		54 119	
December	8 163		7 813		56 050	
Year	8 150		7 890		54 180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer†		Basic†		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37 25	$33 60	$33 95	$31 40	$33 95	$32 40
February	37 25	34 60	33 95	31 40	33 95	32 40
March	37 25		33 95		33 95	
April	36 15		32 95		33 95	
May	36 20		33 00		34 00	
June	36 36		33 16		34 16	
July	36 60		33 40		34 40	
August	36 60		33 40		34 40	
September	36 60		33 40		34 40	
October	36 60		33 40		35 40	
November	36 60		33 40		35 40	
December	36 60		33 40		35 40	
Year	$36 67		$33 70		$34 45	

† As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 4
Alaska Gold M	3¼
Alaska Juneau	1¾
Am.Sm.&Ref.,com	66⅝
Am.Sm. & Ref., pf.	104½
Am.Sm.Sec., pf., A	93
Am. Zinc	12¼
Am. Zinc, pf	43
Anaconda	60¼
Batopilas Min	1½
Bethlehem Steel	63
Butte & Superior	19
Butte Cop. & Zinc	6
Cerro de Pasco	32
Chile Cop	18¼
Chino	33⅜
Colo. Fuel & Iron	38⅜
Crucible Steel	61¼
Crucible Steel, pf	94½
Dome Mines	12½
Federal M. & S.	10
Federal M. & S., pf	36½
Great Nor., ore ctf	39¼
Greene Cananea	41½
Gulf States Steel	55½
Homestake	97¼
Inspiration Con	45
International Nickel	26½
Kennecott	30¼
Lackawanna Steel	67
Mexican Petrol.	176¼
Miami Copper	22¼
Nat'l Lead, com.	67¼
National Lead, pf	107
Nev. Consol	16
Ontario Min	7½
Ray Con	19½
Republic I.&S.,com.	77
Republic I.&S., pf.	101¼
Sloss-Sheffield	48¼
Tennessee C. & C.	13
U. S. Steel, com	93¼
U. S. Steel, pf	114¼
Utah Copper	69¼
Va. Iron C. & C.	55

BOSTON CURB*	Mar. 4
Alaska Mines Corp.	‡.12
Boston Ely	98
Boston & Mont	49
Butte & Lon'n Dev.	11
Calaveras	1
Chief Con	3⅛
Contact	05
Corbin	‡.25
Cortez	13
Crown Reserve	48
Crystal Cop.	19
Eagle & Blue Bell	2½
First Nat. Cop	1½
Houghton Copper	30
Intermountain	‡ 05
Iron Blossom	43
Iron Cap	13
Majestic	18
Mexican Metals	28
Mines of America	‡ 05
Mojave Tungsten	04
Nat. Zinc & Lead	08
Nevada-Douglas	20
New Baltic	1
Oneco	25
Pacific Mines	‡ 35
Rex Cons	05
Yukon Gold	75

SAN FRAN.*	Mar. 4
Alta	01
Andes	08
Best & Belcher	04
Caledonia	.07
Challenge Con	‡ 03
Confidence	03
Con. Virginia	17
Gould & Curry	03
Hale & Norcross	.07
Jacket-Cr. Pt	05
Mexican	15
Occidental	40
Ophir	30
Overman	02
Savage	07
Sierra Nevada	06
Union Con	20
Utah Con	02
Belmont	3 40
Jim Butler	36
MacNamara	13
Midway	32
Mont.-Tonopah	16
North Star	08
Rescue Eula	07
West End Con	1 15
Atlanta	05
Booth	15
Comb. Frac	‡ 02
Florence	15
Jumbo Extension	12
Kewanas	05
Nevada Hills	02
Nevada Packard	17
Round Mountain	40
Silver Pick	06
White Caps	13

COLO. SPRINGS*	Mar. 4
Cresson Con	4 87½
Doctor Jack Pot	04
Elkton Con	04
El Paso	14
Gold Sovereign	‡ 02
Golden Cycle	‡ 76
Granite	14
Isabella	05½
Mary McKinney	06
Portland	90
United Gold M	12
Vindicator	43

BOSTON EXCH.†	Mar. 4
Adventure	‡ 60
Ahmeek	69½
Algomah	‡ 30
Allouez	41
Ariz. Com	11½
Arnold	‡ 20
Bingham Mines	‡8½
Bonanza	‡ .10
Butte-Balaklava	‡ .22
Calumet & Ariz	57½
Calumet & Hecla	400
Centennial	‡13½
Copper Range	39¼
Daly West	3
Davis-Daly	4½
East Butte	8½
Franklin	3
Granby	‡79
Hancock	‡5½
Hedley	‡12
Helvetia	‡ 20
Indiana	‡ 75
Isle Royale	24¼
Keweenaw	99
Lake	‡3½
La Salle	2¼
Mason Valley	‡2¼
Mass	4
Mayflower	3¼
Michigan	2¼
Mohawk	52
New Arcadian	1¼
New Cornelia	15½
New Idria	‡8½
North Butte	10
North Lake	60
Ojibway	1½
Old Dominion	32
Osceola	48
Quincy	56
St. Mary's M. L.	42¼
Santa Fe	‡ 25
Seneca	14
Shannon	2¼
Shattuck-Ariz.	‡14¼
So. Lake	‡1½
So. Utah	14
Superior	5
Superior & Bost	2¼
Trinity	2¼
Tuolumne	90
U. S. Smelting	47
U. S. Smelting, pf	48½
Utah Apex	2½
Utah Con	8
Utah Metal	1¼
Victoria	‡1¼
Winona	‡ 90
Wolverine	17

N. Y. CURB†	Mar. 4
Big Ledge	62¼
Butte & N. Y.	50
Butte Detroit	‡ 01¼
Caledonia	.30
Calumet & Jerome	37¼
Can. Cop. Corpn	2
Carlisle	12
Cashboy	06
Con. Ariz. Sm.	1
Con. Coppermines	4¼
Goldfield Con	19
Goldfield Merger	05
Greenmonster	‡⅛
Hecla Min	4¼
Howe Sound	‡3¼
Jerome Verde	‡ 50
Louisiana	‡⅛
Magma	27
Marsh	03
McKinley-Dar-Sa	47
Milford	‡ 75
Mother Lode	32
Nixon Nevada	‡ 10
Ohio Cop	‡⅛
Rawley	12¼
Ray Hercules	2¼
Richmond	‡ 50
Rochester Mines	‡ 27
St. Joseph Lead	11
Standard S. L.	37½
Stewart	16
Success	05
Tonopah	‡3¼
Tonopah Ex	2¼
Tribullion	‡¼
Troy Arizona	‡ 10
United Eastern	‡4
United Verde Ext	‡30
United Zinc	‡¼
Utica Mines	‡ 08

TORONTO*	Mar. 4
Adanac	18
Bailey	04
Beaver Con	42
Chambers Ferland	09
Coniagas	2 00
Hargraves	02
Kerr Lake	5 12½
La Rose	31¼
Lake Shore	90
Min. Corp. of Can	2 00
Nipissing	18 75
Peterson Lake	07
Temiskaming	30
Wettlaufer-Lor	03
Davidson	‡ 55
Dome Exten	27
Dome Lake	23
Hollinger	6 12½
McIntyre	1 62½
Newray	12½
Porcu. Crown	78
Teck-Hughes	25
Vipond	25
West Dome	14

* Bid prices. † Closing prices. ‡ Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
Blue Annealed						
No. 10	3 90	5 04	6 50	6 50	5.12	5 44½
No. 12	3 95	5 09	6 55	6 55	5 22	5 49½
No. 14	4 00	5 14	6 60	6.60	5 27	5 54½
Black						
Nos. 18 and 20	4 50	5 84	6 02	7.30	6 02	6 24½
Nos. 22 and 24	4 55	5 89	6 07	7 35	6 07	6 29½
No. 26	4 60	5 94	6.12	7 40	6 12	6 40
No. 28	4 70	6 04	6 12	7 50	6 27	6 45
Galvanized:						
No. 10	5 05	6 39	6 57		6 57	6 69½
No. 12	5.15	6 39	6 67	7 85	6 62	6.79½
No. 14	5.15	6 39	6.67	8 00	6 67	6 79½
Nos. 18 and 20	5 45	6 59	6 97	8 15	6 97	7 09½
Nos. 22 and 24	5 60	6 44	7.12	8 30	7 12	7 24½
No. 26	5.75	6.74	7 27	8 45	7 27	7 39½
No. 28	6 05	6 19	7 57	8 75	7.57	7 69½

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$55.00	$55 00	$65.00	$60–65
Standard openhearth rails	57.00	57 00	67.00	63–65
Light rails, 8 to 10 lb.	3 13½	3 13½*	3.13½	3 13½*
Light rails, 12 to 14 lb.	3.09	3.09*	3.09	3 09*
Light rails, 25 to 45 lb.	3.00	3.00*	3.00	3 00*

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger	$3 70	$3 90	$4 50	$5.04	$6 15
Track bolts	4 90	4 90	5 50	Premium	7 50
Standard section angle bars		3.25	4 45	Premium	5 15

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$2 80	$4 07	$4 19½	$4 14	$4 07	$5 25	$5 50
Channels, 3 to 15 in.	2 80	4 07	4 19½	4 14	4 07	5 25	5 50
Angles, 3 to 6 in. ¼ in. thick	2 80	4 07	4 19½	4 14	4 07	5 25	5.50
Tees, 3 in. and larger	2 80	4 12	4 19½	4 14	4 07	5 25	5.50
Plates	3 00	4 27	4 44½	4 14	4 27	5 50	5 70

STEEL SHEET PILING—The following price is base per 100 lb f. o. b Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4–5	$4–5	$4–5

RIVETS—The following quotations are per 100 lb.

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
STRUCTURAL							
¾-in. and larger	$4 40	$5 67	$7 00	$5 57	$4 74	$6 70	$7 00
CONE HEAD BOILER							
¾ in. and larger	4 50	5 77	7 10	5 67	4 84	8 80	7 10
⅝ and 11/16	3 65	5 92	7 25	5.82	4.99	6 95	7 25
½ and 9/16	5.00	7 10	7 60	6 17	5 24	7 30	7 60

Lengths shorter than 1 in take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+17½%
Galvanized cast steel rigging	2½%
Bright plow steel	30%
Bright cast steel	17½%
Bright iron and iron tiller	List

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$6 25	$7 25	$7 00@7 25	$6.25	$8 00	$7 25
Assorted	6 40	7 75	7.15@7.40	6 40	8 25	7 50

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh

Iron bars	3 5c.	Steel bars	2.90c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0 16½	$0 18	$0 19	$0 18½	0.16½

DRILL STEEL—Warehouse price per pound

	New York	St. Louis	Birmingham	Denver
Solid	16c	14c	15c.	16c.
Hollow	24c.	25c.		28c.

STEEL AND IRON PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Jan. 1 for steel pipe and iron pipe:

Inches	Steel Black Per Cent	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
BUTT WELD					
¾ to 3	54	40½	¾ to 1½	36	20
LAP WELD					
2	47	34½	1¼	21	6
2½ to 6	50	37½	1½	28	14
7 to 12	47	33½	2	29	15
13 and 14	37½		2½ to 6	31	18
15	35		7 to 12	28	15
BUTT WELD, EXTRA STRONG PLAIN ENDS					
¾ to 1½	52	39½	¾ to 1½	36	21
2 to 3	53	40½			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	45	33½	1¼	22	7
2½ to 4	48	36½	1½	28	14
4½ to 6	42	35½	2	30	17
7 to 8	43	29½	2½ to 4	32	20
9 to 12	38	24½	4½ to 6	31	19
			7 to 8	23	11
			9 to 12	18	6

From warehouses at the places named the following discounts held for steel pipe:

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	43%	43%	44 9%
3½ to 6 in. lap welded	38%	39%	40.9%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	27%	26%	29.9%
3½ to 6 in. lap welded	23%	23%	26 9%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 5%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0 80	$1.00	$1 25	$1 40	$0 98	$1.05
Hot pressed hexagon	.80	1 00	1 05	1.20	78	85
Cold punched square	2 50*	1.00	75	.75	1 00	1 50
Cold punched hexagon	2.50*	1 00	.75	75	1.00	1 50

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	40%
Chicago	50%	60%
Cleveland	50–10%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	40–10%	40–10%	40%
Larger and longer up to 1 in. by 30 in.	20–5%	20–5%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York	$2 00	Cleveland	$1 50	Chicago	$1 75

For cast-iron washers the base price per 100 lb. is as follows:

New York	$6 00	Cleveland	$4 25	Chicago	$4 50

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$54.00	$52.00	$55.00	$53.00
Tar pitch (in 400-lb. bbl.)	21 00	18.00	22 00	19 00
Asphalt pitch (in barrels)	36.00	36.00	41.50	41 50
Asphalt felt	67 50	67 50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.35	$1.60	$1.70	$1 95	$2.05	$2 30
No. 2 grade	1 20	1 45	1 50	1 75	1 80	2 05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.10 per roll in carload lots and $2.35 for smaller quantities.

Shingles, red and green slate finish, cost $5 50 per square in carloads, $5.75 in smaller quantities, in Philadelphia

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$ 056	$0 11	$0 162
Cincinnati	086	.165	.218
Seattle	09	175	30
Los Angeles*	079	144	181
New Orleans	16	22	32

* F.o.b. factory, 4, 8 and 10 inch.

LUMBER—Price per M in carload lots:

	8 x 8-In x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	Y. P.	Fir	Hemlock	Spruce	Y. P	Fir
Cincinnati..	$32 00	..	$36 00		$41.00	$40 00
Kansas City..	40 50	41 50	$41.50	$39.50	45 50	43.50
Seattle	17 50	17 50	17.50	17.50	17 50	17.50
New Orleans	48.00	...	...	....	50.00	...
St. Paul		50 00	46.00	46 00		53 00
Denver	44 00	34.50	34 50	..	49.00	39 00
Los Angeles	*	*	*	*	*	*

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and G. 10 In. x 16 Ft.	
	Y.P.	Fir	Hemlock	Y P	Fir
Cincinnati.	$43 00		$39 00	$42 00	$39 00
Kansas City	50 00	$55 75	55.75	53 50	60 00
Seattle	17 50	17 50	17 50	17 50	17 50
New Orleans	54 00	.		60.00	..
St. Paul	50 50	40 00		.. ...	44 50
Denver	45 00	33 50	33 50	38.00	31 00
Los Angeles	39 00	33.00	34 00	*	*

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 50	$4 32	$4 75	$4 32	$5 35
Cut	4 00	6 50	...	6 50	6 75

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags

	Current	One Month Ago	One Year Ago
New York	$3 45	$3 45	$2 25
Jersey City	3 62	3.62	2 16
Boston	3 57	3 67	2 37
Chicago	3 05	3.05	2 21
Pittsburgh	3 15	3.15	2 31
Cleveland	3 32	3.32	2 44
Denver	3.67	3.67	3 20

Note—Bag refund is generally 25c. each; exceptions being, Cincinnati, 9c.; Dallas, 10c.; San Francisco, 15c.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17 50	$14 50	$2.90	$2 65
Chicago	18 00	17 50	1.80*	1.10*
St. Louis	22.00	18 00	.	1 75*
Boston	22 20	18 00	3.75	3.40
Dallas	2 25*	1.25*	.....	.
San Francisco	19 00	16 00	....	2 00†
St. Paul	25 00	19 00	1.97*	1.93*
New Orleans	19.74	16.45	1.97*	1 93*
Cincinnati	14 20	11.95	.....	.
Denver	.....	26.25‡	...	2.50*
Los Angeles	..	......	3.00	2.30†

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton.
Note—Refund of 10c. per barrel.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1 50	$1.39	$1 65	$1.40	$1 66	$1 41
5-gal. cans	1.65	1.49	1 80	1.50	1.88	1.51

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13 00	14.50	11.25	11 50	13 00	12 50
25- and 50-lb. kegs	13 25	14 75	11 50	11 75	13 25	12 75
12½-lb. keg	13 50	15 00	11 75	12 00	13.50	13 00
5-lb. cans	15 00	16 50	13 25	13 00	15 00	14 50
1-lb. cans.	16 00	17 50	13 25	13 50	16 00	14.50

MINING AND MILLING SUPPLIES

HOSE—

Fire

	50-Ft. Lengths
Underwriters' 2½-in	75c. per ft.
Common, 2½-in	30%

Air

	First Grade	Second Grade	Third Grade
½-in per ft	$0 55	$0.40	$0.30

Steam—Discounts from List

First grade	25%	Second grade	35%	Third grade	40%

LEATHER BELTING—Present discounts from list in the following cities are as follows

	Medium Grade	Heavy Grade
New York	40-5%	35%
St Louis	45%	50%
Chicago	45%	40+5%
Birmingham	30%	35%
Denver	35-5%	30%
Cincinnati	40—10%	40%

RAWHIDE LACING—50c. for cut; 45c. per sq.ft. for ordinary.

MANILA ROPE—For rope smaller than ¾-in the price is ¼ to 2c extra; while for quantities amounting to less than 600 ft there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅝-in., 8 ft, ¾-in, 6, ⅞-in, 4½, 1-in, 3½, 1⅛-in, 2 ft 10 in; 1¼-in., 2 ft 4 in. Following is price per pound for ¾-in and larger, in 1200-ft coils

Boston	$0 32	Denver	$0 32
New York	30½	Kansas City	32½
Cincinnati	33	New Orleans	.31½
Chicago	30½	Seattle	24
St. Paul	32	St Louis	21½
San Francisco	29	Atlanta	24

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1 60
Duck and rubber for piston packing	1 00
Flax, regular	1 20
Flax, waterproofed	1 60
Compressed asbestos sheet	1 00
Wire insertion asbestos sheet	1 20
Rubber sheet	60
Rubber sheet, wire insertion	80
Rubber sheet, duck insertion	50
Rubber sheet, cloth insertion	30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1 20
Asbestos wick, ½- and 1-lb. balls	85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120 00 at Chester, Penn.
Chrome cement	net ton	65 00 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40-30 at Clearfield, Penn.
Clay brick, 2nd quality	net ton	38-48 at Clearfield, Penn.
Magnesite, dead burned	net ton	37 50 at Chewalah, Penn.
Magnesite brick, 9 x 4½ x 2½ in	net ton	90 00 at Chester, Penn.
Silica brick	net ton	45-55 at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.
Birmingham—Fire clay, $40-$45; silica, $40-$50; magnesite, $90; chrome, $120.
Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold.

	Material	7 In. x 9 In. by 8 Ft 6 In.	6 In x 8 In by 8 Ft.
Chicago	Plain	1 48	1.33
San Francisco	Douglas Fir—Green	1 35	96
San Francisco	Douglas Fir—Creosoted	2 70	1 92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0 70	No. 1	$0 55
No. 2	80	No. 2	.65
No. 3	90	No. 3	.75
No. 4	.98		
7x9x8 white oak			1 05
7x9x8 red oak, No. 4	.80	No. 5	87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago In Bbl.	Chicago Carloads	Denver In Bbl. Lots
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0.58	$0.71	$0.69	$0 81
Pure destructively distilled pine oil	.58	.68†	.66†	.55-.65
Pine tar oil, sp. gr. 1.02 = 1.035	35	36	.34	.60
Crude turpentine	.45	68	.66	.60-65
*Hardwood creosote, sp. gr. 0.96-0.99	.23		.	.42-.45

* F.o.b. Cadillac, Mich. † Very scarce.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11 00 to 13.00	13 00	16 50	12 00 to 16 50
Colored mixed	8 50 to 12 00	10 00	13 00	11 50 to 14 00

WIPING CLOTHS—Jobbers' price per 1000 is as follows.

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58 00
Chicago	48 00	50 00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York	.	$0 29½	$0 34½		$2 40
Boston	$0 22½	.26½	.31½	$0 35½	2 40
Cincinnati	.18½	22½	26½		2 35
Kansas City	.20½	25½	30½	38½	2 45
New Orleans	.20½	26½	31½	37½	2 60
Seattle	14½	.20½	25½	31½	1 90
Chicago	18½	.22½	30	36	2 35
St. Paul	19	.24½	30½		2 45
St. Louis	19	25½	30½	36½	.
Denver	.17½	.24	.29	35	2 45
Dallas	.25	.31	36	.42	.

CHEMICALS

SODIUM CYANIDE—New York price is 30c per lb; Denver, 42c.; Chicago, 31½c.; St Louis, 31c

SODIUM SULPHIDE—In New York the price per pound is 4½c. for concentrated, 2½c for crystals. The St Louis price is 6c. for concentrated, 5½c. for fused, 3½c. for crystals. The Chicago price is 6c for concentrated, 3½c. for crystals. Concentrated comes in 500-lb drums, the crystals in 440-lb bbl.

ZINC DUST—For 350 mesh the New York price is 14c per lb., Chicago, 13c.; Denver, 13½c f.o.b. Pueblo; St. Louis, 12½c., less than car lots 13c.

ALUMINUM DUST—Chicago price is $1.30 per lb.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	'Cameo 100-Lb Drums Per Ton	Union 25-Lb Drum Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101 00	$1 52
Southeastern portion U. S. A	115 50	110 50	1 63
Texas (except El Paso)	124 00	119 00	1 74
El Paso, Texas	126 00	121 00	1 77
Denver, Colo	124 00	119 00	1 74
West Coast	129 00	124 00	1 81

Engineering and Mining Journal

March 15, 1919

Volume 107 *Number* 11

THE TOWN OF JOHANNESBURG

In the distance may be seen the residue dumps from the string of mines that stretch, in an unbroken chain, for 60 miles, from Randfontein to Springs.

Rand Gold Mining

BY "SOUTH AFRICAN"

Notes on the development of the great Witwatersrand gold-mining area, with reminiscences of earlier times. The native labor question is briefly reviewed and the important influence of the black population outlined. Statistics are included to show the progress of the industry, and the results of the new system of leasing by the government, which has proved highly successful.

THE most important group of gold mines in South Africa is situated in the eastern Transvaal, on a ridge known as the Witwatersrand. This lies at an altitude of 6000 ft., and is a watershed—all rivers and streams to the south finding their way to the Atlantic, and those to the north running into the Indian Ocean. The ore-carrying body is a tilted wall of conglomerate extending from east to west in an almost uninterrupted stretch of 60 miles. Midway along this line is the town of Johannesburg, with a white population of 138,000. The West Rand, though comprising many rich producers, has proved, in late years, somewhat patchy and broken, and poor dividends have accrued from the furthermost properties. So far, the East Rand has played the most important part in the history of the gold fields, and recent development has proved not only the continuity of the reef to great distances, but that the richest ore is to be found there.

The Witwatersrand gold reef slopes to the south at an angle of from 30 to 40° in the central portion of the Rand, but this incline diminishes as one goes east and west, and the trend of the line is abruptly curved to the south at each extremity. Up to the time of the Boer War, little was known respecting the workable depth of the reef; but in 1903 the permanence as well as the consistency of the orebody was definitely established, and this resulted in what was known as the "deep-level" boom. Some of the mines are now operating at from 5000 to 6000 ft. in depth. Over $2,500,000,000 worth of gold has so far been extracted from this marvelous belt of gold reef, and still more remarkable is the fact that the average recovery has been about $6 per ton. But this colossal achievement has been possible largely on account of the presence of unlimited coal deposits, adjacent to the gold mines, and to the supply of black labor which the country affords.

THE NATIVE PROBLEM

The total white population of the Union of South Africa is 1,250 000, of which the Transvaal contains 500,000. The natives number 5,000,000 (according to the 1918 census); and on the mines of the Transvaal 200,000 natives and 21,000 whites are employed. It is this great preponderance of native labor that, though insuring success for the mining industry, has materially retarded the progress of the country on "white" lines. In Australia the aboriginal population gradually died out; but in South Africa the government is faced with a very difficult problem, when the overwhelming number of "blacks" in the subcontinent is considered—the increase alone having been 1,000,000 from 1904 to 1918. Plainly, such an evil as this cannot be obviated; the blacks are there and must remain.

To use a sporting phrase, the kafir has been the "pacemaker" in this country. Nothing in the way of hard work is done by whites, either in the mines, agricultural districts, factories, or homes. No white man is expected to perform menial labor; the actual mining operations are entirely done by kafirs, and white men merely act as supervisors and contractors. The local miners' union is powerful, and clearly defines the relationship between the races, dictating what the native shall and shall not do. Although there are now many thousands of "boys" (as the natives are designated) thoroughly experienced in mining work, they are not permitted to rise into the higher grades of labor. In fact, at the time of writing, the union has just demanded that, within a month from date, all natives being employed as drill sharpeners must be taken off this job, and further rearrangements along similar lines may be expected.

RAND MINES ARE LOW GRADE

The richest Rand mines are 8-dwt. propositions. Only one or two exceed this, and the great majority run from 5 to 6 dwt. Before the war ore of 4½ dwt. was mined profitably, but the enormous increase in the cost of stores and labor has relegated such material to reserves labeled "unpayable under present conditions."

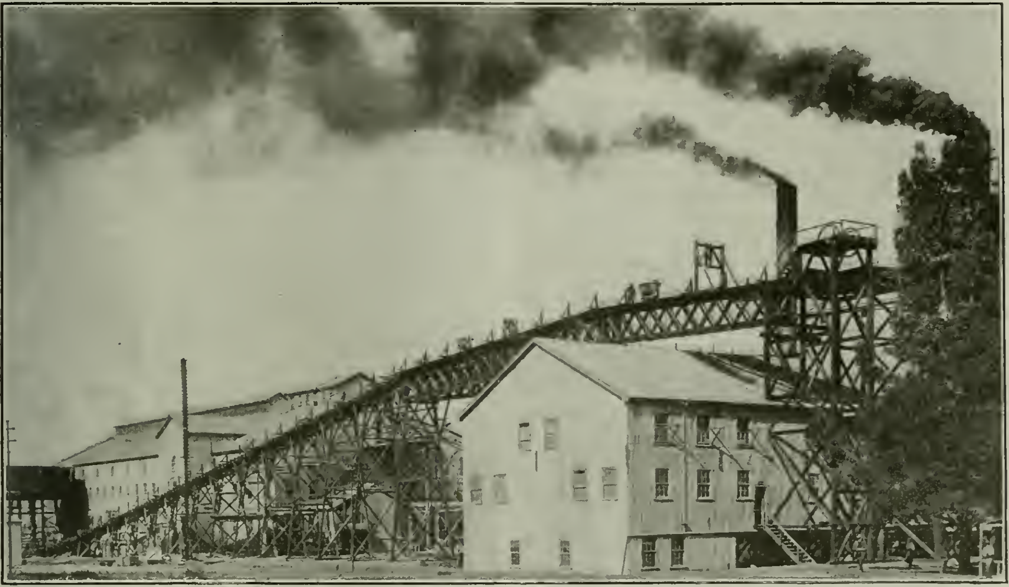
RESIDUE DUMP, SLIME DAM, AND TREATMENT VATS, IN FOREGROUND, OF A RAND PLANT

In 1886, the outcrop of the reef was being mined by open cuts, and only the richer portions of the ore were treated. This wasteful and unscientific method was speedily discontinued, however, and systematic mining began. The properties owned in those days by individual companies were comparatively small—a hundred claims or so—and the mills consisted of from 10 to 50 stamps of light weight, with no treatment of tailings. Compared with these, the mines of today are huge concerns in all respects. Some of them are larger than a score of the older concerns put together. The vast bodies of low-grade ores can only be rendered payable by working on a great scale, and by the treatment of enormous tonnage. The mills range from 100 to 600 stamps which are of the heaviest practicable type. Tube mills for further reduction are extensively employed, and the cyanide process is used for the treatment of the tailings resulting from a thorough treatment by amalgamation. The system of mining and mechanical haulage may be considered as up to date as in any other mining center in the world, for not only are all the best devices that are in operation elsewhere utilized, but special adaptations have been made as the result of 30 years' experience.

STATISTICS TYPICAL OF RAND OPERATION

One of the largest of the mines is the Randfontein Central. It employs about 20,000 natives and 2500 white men. About 151,000 tons of ore per month is put through the mill, from which is obtained an approximate output of 40,000 oz. of fine gold per month. This mine is situated on the Far Western Rand. Another great producer is the Government Gold Mining Areas, Ltd., so called because the Johannesburg Consolidated Investment Corporation leased the ground from the government, and now pays a percentage of the profits, on a sliding scale. This mine lies in the zone just coming into prominence, called the Far Eastern Rand, and is one of the richest concerns in that favored region. A recent normal month's output was valued at £179,046, from 106,000 tons treated. The working costs were £144,244, or 19s 6d per ton milled, and the profit was £75,356. This mine was the first instance of the government offering a large block of mining claims for public tender, as against the old system of "pegging off" claims.

The new leasing system has proved such a highly profitable experiment that other blocks have been similarly disposed of, and one of these has been successfully tendered for by the Anglo-American Corporation. This company was floated about a year ago for the purpose of acquiring mining and other industrial interests in South Africa. The capital is £1,000,000, with power of increase to double this amount, and the board of directors consists of Ernest Oppenheimer, W. L. Honnold (New York), the Hon. Hugh Crawford, the Hon. H. C. Hull, W. B. Thompson (New York), and C. H. Sabin (New York). This company's first venture into the realms of South African mining is the acquisition of one of the government leases, situated west of the Springs Mines, Ltd., which has just been organized into a company called West Springs, Ltd., with a capital of £1,400,000. Of this amount, underwritten by the A.-A. Corporation at par, 200,000 shares were offered for subscription, and four other Johannesburg corporations have been granted a participation in the united capital subscribed. From the inception of the company to the producing stage a long period, extending to six or seven years, must elapse, as the development of a deep-level mine is a big undertaking.



PART OF SURFACE PLANT OF THE VILLAGE DEEP MINE

Proving Negligence of Employer

BY A. L. H. STREET*

Applying the general principle of law that an employee suing for damages for personal injury has the burden of establishing not only his injury but some specific act of negligence imputable to the employer and directly bringing about the injury, the U. S. Circuit Court of Appeals, Ninth Circuit, holds in the recent case of Suborich *vs.* Alaska United Gold Mining Co. (*251 Federal Reporter, 885*), that plaintiff failed to make out a cause of action by showing that, while he was employed in defendant's mine, his eye was injured by small bits of rock which flew from a rock which a co-employee was breaking with a hammer. In the absence of proof that the co-employee was careless in the manner in which he did his work, or that breaking of rock at the particular place was improper or unusual, it could not be presumed that there was negligence for which the employer should respond.

---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Uses and Limitations of Respirators, Gas Masks And Oxygen Apparatus

IN 1918 the Bureau of Mines, Department of the Interior, received many inquiries, for protection of Army gas masks in the industries, for protection of workers against poisonous and irritating gases. These inquiries show a general belief on the part of the public that this type of mask will protect the wearer, under all conditions, against any gas whatsoever, even in absolutely irrespirable air, to the exclusion of the more cumbersome mine-rescue breathing apparatus. This erroneous belief will no doubt be further confirmed by millions of discharged soldiers who have been trained in the use of the gas mask and have been taught that it gives them absolute protection against all gases used or likely to be used in warfare.

The promoters of such inquiries do not realize that the percentage of gas in the air of the battlefield can never be as high as that occurring in the confined spaces of a factory operation. A mask may afford complete protection under outdoor conditions, and break down at once when used indoors where a gas container has burst and filled the room with a greater concentration of gas. It must also be remembered that the absorbents in the Army respirator, which filter out the poisonous gas, are specially designed for the gases used in warfare, and as a matter of fact do not protect against the more common industrial gases such as illuminating, natural, producer, and blast-furnace gas. The Army gas mask never should be used in mines, because of the uncertainty as to the kinds and amounts of gases that may exist in the atmosphere and the possibility of the presence of an insufficient supply of oxygen to support life. In view of these limitations of the Army gas mask, which, if not realized, will lead to serious accidents and fatalities, the Bureau of Mines has issued the following brief statement concerning the industrial use and limitations of the several dust respirators, gas masks, and oxygen breathing apparatus:

Dust Respirators

Protection from dust and liquid mists is obtained by the use of a simple dust respirator, which removes these particles by means of a filter of moist sponge, cotton, or wool pad, porous paper or even a fine-mesh metallic gauze. The respirator may enclose the mouth and nose only, or it may be combined with a face mask containing eyepieces if the eye must be protected. The simple "pig-snout" respirator containing a moist sponge has been on the market for years. It is highly uncomfortable to wear and rather inefficient for removing fine dust, and most workmen prefer to tie a large handkerchief over the nose and mouth. Some improvement has been made in recent years, but, on the whole, a really efficient and comfortable dust respirator that workmen will wear continuously is yet to be devised. The urgent need of such a device for safeguarding the health of workmen in the mining and metallurgical industries has resulted in a study of dust respirators by the Bureau of Mines, in an effort to find as satisfactory a model as possible for use in these industries.

The Army gas mask consists of a facepiece of rubber and cloth fabric, containing eyepieces, and connected by means of a flexible rubber tube to a canister which contains charcoal and soda-lime for filtering out the poisonous gas from the inhaled air. The canister is supported in a knapsack slung from the neck. The device is by no means the unusual protective appliance that it is popularly believed. It does not afford universal protection against all gases, nor can it ever be safely used in low-oxygen atmospheres. It furnishes no oxygen to the wearer, and can remove only a small percentage of poisonous gas from inhaled air, usually less than 1 or 2%. Higher percentages will immediately penetrate the canister and "gas" the wearer. The standard Army gas mask will furnish protection against percentages not exceeding 2% of the following gases in air: Sulphur dioxide, hydrogen sulphide, chlorine, carbon bisulphide, nitrogen peroxide, aniline vapor, benzyl bromide, benzyl chloride, chloracetone, chlorpicrin, hydrogen chloride, phosgene, sulphur chlorides, xylyl bromide, stannic chloride, titanium tetrachloride, and silicon tetrachloride.

It will be noted, from the list of gases from which the Army mask affords protection, that the field of usefulness of that mask is confined to certain of the chemical industries, around smelteries and roasting plants where sulphur fumes are given off, and in the industries using chlorine and bleaching powder. The Army canister also contains cotton filter pads that remove irritating and poisonous dusts, which increases its usefulness around smelting plants where sulphur and arsenic fumes must be removed.

The Army mask furnishes no protection whatever against carbon monoxide, which is the poisonous constituent of blast-furnace, producer, and illuminating gases, and of mine gases after fires and explosions in coal mines. Carbon monoxide is also likely to be present in ordinary fire-fighting conditions met by fire departments. Moreover, in all of these cases there is likely to be a deficiency of oxygen. Therefore, for adequate protection against these conditions, the oxygen breathing apparatus must be used, and reliance on the Army mask may be fatal. The Bureau of Mines is experimenting with a carbon-monoxide mask in the hope of developing one that may be used in the future for low concentrations of this gas, but such a mask is not now available. Another gas that will penetrate the standard Army canister is ammonia. However, a special chemical may be placed in the canister which will adapt it for use around refrigerating plants.

Oxygen Breathing Apparatus

The self-contained oxygen breathing apparatus cannot be displaced by the gas mask for use in atmospheres deficient in oxygen. Such atmospheres are encountered in mine-rescue work, in gas mains, blast-furnace stoves, and in gasoline tanks. Aside from the lack of oxygen, carbon monoxide is also present, for protection against which the Army mask is useless.

The oxygen breathing apparatus must also be used instead of the Army gas mask wherever there are large quantities of irrespirable or poisonous gases, as, for example, in entering a gasoline tank containing some residual liquid, or similar tanks, towers, and other closed spaces. The concentration of vapors produced by volatile liquids in closed containers is too high to be entirely removed by gas-mask absorbents. The only recourse in such cases is a self-contained appliance in which the wearer does not breathe any of the irrespirable atmosphere.

Importance of Expert Advice on Protective Breathing Appliances

Owing to the many factors that enter into the use of protective respiratory appliances, the importance of competent advice on the selection and use of such devices cannot be overestimated. The information that the Army and Navy used gas masks has been widely disseminated, and the significance of the fact is likely to be misunderstood, especially by men who have had some training in their use. It also should be made known that both the Army and Navy used the oxygen breathing apparatus in its appropriate place.

In connection with the work of the Bureau of Mines in safeguarding the health of miners and workmen in the metallurgical industries, a general investigation of respirators, gas masks, and breathing appliances is being undertaken at the Pittsburgh Experiment Station. This research will be conducted by experienced chemists and engineers who were in charge of gas-mask research in the Bureau's war-gas investigations and subsequently in the Research Division of the Chemical Warfare Service, U. S. Army.

The industrial-respirator investigation will include advice on the suitability of the standard Army gas mask for use under conditions in which various industrial gases are present; approval of industrial gas masks and respirators when properly submitted to the Bureau by the manufacturer in accordance with a schedule to be announced later, and instruction of workmen at plants in the use of masks and respirators in a manner similar to that now being given by the Bureau in the use of oxygen breathing apparatus.

German Potash Deposits

By H. H. Taft*

The German potash industry was developed at Stassfurt, near Magdeburg, in Prussian Saxony. The town was known for its salt for over a thousand years, but the quality was inferior, which was probably the reason for the further exploitation of the deposits. In 1843 a well was drilled to a depth of 820 ft.; later 1080 ft. more were drilled, and in 1851 the Prussian government began the sinking of two vertical shafts, which in five years reached a depth of 1068 ft. These shafts, of course, made possible a thorough study of the various strata. Later this formation (the red beds or the Jura-Triassic-Permian) was found to underlay nearly the whole of the North German plain.

The potash industry was initiated by Dr. A. Frank, beginning in 1860, and it developed rapidly after the simple geology was determined. The cost is about a dollar a ton to place the crude salts upon the surface and from $10 to $15 per ton to make a marketable product. About 1900 the potash boom began. The business was profitable, it was easy to find new deposits, and the field was so great that the investment soon became over $150,000,000. In 1904 a selling syndicate was formed, which lasted five years, but new mines were so easily found and American buyers were so constantly contracting with the operators at a lower rate that conditions brought about the so-called "potash war" of 1909-1910. The situation became so bad that the Prussian government decided to establish a monopoly and prorate the output among the various operators.

At Stassfurt the beds dip steeply; the overburden is red sandstone, blue and red clay and marl, and the various beds are interstratified with marl, blue and red clay, gypsum and anhyrite. They are generally classified as follows: Bischofite (magnesium chloride) zone, 13 ft.; carnallite (potassium-magnesium chloride), 98 ft.; kieserite (magnesium sulphate), 51 ft.; polyhalite (calcium-magnesium-potassium-sulphate) 13 ft.; anhydrite (calcium sulphate) 36 ft., and rock salt, 989 ft. Geologists have discussed at length the sequence of these salts and their probable origin and the evaporation of an inland sea. The pertinent fact is that the potash salts are near the top, associated with magnesia, and there is a large amount of gypsum and common salt laying beneath.

A similar geological formation is extensively disclosed in the Western part of the United States. It gives the wonderful color to the Grand Canyon of the Colorado, and extends west to California and east across Arizona, New Mexico, and on into Kansas and Nebraska. There are few Western states that have not some areas of it. Common salt, gypsum, and other salts are known to exist in it in large quantities. The extent of the potash constituent only is not known, and there has been almost no search for that element. There are many alkali beds and lakes that result from the leaching of the soluble salts in this formation. A few of them have been studied. The lakes of northwestern Nebraska and probably Searles Lake, in California, are of this nature.

[The lack of potash salts in similar formations (the red beds) in the United States, has been the subject of considerable study and controversy. The preponderance of other salts to potash salts in leaching waters, and the resistance of potassium silicates toward solution, make conditions difficult for the deposition of potash. The Stassfurt beds represent a confined area, subjected to a long period of leaching, deposition, and crystallization of potash salts. The absence of an overlying, impervious stratum of gypsum and clay, such as characterizes the Stassfurt deposits, is another condition wherein American deposits differ.—Editor.]

---

*Box 432, El Paso, Texas.

Labor Conditions in British Malaya, according to a consular report, are such that mining work is practically confined to Chinese and Indians, the latter, however, forming a small proportion of the total number employed. The rates of wages are partly dependent on the price of tin and are influenced by the general demand for and the rates of wages paid to Chinese labor on estates. Considered broadly, a fair average rate of wages for mining coolies may be taken to be from 34c. to 57c. a day, with food in addition. The cost of food may be estimated at 14c. a day.

Reëducation Versus Compensation For Crippled Men

BY DOUGLAS C. McMURTRIE*

The problem of how best to serve the interests of war-crippled men themselves and of the community in general is less in evidence in the United States than in many other countries where the "Journal" circulates. In all lands, however, the industrial-cripple problem is present; and mining and metallurgy add their yearly quota to the list of maimed and deformed. The writer of this paper makes a strong plea for the reëducation and rehabilitation of crippled men, whenever possible, as an alternative to the payment of compensation; and cites instances to show that the problem should be approached more with a desire to benefit the worker, the industry, and the community, than with the idea of evading all responsibility by periodic money payments, which, in the majority of cases, do more harm than good.

IN THE past, the usual method of dealing with men permanently disabled in the course of employment has been to pay the worker a pension in the form of compensation, and then forget him and his injury. But the cost of such disability to the mining industry cannot be covered by the premiums paid for casualty insurance. The cost in training and adapting the skilled worker who does not return to his job must be considered, and a newcomer must take his place, for whom additional expense must be incurred.

There are three means of reducing the cost of disability: accident prevention, medical attention to minimize the results of the injury, and salvage of the remaining abilities of the worker through rehabilitation for self-support. The first of these has already received wide attention from employers, and has wisely been encouraged in a financial way by casualty-insurance companies and state funds. The importance of the latter two has, however, not as yet been appreciated. Their energetic application would effect a tremendous saving to industry.

SKILLED MEDICAL ATTENTION CHEAPEST IN THE END

Many injuries from which men would completely recover in a short time under adequate and high-grade medical attention are treated for an insufficient time, or by incompetent physicians; and, instead of a prompt return to work, the case at best drags along over an extended period, and, at worst, becomes chronic or develops into permanent disability. Some states require the insurance carrier to provide but two weeks of compulsory free medical attention to the injured man. For the insurance company to take advantage of this limitation is the most short-sighted policy possible, because for every dollar saved in physicians' or hospital fees, the insurance carrier pays out later $10 in compensation. And what the insurance company pays is actually paid by the insuring employers in their regular premiums.

Unlimited medical attention of the highest grade should be an axiom of casualty practice. It should be insisted upon by employer and workman alike. The most desirable outcome of any injury is to have the employee return to his job as a sound man in the shortest possible time. It is well to develop a science of dealing with cripples, but the ideal is to have fewer and fewer cripples with which to deal.

The third method of attack on the cost of disability is rehabilitation for self-support—the reëducation of an injured man for an occupation which he can follow, in spite of his handicap. The science of rehabilitation is new, and experience in it has practically all been gained in the effort to make sound and just provision for the disabled soldier or sailor. Every country among the recent belligerents is today operating a comprehensive system of reëducation for disabled soldiers and seamen, and is placing upon that system more dependence than upon the pension system.

COMPENSATION PAYMENTS ENCOURAGE IDLENESS

Paying a man a small monthly or weekly stipend on which he is expected to live in idleness is not a constructive remedy. With the breakdown of confidence in the pension system, it was realized that the only real compensation for disablement was restoration of capacity for self-support. It was further realized that few avocations require all the physical faculties, and that, in the present-day variety of industrial processes, it is possible to find a job in which a man with a given type of disability can function with 100% efficiency. Some tasks are performed when standing, some when seated; others require walking about; some labor at a bench working on small articles requires but little strength; other kinds of work involve great physical exertion. Still other industrial processes do not require the sense of hearing; in others the sense of sight is not essential. Finding work for disabled men, therefore, requires expert and painstaking choice; but a successful selection is possible even for the seriously handicapped worker. The first aim is to place the man back in a different job in his own trade or in a trade closely related to it. In such a place his experience will stand him in good stead. Failing this, he can be retrained for a different line.

The process of re-training the disabled is known as reëducation, and can best be provided in a special school for crippled men. The first school of this kind in the United States is the Red Cross Institute for Crippled and Disabled Men, established in New York City through the generosity of Jeremiah Milbank. At this school, open to disabled civilians and soldiers alike, six trades are already being taught: artificial-limb making, motion-picture operating, oxy-acetlyene welding, print-

---

*Director, Red Cross Institute for Crippled and Disabled Men, [illegible]d St. and Fourth Ave., New York

ing, jewelry work, and mechanical drafting. More will be added as the demand develops. Graduates are already giving satisfaction in the positions to which they have been assigned, so the enterprise has passed the experimental stage. In the work achieved by disabled soldiers abroad there is overwhelming evidence of the logic and practicability of rehabilitation.

Reëducation Problems Apply Alike to War and Industrial Cripples

The cost of soldier rehabilitation in their respective countries is being met by the United States Government and by the governments of some of America's allies. The advantages of reëducation should be made available to disabled civilians as well, and the expense should not be prohibitive, as rehabilitation effects a reduction rather than an increase in the cost of disability to industry or to the community as a whole.

A typical case will illustrate how the saving is effected: A worker in Massachusetts was injured by a fall while working inside a submarine, and his hand became permanently crippled. In due course his compensation rate was determined, and he was referred to the insurance carrier to be paid $10 a week for a long period, with a maximum total payment of $4000. The disability was manifestly permanent, so the insurance company wrote the case off its books as a $4000 loss, and transferred that amount to reserve to cover the weekly payments. After the compensation had been paid for nearly a year, a new official of the insurance company began looking over the list of men to whom the company was paying compensation. His attention was directed to the man in question, and the latter was requested to call at the office of the company. The case was like many thousands of others—susceptible of rehabilitation for self-support; so the insurance company official put a proposition to the man in frank terms, saying, "I believe that you can be trained to earn a good living. I want you to understand very clearly, however, that this proposal is to the financial advantage of the company, but I also believe it is to your advantage as well. A total income of $10 a week is not very attractive to you, and you would probably rather return to work at a good wage than remain idle. If you will consent, the company will send you to a school of reeducation and see if we cannot get you back on your feet in good shape."

Actual Results Prove Value of Reëducation

The injured man consented to the proposal, and the company sent him to the Red Cross Institute in New York. It began to pay, not $10 a week as required by law, but $40, $20 to him in New York and $20 to his wife at home. The company also paid liberally his traveling expenses in both directions. In the period of eight weeks he was reëducated in oxy-acetylene cutting and welding, and returned home. He is now making not only a satisfactory wage, but twice as much as he had ever earned before the accident took place.

In the whole transaction every party was benefited. The man was helped in that his general living standard was raised, and the necessity of working for his living could not be considered a hardship. The company paid less than $500 for his rehabilitation; and this expense, in conjunction with the $500 already paid in weekly compensation during the first year of idleness, made a total expense for the case of $1000. The company was thus enabled to charge $3000 of profit to the account of profit and loss. The community was infinitely the gainer, because the man, formerly an unproductive consumer, became a useful producer instead. The community further gained in the elimination of the disabled man from the category of a prospective dependent, because, although compensation might have taken care of him in an insufficient way during the period of idleness, a time would have come when compensation ceased, and then he would have been in desperate straits—confirmed in habits of idleness, untrained for skilled work, and without any source of support.

Insurance Carriers Should Be Encouraged To Favor Rehabilitation Schemes

A more intelligent handling of disability by insurance carriers will, therefore, reduce their expense, and will thus cut the cost of casualty protection to the employer. Some revision of compensation laws is also needed, however, so that there may be definite encouragement to insurance carriers to offer opportunity of rehabilitation, and definite encouragement to the disabled men to take advantage of it. Practically every compensation case that has ever come to the Red Cross Institute has come on the day the compensation expired. For one year, for two years, or for four years the man has existed in idleness, drawing compensation and cultivating habits of indolence. When his support was cut off, he then became interested in rehabilitation. Present compensation legislation tends to encourage the man to remain idle, because his payments are reduced by any improvement in earning capacity. A revision of this practice will make for more constructive provision.

In short, the first effort should be to prevent injury, the second to minimize its permanent effects, the third —when disability has ensued—to offset its economic consequences. The execution of this complete program is not only sound humanitarian practice—it is good business as well.

Converting Chinese White Iron Into Foundry Pig Iron

Shortage of pig iron in the Far East has been due to lack of exportations of that commodity from the United States, and the supply from China and Japan is not sufficient to meet the demand. This has resulted in an advance of price from $38.70 to $219.30 per ton, according to C. T. Huang, in *Iron Age*.

The conversion of native white iron into foundry pig is under consideration, and experiments along these lines have been made by the Hanyang Iron and Steel Works. The process involves metallurgical conversion, in which the combined carbon is changed into graphitic form, the sulphur is removed to a permissible limit, and silicon is introduced up to 2%. The hearth heat in the blast furnace is sufficient only for its own work; therefore it is necessary either to lighten the burden or to increase the coke consumption for the smelting of the native white iron. The amount of heat is equivalent to one ton of coke to four tons of iron.

After various attémpts, it was found that three furnaces of the Hanyang Co. could take up only 40 tons of native iron, equivalent to 10% of the daily output, without interfering with the normal working of the furnaces. This is governed by the relation of iron to the slag volume. It is through the medium of slag that the sulphur is partly, if not completely, eliminated, silicon introduced and carbon changed into the graphitic form. It may be possible for the furnace to smelt a higher tonnage than 10% of its own capacity by adding slag and coke to the sides, but it must not be forgotten that the slag and coke occupy space, sacrificing furnace capacity.

Another point which puts a limit upon the smelting of the native white iron up to more than 10% of the furnace capacity is uniformity in the distribution, and descent of the stock is of prime importance in the smooth operation of blast furnaces. It is noted that scrap iron, charged together with ore, limestone, and coke into the furnace, descends much faster, causing a chilled hearth and the production of off-grade iron. This is because of the higher specific gravity of iron compared with other constituents of the charge, and the action of differential sinking and separation resembles closely that of a pneumatic jig used in ore dressing.

This jigging action was observed and proved to have taken place in the blowing out of one of the furnaces, as 80 tons of limestone had been charged, and on raking the material out it was found that the limestone came down to the hearth quicker, leaving a large layer of coke on the top, showing clearly a distinct and separate layer of coke and limestone. This tends to support the theory that one cannot charge too much white iron into the furnace at a time, because of the difference in specific gravity, tending to produce a chilled hearth.

Recently more scrap pig than the amount permitted was added to one of the furnaces and at the same time the burden was lightened. The result was the chilling of the hearth and the production of bad iron, which required remelting and conversion in the furnace again. To raise the hearth heat, the furnace with a light burden must be run with a decreased supply of blast, which imparts a higher heat to the slag, giving rise to hanging and other consequent irregularities. Therefore it is rather risky to smelt more than 10% of the furnace capacity.

There is another important point. The displacement of ore charge by the native white iron decreases the furnace capacity for smelting ore the iron content of which is about 60%. For every 250 kg. of white iron entering into the furnace per charge, it was necessary to lighten the ore burden by 100 kg., equivalent to 60 kg. iron. The average number of charges in three furnaces per day is 160, which means that the capacity of the furnaces for smelting ore is reduced by 9.6 metric tons of iron, as against 40 metric tons of white iron smelted in place of the ore.

German Destruction in Belgium*

What a contrast there is between the present aspect of the plant of the Société John Cockerill and that which it presented to the wondering eye of the visitor before the war! Of these great and splendid installations, patiently built up since 1817 and always kept at high-water mark as far as equipment and up-to-date devices were concerned, which sent out all over the world the greatest variety of products, there is nothing left; for the Germans have accomplished a systematic work of destruction unequaled in history. The little that they spared—the general offices, the technical and mechanical offices of adjustments and modeling—was destroyed by fire in 1917.

The destructive action of the Germans extended to all parts of the plant. Everywhere one is faced with devastation and ruin, with here and there a piece of machinery that the despoilers were unable to take away. Nothing remains of what was formerly the workshop for assembling small and delicate pieces of artillery. Everything was requisitioned. All the machine tools went to Germany, unless they were sent to rival plants, then working for the enemy, or were concealed in a place of hiding for future use. The machines themselves have been taken away, or reduced to old iron. The turning bridges, transmission apparatus, and belts have disappeared. There is no longer any trace of the stock of small tools, which were taken by German civilians.

The locomotive workshop is absolutely empty. The same can be said of the storeroom where the spare parts for the different workshops were kept. Everything has been reduced to scrap. Nothing remains of the lever apparatus, nor of the steam cranes, nor of the screw-bolt workshop. More than 1000 machines were stolen, or broken, in the workshop division.

With the exception of one great press, one small special press, and a hammer, everything has disappeared from the large forge and welding section. The turning bridge no longer exists; the ovens, the works, and the metal parts are destroyed. Almost all the pressure pumps were taken out of the machine shop; the accumulators are useless.

Everything has disappeared from the rough-cleaning workshop and from the new forge workshop, which was built since the beginning of the war and was ready to start operations. The same situation exists in the electric power plant, which is reduced to chaos. A gas motor and dynamo of 10,000 hp., weighing about 800,000 kilos, was dismantled and taken into Germany.

It was perhaps in the destruction of the metallurgical division of the blast furnaces and steel works that the enemy exhibited the greatest vindictiveness. Of the seven blast furnaces, only two are left, and even they have been cut off from the blowers, so that important repairs to the pipe will have to be made before they can be worked. Of the six gas blowers, three were taken away, as were the three steam blowers. Three of the four Martin ovens remain, but the refractory products, without which they are useless, are stolen. Four of the five Thomas converters were destroyed.

It is evident that the Germans attacked everything—they spared nothing. And it is in this way that they reduced one of their most dangerous rivals to helplessness for a period of time which it is impossible to determine.

The Mineral Resources of Yunnan Province, in China, include coal, copper, silver, gold, zinc, iron, tin, antimony, bismuth, quicksilver, nickel, sulphur, platinum, tungsten and salt, according to "Commerce Reports" of Jan. 27. It is claimed that Yunnan is China's richest province in minerals.

---

*Translated from the *Texte de l'Echo des Mines et de la Metallurgie*, Jan. 12 1919.

Early Indian Raids on Mexico

By J. B. Tyrrell*

Evidences of the productiveness of early silver mines in Mexico are not lacking, and in the following accounts, chronicled by David Thompson, the geographer and fur trader, reference is made to the transportation of that metal by the Spaniards. Apparently the Indians, who made the raids ostensibly for the purpose of securing horses and mules, cared but little for the silver.

IN DAVID THOMPSON'S journal, written in the early part of the last century, are two accounts of horse-stealing expeditions by Indians conducted from the plains of the Saskatchewan down to the silver mines of Mexico. One of these accounts has been published in "David Thompson's Narrative of His Explorations in Western America," issued by the Champlain Society; the other has not appeared in print.

Thompson was a fur trader and geographer who lived in western Canada and the northwestern states from 1784 to 1812. After leaving the West, and while living in eastern Canada, he was the astronomer and geographer who surveyed the boundary line between the United States and Canada from St. Regis, through the Great Lakes to the northwest angle of the Lake of the Woods. During his life he kept a copious journal of occurrences, most of which is still extant, and in his later years he summarized this journal for publication, but it was not until 1916 that this summary was published by the Champlain Society in an octavo volume of 582 pages, accompanied by a copy of the large "Map of the North West Territory of the Province of Canada," drawn in 1813 and 1814.

In 1787, when but a youth, Thompson lived in a camp of the Piegan Indians on the plains of Alberta south of the Saskatchewan River, and in several subsequent years he was in charge of fur-trading posts in the same region. At that time the war chief of these Indians was a redman named Kootenae-Appe, whom Thompson describes as follows:

"Early in life Kootenae-Appe became the war chief. He had all the qualities for this station. I was well acquainted with him. He was a man of mild manners, and, for an Indian, polite and affable, beloved in his family. He was a dauntless warrior, who was always successful in battle. He has told me that to fight with men was honorable, but the murder of women and children he detested as beneath the warrior. His stature was 6 ft. 6 in. Tall and erect, he appeared to be of bone and sinew, with no more flesh than absolutely required. His word was sacred; he was both loved and respected: and his people often wished him to take a more active part in their affairs, but he confined himself to war. He praised every chief that in the least deserved it, but never appeared to regard fame as worth his notice."

The two expeditions referred to were undertaken by the Piegan Indians under this war chief Kootenae-Appe. The raiders appear to have traveled south as far as the silver mines of Mexico, to have captured pack trains of horses and mules loaded with silver, and to have returned safely to their own land on the plains of the Saskatchewan. Thompson's accounts are derived from personal knowledge, as he was present in the first case, at least when the party returned, and, in the second instance, certainly when it departed and probably also when it returned.

The first account is as follows:

"I have remarked the Peagan Indians have something chivalrous in their character; their war parties make war at a great distance beyond what we could believe. In the year 1787 when a war party returned they related they had made ready to attack the Spaniards, who had a long file of Horses and Mules heavy loaded. As soon as the Spaniards perceived them, they threw the Loads off the Horses and Mules, each man sprang on his Horse and rode off, leaving all the others to the Indians. The Horses were of a good breed, more made for activity than strength; the Mules were very fine animals, of a strong make and in good condition for the distance they had been ridden and driven; the saddles were only on some; they were heavy and awkward, but the leather very good; the bits were uncommonly heavy and rough made. I was then in Peagan camp and I inquired after the loads. They said the bags were full of white stone (silver) and by its description it must have been ingots of silver; they said the country was open, so that the Spaniards could see them at some distance; they never stood a charge, but always fled. They do not make annual incursions on the Spaniards, but only after a lapse of several years. They once attempted an annual incursion, but at the usual season found neither Spaniards, Horses, nor Mules, and had to return with their own weary Horses. The last incursion I am acquainted with was in the year 1805. When they informed me of their intention, a strong hearty Indian offered to bring me an ingot of white stone (silver). I told him if he did I would give him a good Horse and a scarlet Coat, and Beads to his wife. They found the Spaniards in the usual route, and attacked, but were not so fortunate as usual. The Spaniards had time to throw off the loads and drive away part of the Horses and Mules. My Indian tried to keep his word. He took an Ingot of Silver and carried it for two days, which made his arm so tired that he left it. Should it ever be found it may become a curious question how it came there. Both the expeditions were conducted by Kootenae-Appe, the principal war chief, with about three hundred warriors each time."

Here is the second account:

"In the year 1807, in the early part of September, a party of about two hundred and fifty Warriors under the command of Kootenae-Appe went off to war on the Snake Indians; they proceeded southward near the east foot of the Mountains and found no natives; they continued further than usual, very unwilling to return without having done something. At length the scouts came in with word that they had seen a long file of

---

*534 Confederation Life Chambers, Toronto, Canada.

Horses and Mules led by Black Men (Spaniards) and not far off. They were soon ready and formed into one line about three feet from each other, for room to handle their Bows and Shields, having but a few guns; the ground was a rough undulating plain, and by favor of the ground they approached to near the front of the file before they were discovered; when, giving the war-whoop, and making a rush on the front of the file, the Spaniards all rode off, leaving the loaded Horses and Mules to the war party, each of whom endeavored to make prize of a Horse or Mule. They were loaded with bags containing a great weight of white stone (silver) which they quickly threw off the animals on the ground; in doing which the saddle girths were cut, except a few, and then (they) rode off. I never could learn the number of the animals; those that came to the camp at which I resided were about thirty Horses and a dozen Mules, with a few saddles and bridles. The Horses were about fourteen hands high, finely shaped, and though very tired yet lively; mostly of a dark brown color, head neat and small, ears short and erect, eyes fine and clear, fine manes and tails, with black hoofs. The saddles were larger than our English saddles; the side leather twice as large, of thick well-tanned leather of a chocolate color with the figures of flowers as if done by a hot iron; the bridles had snaffle bits, heavy and coarse as if made by a blacksmith with only his hammer. The weight and coarseness of these bits had made the Indians throw most of them away. The place this war party started from is in about 53° 20′ N, and the place where they met the Spaniards conveying the silver from the mines is about the latitude of 32° N, a distance of 1500 miles in a direct line."

The latter account would appear to refer to the raid carried out in 1787, the writer having made a slip of the pen in writing the date. The distance traveled by the Indians may seem to be incredibly great, but it must be remembered that horses had only been first obtained by the Piegans from the Snakes to the west of them about 50 years before, that they were still their most precious possessions, and that no exertions were too great if they showed prospects of securing them. It is evident that the pack trains followed a regular route or trail which the Indians knew, and that they followed this trail for many years, for the dates given for the two raids are 18 years apart.

In evaluating accounts given by Indians, and in computing distances traveled by them, Thompson was a thoroughly trained expert, but in these instances he made slight underestimates, for the raiders must have gone south of latitude 29° before they reached any working silver mines.

Neutralizing Acid Mine Water*

The problem of the neutralization of acid mine water has received only slight consideration, and a valuable agent, which promises to prove much more successful than lime (CaO) or carbonate of soda (Na_2CO_3), has been overlooked. This is magnesia (MgO). In using magnesite as a water purifier, the following facts may prove interesting: The combined weights of the substances (taking them all as normal) are: Sulphuric acid (H_2SO_4), 49; lime (CaO), 28; carbonate of soda (Na_2CO_3), 53, magnesia (MgO), 20. This shows that the theoretical amount of the alkalies required to neutralize 49 parts of sulphuric acid is: Lime, 28 parts; carbonate of soda, 53 parts; magnesia, 20 parts. It will be noted that in theory the magnesia is considerably more efficient, weight for weight, than either lime or soda. In practice this superiority is even more marked. Soda is superior to lime, owing to its greater solubility although theoretically lime is nearly twice as efficient as the soda.

Sulphate of soda or Glauber's salt has an additional advantage over lime, owing to this solubility of its product; it does not precipitate and choke pipes, as the almost insoluble sulphate of lime (gypsum) does. The advantages of magnesia over lime are the same as those of soda, the sulphate of magnesia formed being very soluble. It has also an advantage over soda, magnesia being very insoluble in water, whereas carbonate of soda is readily soluble, thus causing loss in working. This advantage is apparent in practical working when a considerable excess of magnesia can be used to insure the complete neutralization without troubling to make careful tests of the acidity of the water, and this without any appreciable loss of magnesite. If the neutralization is carried out by causing the acid water to flow through a bed of calcined magnesite in lumps of suitable size, the work could be entrusted to an unskilled white man or even to a native, without danger of either incomplete neutralization or loss of magnesia, it being merely necessary to replace the magnesite as it is dissolved away. When an excess of soda is used, this excess is lost, owing to its being dissolved unchanged and carried away. In addition to this, it will be noted from the combining weights that magnesia is more than 2½ times as effective as soda, and as in practice 75% carbonate of soda is found more efficient than lime, it follows that calcined magnesite, which can be easily obtained of a purity of from 90 to 95%, is more than three times as effective as lime.

Calcined magnesite has another advantage over crude carbonate of soda, inasmuch as it can easily be obtained practically free from organic impurities, whereas crude soda contains these to a considerable extent, and it is a well-known fact that even small quantities of organic matter in cyanide solutions interfere with the precipitation of gold in the extractor boxes. Calcined magnesite readily combines with sulphuric acid, even in dilute solution. The advantages of magnesite may be summed up as follows: *Advantages over lime*: (1) Over three times as effective (in practice); (2) does not choke pipes. *Advantages over crude carbonate of soda*: (1) Over three times as effective (without considering the loss of soda due to its solubility); (2) free from organic impurities; (3) more easily used. The following is the result of an experiment in neutralizing acid water with calcined magnesia: An aqueous solution of sulphuric acid was made up containing 0.05% H_2SO_4, this being an approximate reproduction of a sample of water from a colliery recently tested. This solution was run through a bed composed of 10 gm. of calcined magnesite in pieces from ⅛ in. to ¼ in. in diameter at the rate of 3.5 l. per hour. After passing through the magnesite, the water was found to be faintly alkaline.

---

*Abstracted from the *So. African Mining Journal and Engineering Record*, Dec. 14, 1918, p. 314

Melting Points and Other Temperatures[*]

The accompanying table of melting points of the chemical elements is issued in compliance with numerous requests for this information. The melting points used by the Bureau of Standards as standard temperatures for the calibration of thermometers and pyrometers are indicated in capitals. The other figures have been assigned after a painstaking survey of all the available data.

As nearly as may be, all figures, in particular the standard points, have been reduced to a common scale—the thermodynamic. For high temperatures, and for use with optical pyrometers, this scale is satisfied very exactly by taking $c_2 = 14\ 350$ in the formula for Wien's law[1] connecting I_λ monochromatic luminous intensity of wave length λ, and T, absolute temperature: $_\lambda = c_1 \lambda^{-5} e^{\frac{c}{T\lambda}}$. For all purposes, except the most accurate investigations, the thermodynamic scale is identical with any of the gas scales.

At high temperatures some of the results are uncertain; thus, although the melting point of platinum may be considered accurately known to 10° C., that of tungsten is possibly uncertain by 50° C. or more. Temperatures centigrade are given to the nearest degrees, together with the exact Fahrenheit equivalents. Formerly the pyrometer was a scientific laboratory appliance, but it is now also an important instrument in practical operations. Calibration is a necessity, and is possible only with known melting points such as are given.

OTHER STANDARD TEMPERATURES

Substance	Phenomenon	C.	F.	Variation With Pressure (Pressure in Mm of Hg)
Oxygen	Boiling	—183.0	—297 4	$C° = -183.0 + 0.01258\ (p-760) - 0.0000079\ (p-760)^2$
Carbon dioxide	Sublimation	— 78.5	—109.3	$C° = -78\ 5 + 0.01595\ (p-760) - 0.0000111\ (p-760)^2$
Sodium sulphate $Na_2SO_4 + 10H_2O$	Transformation into anhydrous salt	32.384	90.291	
Water	Boiling	100	212	$C° = 100 + 0.03670\ (p-760) - 0.00002046\ (p-760)^2$
Naphthalene	Boiling	217.96	424.33	$C° = 217\ 96 + 0\ 058\ (p-760)$
Benzophenone	Boiling	305.9	582.6	$C° = 305\ 9 + 0\ 063\ (p-760)$
Sulphur	Boiling	444.6	832.3	$C° = 444\ 6 + 0.0908\ (p-760) - 0.000047\ (p-760)^2$
$3Ag_2Cu$	Eutectic freezing	779	1434	
Sodium chloride	Freezing	801	1474	

MELTING POINTS OF THE CHEMICAL ELEMENTS

Element	C.	F.	Element	C.	F.
Helium	<—271	<—456	Neodymium	840?	1544
Hydrogen	—259	—434	Arsenic	850	1562
Neon	—253?	—423	Barium	850	1562
Fluorine	—223	—369	Praseodymium	940	1724
Oxygen	—218	—360	Germanium	958	1756
Nitrogen	—210	—346	SILVER	960.5	1760.9
Argon	—188	—306	GOLD	1063.0	1945 5
Krypton	—169	—272	COPPER	1083.0	1981.4
Xenon	—140	—220	Manganese	1230	2246
Chlorine	—101.5	—150 7	Beryllium (Glucinum)	1280	2336
MERCURY	— 38.87	— 37.97	Samarium	1300–1400	2370–2550
Bromine	— 7.3	+ 18.9	Scandium	?	..
Caesium	+ 26	79	Silicon	1420	2588
Gallium	30	86	NICKEL	1452	2646
Rubidium	38	100	Cobalt	1480	2696
Phosphorus	44	111	Yttrium	1490	2714
Potassium	62.3	144 1	IRON	1530	2786
Sodium	97.5	207 5	PALLADIUM	1549	2820
Iodine	113.5	236.3	Chromium	1615	2939
Sulphur S_I	112.8	235 0	Zirconium	1700?	3090
Sulphur S_{II}	119 2	246.6	Columbium (Niobium)	1700?	3090
Sulphur S_{III}	106.8	224 2	Thorium	>1700 <Mo.	>3090 <Mo.
Indium	155	311	Vanadium	1720	3128
Lithium	186	367	PLATINUM	1755	3191
Selenium	217–220	423–428	Ytterbium	?	....
TIN	231 9	449.4	Titanium	1800	3272
Bismuth	271	520	Uranium	<1850	<3360
Thallium	302	576	Rhodium	1950	3542
CADMIUM	320.9	609.6	Boron	2200–2500?	4000–4500
LEAD	327.4	621.3	Iridium	2350?	4260
ZINC	419.4	786.9	Ruthenium	2450?	4440
Tellurium	452	846	Molybdenum	2550	4620
ANTIMONY	630.0	1166.0	Osmium	2700?	4890
Cerium	640	1184	Tantalum	2900	5250
Magnesium	651	1204	TUNGSTEN	3400	6152
ALUMINUM	658.7	1217.7	Carbon	>3600	>6500
Radium	700	1292			
Calcium	810	1490			
Lanthanum	810?	1490			
Strontium	>Ca<Ba?	......			

---

[*] Circular of the Bureau of Standards No. 35, 3d Edition.

[1] See Bureau of Standards Circular No. 7 or Scientific Paper No. 11.

Power in Chemico-Metallurgical Industries

M. Cote has published in *La Houille Blanche* an interesting table on the uses of electrical power in metallurgical and chemical industries. This table was furnished by Professor Flusin, and appears in a recent issue of *Métaux, Alliages et Machines* and summarizes, for many products which are commonly manufactured by electrical power, (1) the kilograms of product obtained per kw.-day consumed; (2) the kw.-days consumed per metric ton of manufactured product; (3) the tons of raw material used to manufacture a metric ton of product; and (4) the kilograms of raw materials used per kw.-day consumed. Professor Flusin has compiled these tables for the purpose of eliciting other views on the subject, and to encourage the publication of similar tables for other products. It is felt that a new era is dawning for France in the use of electrical power, and that such tables of reference will be of basic importance in inducing prospective manufacturers to consider the subject.

CONSUMPTION OF ELECTRICAL POWER AND RAW MATERIAL IN THE PRINCIPAL FRENCH ELECTRO-CHEMICAL AND ELECTRO-METALLURGICAL INDUSTRIES

Manufactured Product	Kilograms Obtained per Kw.-Day Used	Kw.-Day Consumed per Metric Ton Manufactured	Tons Raw Material Used per Ton of Product	Kilograms Raw Material Used per Kw.-Day Consumed
Phosphorus	1 1	909	1 3@20	14@22
Chlorine and caustic soda—chlorine basis	6 0	167	4 5	27
Chlorine and caustic soda—soda basis	6 6	167	4 5	27
Chlorate	3 0	333	1.3	4
Perchlorate of soda	5@7	200@143	0 95	4 7@6 6
Carborundum	2 8	357	3.6	10
Artificial corundum	9@11	111@91	2 0	18@22
Calcium carbide	5 5@6	182@167	1.75	9@10
Synthetic nitric acid	1.3@1 5	770@667	0	0
Calcium cyanamide	45	22	0.8	36
Sodium	1 2	834	2.6	3.1
Aluminum	0.8@0 9	1250@111	3.0	2 5
Pig iron	10	100	Variable	Variable
Synthetic iron	24@30	42@33	1.3	36@38
Steel in solid form	22	45.5	1.3	27
Steel in liquid form	120	8.3	1.3	150
Electrolytic iron—rotating cathode	6	167	1.1	7
Electrolytic iron—fixed cathode	23	43.5	1.1	25
Ferrosilicon, 10-12% Si	9 2	109	1 55	14 3
Ferrosilicon, 25-30% Si	5 8	172	1 90	11.0
Ferrosilicon, 45-50% Si	3.0	333	2 90	8 7
Ferrosilicon, 70-80% Si	1.4	714	4 30	6 0
Ferrosilicon, 90-95% Si	1.0	1000	6 40	6.4
Ferromanganese, 18-20% Mn	15	67	1.80	27
Ferromanganese, 70-75% Mn	6	167	3 15	19
Ferrochrome, 10% C	3 5	286	2 90	10
Ferrochrome, 1% C	1 8	555	4.05	14
Ferrotungsten	2.5@3.5	400@286	2 7	7
Silico-manganese, 10% Si, 20% Mn	7 5	133	2.2	16.6
Silico-manganese, 10% Si, 70% Mn	4 6	217	2.5	11.4
Silico-manganese, 25% Si, 50% Mn	3 0	333	2 7	8.0
Silico-calcium	1.5	667	(a)	(a)
Silico-aluminum	1.0	1000	(a)	(a)

(a) No data.

Pumping Cost at the Bunker Hill & Sullivan mine, at Kellogg, Idaho, for the year 1917, was $20,734.62, which, reduced to a per ton basis on 448,843 tons hoisted is: Pumpman, $.012; miscellaneous, .003; machine shop repairs, .007; electrical repairs, .002; electric power, .022; total, $.046 per ton.

Deoxidizing Water To Prevent Pipe Corrosion*

By F. N. Speller

No new work was undertaken in the past year on the application of the deoxidation principle for the prevention of corrosion in pipe. However, the new test pipes put into the Irene Kaufmann Settlement installation two years ago, where deoxidized water is used, have been reëxamined. The following abstract from a report of the Pittsburgh Testing Laboratory summarizes the results to date:

> The pipes included in this test were originally two 29-in. lengths, each of 2-in. uncoated black steel pipe, and 2-in. wrought-iron uncoated black pipe.
>
> The installation was made Nov. 22, 1916, on which date it was first put into service. On Dec. 24, 1917, the pipe line was reopened, and the wrought-iron pipe and steel pipe were found to be practically uncorroded after more than one year of service. Their inner surfaces were covered with a soft, black slime. Oxygen removal by the deoxidizer had at times been incomplete, because of the low temperature of the water. Nevertheless, corrosion had resulted, during this time, in perforation of duplicate pipes in part of the same hot-water system unprotected by the deoxidizer.
>
> Samples of the zinc and brass which had been in the line for 42 days showed practically no corrosion, whereas similar samples in the unprotected part of the hot-water line showed pitting of the zinc and solution of the zinc constituent of the brass, leaving metallic copper at the edges of the brass samples. The zinc and brass specimens were put back into the line, and riveted couples of steel and copper sheets, and of steel and brass sheets, were also placed in the line. Copper rivets were used.
>
> On Jan. 3, 1919, after two years and 42 days of service, the condition of the pipes in the deactivated hot-water line was again observed, and found to be so good that it was decided to continue the test for at least another year. The pipes showed the same soft black coating, and there was no evidence of pitting, even where the steel pipe was in contact with a brass union, a condition favorable to rapid corrosion by electrolytic action.
>
> The specimens already mentioned were removed, and sent to the laboratory to determine their losses in weight and general condition. The relative losses of weight were striking. The zinc plate had lost in the deactivated water, in about 12 months, only 1%, as compared with 10% in the untreated water in the same line. The brass plates, during the same period, lost less than 0.1% in the deactivated water, as compared with more than 1% in the untreated portion of the water in the line. The steel in the riveted brass and steel couple lost about 16% in the deactivated water, but was entirely corroded away in the untreated water in the same line. In the case of the riveted steel and copper plates, the loss of weight of the steel in the deactivated water was 20%, whereas in the untreated water the steel was destroyed by corrosion before the end of the 12 months' period.
>
> Removal of the oxygen by the Speller deoxidizer has been the means of hindering the corrosion of wrought-iron and steel pipe exposed for over two years in a hot-water line. In the meantime, specimens of the same iron and steel pipe have failed by pitting in less than a year in an unprotected part of the same hot-water line.

The plant at the Irene Kaufmann Settlement, Pittsburgh, has now been in use continuously for over three years. An analysis of the water shows the same percentage of oxygen removal as was found when the plant was installed.

Interesting data were obtained at the inspection this month, from test plates of zinc and some pieces of steel riveted to copper and brass plates. These were all weighed and inserted into hot-water lines carrying about the same volume of raw and deactivated water for about 14 months, and a greatly reduced loss of weight for the zinc and brass plates in deoxidized water was noticeable. The free oxygen in this water was reduced on the average to about 7% of the amount found in the raw water, so that, with a larger plant and more perfect deoxidation, still better results might be expected.

There has been considerable trouble with some brass pipe with ordinary hot water, owing to development of porosity and leaks, which are first manifested by a white incrustation on the outside of the pipe. In galvanized pipe, the zinc dissolves rapidly, and in this way protects the iron, but the protection is good for only two or three years under conditions in which the waters are moderately soft. So it appears that the brass pipe will be protected in practice by the removal of free oxygen almost as much as galvanized pipe.

It is of practical interest to note that, in the three years' trial which this system has undergone, the oxygen removal has not been complete, yet there is no perceptible action of the deactivated water on unprotected iron, steel, or brass pipe. A considerable amount of hydrogen has been found in this water, between which and the free oxygen some proportionate ratio would seem to exist, which inhibits corrosion.

---

*Abstracted from discussion at the January, 1919, meeting of the American Society of Heating and Ventilating Engineers.

United States Imports of Tin

Imports of tin bars, blocks, pigs, etc., by countries during November and December, 1918, according to the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce, were as follows:

Countries	November, Pounds	December, Pounds
England	280,390	179,662
Mexico		748
British India	56,000	112,036
Straits Settlements	7,704,006	4,498,206
Dutch East Indies	1,251,568	114,689
Hong Kong	581,955	288,037
Australia	799,112	693,685
Canada	56,047	..
China	5,101	
Totals	10,734,179	5,887,063

In November and December of 1917, imports of tin bars, etc., amounted to 8,405,601 and 9,155,644 lb., respectively. Total tin imports (exclusive of ore) in 1917 were 143,636,782 lb., and in 1918 the total was 142,507,393 pounds.

Imports and Exports of Tungsten-Bearing Ore

Imports of tungsten-bearing ore during December, 1918, as reported by the Department of Commerce, amounted to 1033 long tons. The countries from which this ore came are as follows: Argentina, 42 long tons; Bolivia, 25; Chile, 100; Colombia, 35; Peru, 45; China, 244; Hong Kong, 526; Japan, 12; and Mexico, 4 long tons. In November, 1918, the imports of tungsten ore amounted to 2311 long tons, of which 321 tons came from Japan; 184 from Chile; 171 from Peru, and the remainder from other countries.

Total imports of tungsten ore in 1918 amounted to 10,362 long tons, the countries of origin being as follows: Peru, 1631 long tons; Japan, 1215; Chile, 1116; Argentina, 479; other countries, 5921 long tons.

Exports of tungsten and ferrotungsten from the United States during December, 1918, amounted to 2225 lb.; of which 2000 lb. went to Canada, and the remainder to Argentina. In November, 1918, the exports of these metals amounted to 43,531 lb., the total for the year being 1,232,260 pounds.

Iron-Ore Output of Sweden, during 1917, according to *Iron Age*, was 6,542,542 tons, including slick and briquetted ore. This compares with 7,322,983 tons in 1916. The manganese-ore production in 1917 was 19,873 tons, as compared with 8894 tons in 1916.

A Study of Shoveling as Applied to Mining*—I

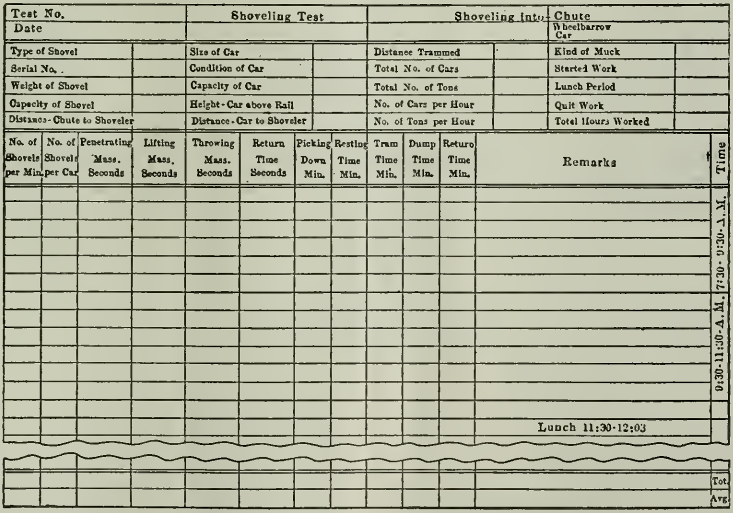
By G. TOWNSEND HARLEY†

The important part played by shoveling in mine work should receive attention from operators. The Phelps Dodge Corporation, which has already set a pace in initiating the standardization of various branches of mine operation, has, by means of a well-devised, systematic study of mine shoveling, determined upon methods of increasing the production per man per day to be secured in this manner. Hand shoveling in other fields of industry has been the subject of study and analysis, but we believe that the investigations here recorded constitute the first attempt at similar work in the mining industry of this country.

STOPING methods in which shoveling plays an important part are gradually being replaced by other and cheaper processes. But there will always be considerable shoveling done underground, in stopes as well as in drifts, tunnels, winzes, and shafts. At the mines of the Phelps Dodge Corporation at Tyrone, N. M., the cost of shoveling in all stopes during 1917 amounted to 24c. per ton. In the top-slice stopes for the same period shoveling cost 27c. per ton, or 16% of the total cost of these stopes. The tonnage for shovelers from all stoping was 9.3 tons per man, and for top-slicing 8.2 tons per man per day. These stopes were not unduly hot, and there was not more than the usual amount of timber to interfere with the work of the men. The tonnages obtained per shoveler were considered low; first, because of a poor grade of Mexican labor, many of the men having come in from railroad-grading camps; and, second, because of a poor spacing of raises, especially in the top-slice stopes, where, in general, they were spaced 25 ft. by 66 ft. centers. The average wage per laborer shift was $2.67 during the year under review.

CONSIDERATIONS IN THE STUDY OF SHOVELING CONDITIONS

As a first step toward determining how the general efficiency of underground shoveling could be improved, several weeks were spent in a general survey of the field and making time studies on various men, to see what points would need to be determined for a full consideration of the subject. The following factors were soon recognized: The type, weight, size, and design of shovel giving the greatest shift tonnage without too much wear and tear on the man would have to be determined; a standard of comparison would be necessary if the ill effects of mine air, powder gas and smoke, temperature, humidity, and poor light were to be estimated, and the layout and spacing of chutes would have to be studied with regard to their effect on shoveling directly into the chutes, or loading into wheelbarrows or cars and tramming to them. This latter work would determine the proper distance at which shoveling into a chute should cease and loading into a wheelbarrow or car would begin, and the information would also be of great value in planning the development of a stope. Further considerations were: Hindrances to work, such as timber standing in line of throw or closely spaced, and men and supplies passing back and forth through working space; manner of placing the shovelers to obtain maximum results from them, number of men in one working place, and size of working place required per man; the hours of actual work and the cause and amount of delays; capacity of a man for work as the day progresses; proper rest periods for



Test No. Date		Shoveling Test		Shoveling into		Chute Wheelbarrow Car	
Type of Shovel		Size of Car		Distance Trammed		Kind of Muck	
Serial No.		Condition of Car		Total No. of Cars		Started Work	
Weight of Shovel		Capacity of Car		Total No. of Tons		Lunch Period	
Capacity of Shovel		Height-Car above Rail		No. of Cars per Hour		Quit Work	
Distance-Chute to Shoveler		Distance-Car to Shoveler		No. of Tons per Hour		Total Hours Worked	

No. of Shovels per Min.	No. of Shovels per Car	Penetrating Mass. Seconds	Lifting Mass. Seconds	Throwing Mass. Seconds	Return Time Seconds	Picking Down Min.	Resting Time Min.	Tram Time Min.	Dump Time Min.	Return Time Min.	Remarks	Time
												7:30-9:30 A. M.
												9:30-11:30 A. M.
											Lunch 11:30-12:03	
												Tot.
												Avg.

FIG. 1. TIME STUDY SHEET USED IN SHOVELING EXPERIMENTS

men to maintain maximum efficiency; best means for instructing men and supervising work, and compensation received and manner of payment.

---

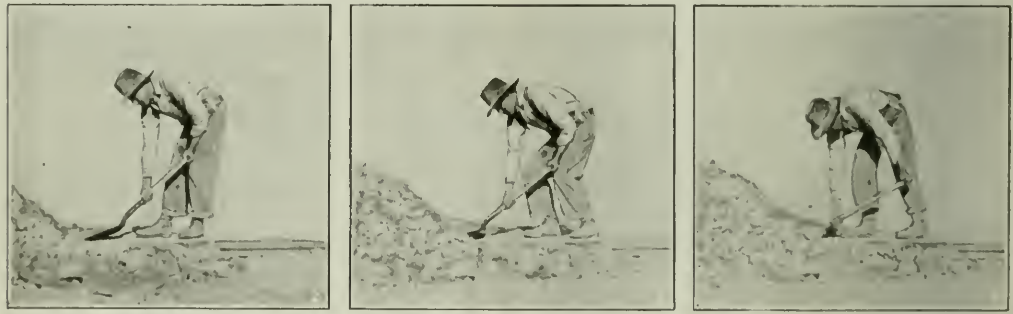
*Abstract of a paper presented at the New York meeting of the A. I. M. E., February, 1919.

†Efficiency engineer, Phelps Dodge Corporation, Tyrone, New Mexico.

Determining the Shovel Best Suited to Conditions

Three types of shovels were in general use at the mines: A No. 2 scoop, a No. 2 or No. 3 square-point D-handle shovel, and a No. 2 round-point long-handle shovel. In determining the average load that the various types and sizes of shovels would handle, so as to be able to decide the best load for the average Mexican laborer of the Southwest, average capacities were obtained by repeatedly shoveling a weighed pile of ore with each of the shovels and counting the number of shovel loads required to move it. It was determined that with Burro Mountain ore a specially made shovel with a 10- by 13-in. blade would hold a 21-lb. load, or 363 cu.in. In practice, however, a No. 4 square-point shovel holding 373 cu.in. and a No. 5 round-point shovel holding 340 cu.in. were used.

A time-study sheet, shown in Fig. 1, was developed, which was used for all tests. In addition to the data placed on this sheet, an extensive log of the work was carried on, which undertook to explain, in detail, all delays, changes of work, rest periods, changes in conditions that would affect speed, high and low efficiency periods during the day, and other points to be considered. During the period of preliminary work, it was discovered that the work of a shoveler can be classified into several divisions, each susceptible to comprehensive study and analysis, and to each of which a definite relative time value can be given.



FIGS. 2, 3, AND 4. PENETRATING MASS AND PREPARING TO THROW CONTENTS OF SHORT-HANDLED SHOVEL.
Fig. 2. Position when starting to penetrate the mass. Fig. 3. Mass has been penetrated. Fig. 4. Position just prior to lifting shovel contents

Standard Time and Standard Performance Established by Means of Motion Study

These divisions, in general, may be classified into time spent actually shoveling, time spent other than shoveling, delays and resting periods. The motions are illustrated in Figs. 2 to 15. By studying each motion separately, it was possible to establish a standard time for each, and, consequently, a standard of performance for the whole. It was possible, also, to discover which were the most tiring motions and how each was affected by length of time worked, length and distribution of rest periods, size of shovel, design of shovel, and length of throw.

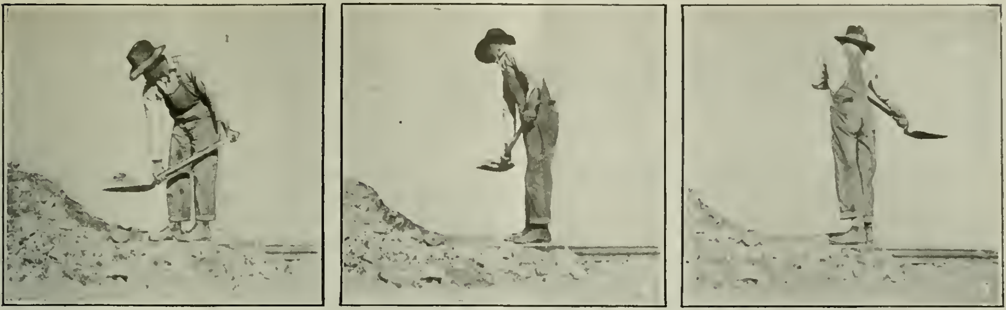
To obtain some standard of comparison for the underground work, some of the mine shovelers were brought to the surface and a record of their work was made under ideal conditions; that is, with good air, good light, no timber to interfere, steady shoveling for various lengths of time, and standard lengths of throw for the muck. In addition to obtaining the comparison standard, it was possible to form definite conclusions, which were later checked satisfactorily under actual conditions in the mine, as to the most advantageous size, type, weight, and design of shovels for general mine use, under the various conditions encountered.

Tests were carried on for two months, three different shovelers, taken from the mines, being observed. Each of these men was warned that he had to work at his best speed, all during the job, but that he was not to overtax himself. He was told that when he became tired he was to take a few moments' rest, as it was better for him to rest at intervals than to try to work all the time, at the expense of speed and capacity. Later the rest periods were regulated, to obtain the proper intervals at which they should occur, and their length.

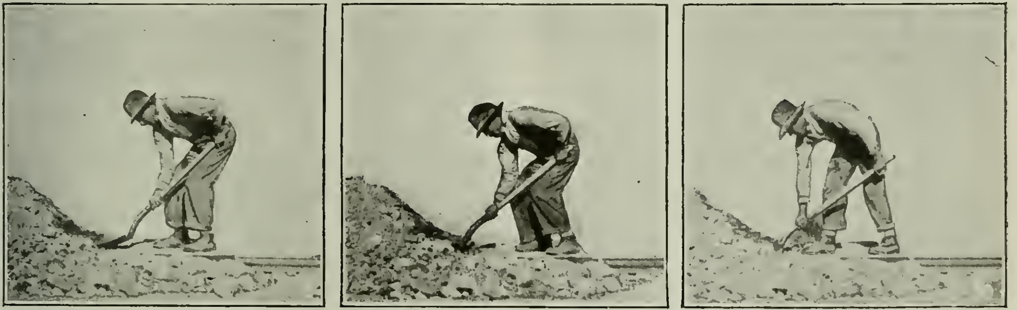
All of the underground shoveling tests may be classified under one of three headings: Shoveling directly into chutes; shoveling into wheelbarrows and tramming to chutes, and shoveling into cars and tramming to chutes. Each of these series was conducted independently of the others, and was complete in itself. The men under observation worked for periods varying from 1 to 8 hours, and for each length of job they threw or trammed the muck over a wide range of distances, with various types and sizes of shovels. In all the underground tests, the work was done under the actual mining conditions, with the one exception that the men were always under observation, and, consequently, were working at a good speed for the full period of the test. In no case did the men overtax themselves, and it is believed that all tonnages recorded are easily obtainable by a good but not exceptional Mexican laborer after he has been properly instructed, and under close and intelligent supervision, together with a wage paid in such a manner as to provide an adequate incentive to do good work.

Tests Reduced to a Comparison Between the Work of No. 4 Shovel and No. 2 Scoop

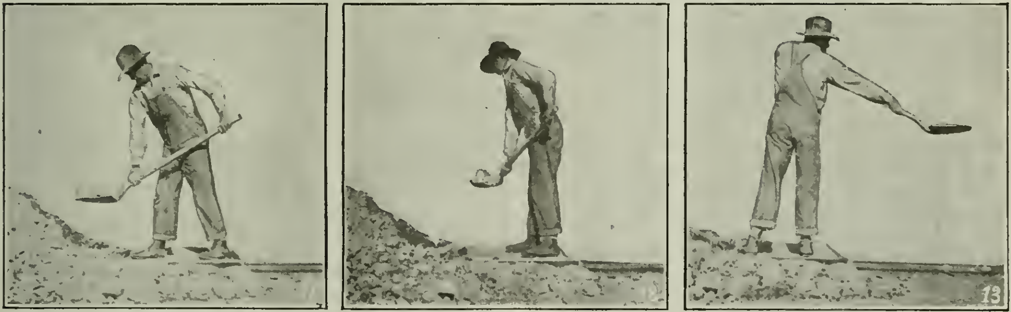
It soon became evident that the great majority of shovels being tested were not suitable for efficient work, and only the work of the No. 4 shovel, which handles the 21-lb. load, together with that of the No. 2 scoop,



FIGS. 5, 6, AND 7. LIFTING AND THROWING SHORT-HANDLED SHOVEL CONTENTS



FIGS. 8, 9, AND 10. PENETRATING MASS AND PREPARING TO THROW CONTENTS OF LONG-HANDLED SHOVEL



FIGS. 11, 12, AND 13. LIFTING AND THROWING LONG-HANDLED SHOVEL CONTENTS

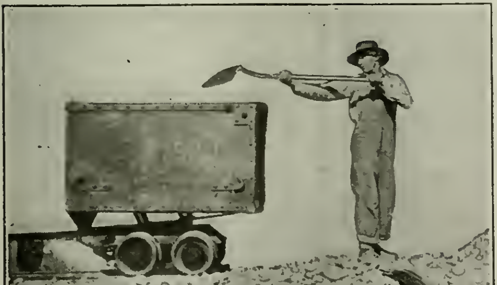


FIG. 14. CORRECT MANNER OF THROWING ORE INTO CAR WITH LONG-HANDLED SHOVEL
(Car is 4 ft. from top of pile)

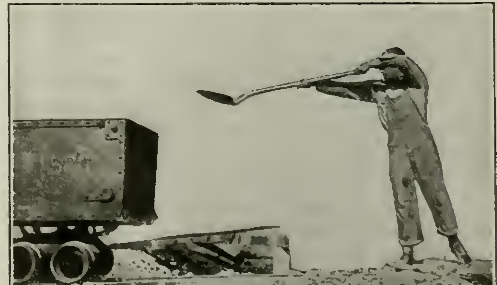


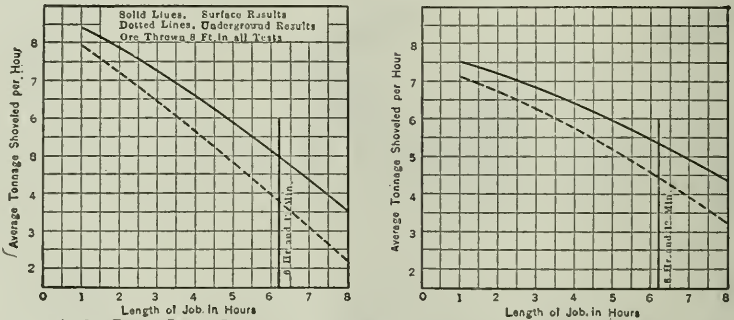
FIG. 15. SHOWING INCREASED EFFORT NECESSARY TO THROW ORE A LONG DISTANCE INTO CAR
(Car is considerable distance from pile)

Fig. 5. Shovelful has been lifted. Fig. 6. Preparing to throw shovel contents; a short step has been taken in the direction of throw. Fig. 7. Contents have been thrown; note strained position in effort to throw a long distance with short-handled shovel. Fig. 8. Position when starting to penetrate mass with long-handled shovel. Fig. 9. Mass has been penetrated; note easy position of man. Fig. 10. Wrong way to start lifting; right foot and hand moved forward. Fig. 11. Shovelful has been lifted. Fig. 12. Preparing to throw shovel contents; a short step has been taken in the direction of throw. Fig. 13. Contents have been thrown; note ease of position as compared with Fig. 7

which was held in high esteem by many of the men in the operating department, was plotted on charts. The results obtained during the surface tests were plotted alongside of corresponding results from underground, to accentuate the adverse effects of underground conditions on shoveling capacity.

SPEED OF SHOVELING DECREASES MORE RAPIDLY WITH SCOOP THAN WITH SHOVEL

The number of shovels per minute thrown into a chute at a distance of 8 ft. from the ore pile, for jobs varying in length from 1 to 8 hours, is greater with the No. 4 shovel than with the No. 2 scoop. Both on the surface and underground, the speed of shoveling decreases more rapidly with the scoop than with the shovel, as the length of the job increases. A man working with a scoop underground can perform at only 72% of his speed on surface for 8 hours, whereas with a No. 4 shovel he can work at 82% of his surface speed.



A - No. 2 Eastern Pattern Scoop

B - No. 4 Sq. Pt. D-Handle Shovel

FIG. 16. AVERAGE TONNAGE SHOVELED PER HOUR FOR ANY LENGTH OF JOB

The percentage reduction in speed between surface and underground work is the measure, in part, of the effect of mine air, powder gas and smoke, temperature, humidity, and poor light. Under the same condition of work, the difference in speed between the No. 4 shovel and the No. 2 scoop is due to the difference in the load handled.

SPEED OF SHOVELING AS AFFECTED BY LENGTH OF THROW

The manner in which the length of throw will affect the speed of the shoveler was worked out for a uniform length of job of 6 hours and 12 minutes, and for varying distances. The decrease in shoveling speed on the surface amounted to an average of 2.5% for every foot increase in distance thrown in the case of the scoop, and 1.8% for the No. 4 shovel. Underground, the working speed was decreased more rapidly, being respectively 4.4% and 3.2% per ft. increase in throw. The rate of decrease in shoveling speed, both on the surface and underground, was greater for the heavily loaded scoop than for the shovel.

USE OF SCOOP REQUIRES LONGER REST PERIOD

In determining the amount of rest required for shoveling jobs of various lengths it was found that the scoop again has a negative effect both on surface and underground, causing a man to use up more time in resting than when working with a No. 4 shovel. The rest period, as considered, was made up of the time consumed in delays, the time actually spent in resting, during which the man may smoke a cigarette and sit down for a few minutes, and the time used in loosening the muck pile, scraping up the dirt on the shoveling plat, or doing other light work, not actually shoveling, but closely related to it.

DETERMINATION OF TIME ACTUALLY SHOVELED

Over a long period it was possible to demonstrate the feasibility of accurately determining the percentage of the working day that a man will actually devote to shoveling. The working day at the Burro Mountain mines is 8 hours, ½ hour of which is given up to the lunch period, leaving 7½ hours as the total possible working time. It was found that of this 7½ hours the man actually worked at shoveling for 82.5% of the time. The remainder of the possible working time, or 17.5%, is spent on other work, the man quitting early for lunch or leaving the mine or commencing to work late at beginning of the shift or after lunch. Observations of this character were gathered by some of the shift bosses, on several hundred-man shifts, and it is surprising how little the figures obtained by each have varied from the average finally obtained.

The average tonnage per hour to be expected of a man throwing the muck a distance of 8 ft. over any period of time is shown in Fig. 16. Experiments to determine the total tonnage shoveled for any period over the same distance showed that for a job lasting 5 hours and 30 minutes, with a No. 4 shovel underground, a man would be expected to shovel 26.0 tons a distance of 8 ft. Five representative tests actually gave the following tonnages under average conditions:

Length of job 5 hours and 10 minutes, tonnage	28.0
Length of job 5 hours and 10 minutes, tonnage	23.0
Length of job 5 hours and 25 minutes, tonnage	26.0
Length of job 5 hours and 50 minutes, tonnage	34.0
Length of job 5 hours and 30 minutes, tonnage	25.0
Average, 5 hours and 30 minutes, tonnage average	27.4

COMPARISON OF WORK DONE BY NO. 2 SCOOP AND NO. 4 SHOVEL

A careful study of Fig. 17 will show the following conditions: (1) The difference in tonnage handled by the same shovel, on the surface and underground, for any length of job, is the measure of the bad effects of underground conditions. For a job of 6 hours and 12 minutes, with a No. 4 shovel, the underground work is 20.5% less than on surface. (2) The difference between the amounts shoveled with the No. 2 scoop and the No. 4 shovel, under same conditions, is the measure of the effect of the difference in load handled by the man. (3) Each line on this chart shows a peak at some particular length of job, and the total tonnage shoveled for any greater period than this is actually less. (4) The presence of this peak accords with the experience of many superintendents and managers, who state that their men do more work in an 8-hour day than they did on the old 10-hour basis. (5) The "economic shoveling day" is about 6⅓ hours, with a No. 2 scoop on the surface, and 5⅓ hours underground. With a No. 4 shovel, on the surface 8 hours is about the proper length of day, whereas underground 6⅔ hours seems to be about correct. As the men actually shovel only 6⅓ hours per day on an average, and as their other work is generally of a light nature, the 8-hour day with the correctly proportioned shovel is probably the best; but with a scoop it is certainly too long. (6) For work on the surface, on jobs lasting longer than 4⅔ hours, the No. 4 shovel is superior to the scoop. Underground the No. 4 shovel demonstrates its superiority for jobs longer than 3⅔ hours. The scoop thus may be considered as a task shovel for short-time jobs, but even here its value is only slightly greater than the No. 4 shovel and it tires the man so that he is unfit for other work when the shoveling task is finished.

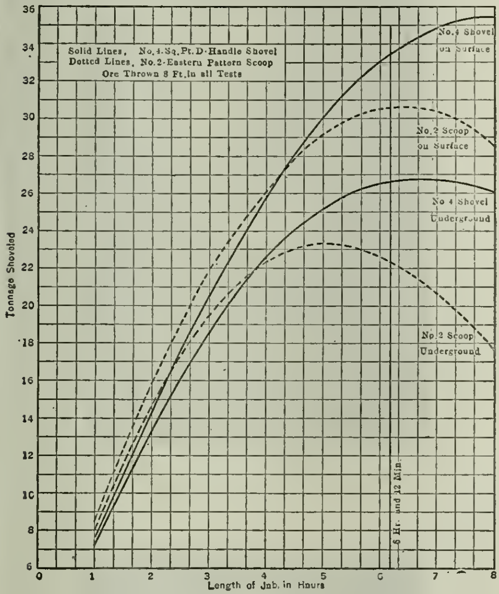


FIG. 17. COMPARISON OF WORK OF NO. 2 SCOOP AND NO. 4 SHOVEL

The following formulas show the manner in which use is made of the figures presented in the preceding diagrams:

Let W = weight of load on shovel, in pounds;
N = number of shovels per minute;
P = % time actually shoveling;
L = length of job, in minutes;
T = total tonnage shoveled;
n = number of shovels per minute for an 8-ft. throw.
p = % increase or decrease due to various lengths of throw.

$$\frac{W \times N \times P \times L}{2000} = T \qquad n = N(1.00 \pm p)$$

In using the No. 4 D-handle shovel it was discovered that a throw of 3 ft. to the wheelbarrow gave the best results as far as number of shovels per minute and rest periods required were concerned, and in all subsequent work the ore was thrown into the wheelbarrow from this distance. For any length of job, the number of shovels per minute is less than when throwing 8 ft. into a chute, and this is due to the fact that the shoveler must place each shovelful carefully to keep the wheelbarrow from spilling its contents and to make it ride easily.

Fig. 18 shows the tonnage to be expected of a man for any length of job, the length of tram being constant at 20 ft. This chart shows that the shoveler has not quite reached his maximum capacity at the end of 8 hours. Two reasons are advanced for this: (1) As long as a man can throw the ore into a chute, he has a fairly direct throw from the ore pile to the chute, and with a car he has a definite path to traverse each trip. With a wheelbarrow, however, the direction and length of tram are constantly varying, as is also the amount of interference from other trammers, timbermen and machine men. The retarding influence of these factors increases as the length of the tram increases. (2) The sequence of operations, shoveling, tramming, and dumping, is of such short duration and changes so often from one to the other that it is hard to keep up any pace that may be set, and probably an unnecessary amount of rest is indulged in for all periods.

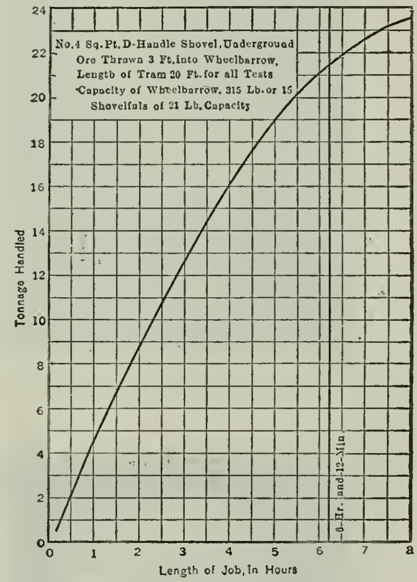


FIG. 18. SHOWING CAPACITY OF A SHOVELER USING A WHEELBARROW FOR VARIOUS JOBS

(To be concluded)

Magnesite Imported Into the United States in December, 1918, amounted to 555 tons, 46 tons coming from Scotland, and 509 tons from Canada, according to figures furnished by the Bureau of Foreign and Domestic Commerce. Total imports for the year were 19,718 tons, two tons coming from England, 774 from Scotland, 17,860 from Canada, and 1082 from Mexico.

Officers of National Mining Societies

HORACE VAUGHN WINCHELL
President American Institute of Mining and Metallurgical Engineers

ALBERT R. LEDOUX
First Vice-President American Institute of Mining and Metallurgical Engineers

HENRY HOBART KNOX
President Mining and Metallurgical Society of America

FREDERICK F. SHARPLESS
Vice-President Mining and Metallurgical Society of America

Officers of Mining Engineering Societies

The American Institute of Mining and Metallurgical Engineers and the Mining and Metallurgical Society of America have recently elected officers for the ensuing year. The principal events in the careers of the presidents and vice-presidents, who are distinguished in various branches of engineering, are herein described.

THE American Institute of Mining and Metallurgical Engineers has done itself an honor in electing to its presidency Horace Vaughn Winchell, of Minneapolis, who, like his father, Newton H. Winchell, has also attained eminence as a geologist. Horace Winchell early conceived the idea that geology was not an abstract science, but that the facts disclosed by its patient study were capable of being translated into data that could be used in the economic development of mineral resources.

From the time of his graduation at Ann Arbor, in 1889, he has continually sought the useful in geology and has applied it to the every-day work of mining. His early association with the Minnesota Geological Survey brought him in close contact with the Minnesota iron formations, and in 1892 he published the first description of the Mesabi iron range. Even before that date he indicated the manner in which the formation was laid down, namely chemical oceanic precipitation; a conclusion which at that time received scant support, but which is now generally accepted as the most logical explanation of its origin.

From 1898 to 1906, Mr. Winchell was closely associated with the Anaconda Copper Mining Co. He organized its geological department and studied the formations exposed by the company's mining operations, giving particular attention to the origin of sulphide ores of copper. It is due to the success of the geological department of this company that other companies have emulated its example. It was while working for this company that Mr. Winchell succeeded for the first time in producing the mineral chalcocite in the laboratory, thereby laying the foundation for a better knowledge of the theory of secondary enrichment.

After leaving the Anaconda, Mr. Winchell was with the Great Northern Ry. for two years, during which time he guided the mining activities of that organization. Since 1908 he has been engaged in general consulting practice and has devoted a large part of his time to mining law and its application. Particularly in apex cases has Mr. Winchell's advice been requisitioned. His keen geological insight, together with his ability to state the facts clearly and concisely to the layman or the court, have made him a valuable witness in cases involving the adjudication of intricate issues having relation to mining and geology.

Mr. Winchell is a linguist of ability. He has traveled extensively, and comes to the presidency of the Institute a thorough American and a believer in the great possibilities and opportunities open for American engineers throughout the world. Upon this expanding field of engineering service, particularly in such countries as Mexico and Russia, where there are but few American engineers at present, Mr. Winchell laid much stress in his recent address to the members. The Institute is to be congratulated.

ALBERT R. LEDOUX

Dr. Albert R. Ledoux, recently elected first vice-president of the American Institute of Mining and Metallurgical Engineers, and former president, in 1903, was born in Newport, Ky., on Nov. 2, 1852. His father, the Rev. Dr. Louis Palemon Ledoux, was a distinguished clergyman and educator who undertook the early education of his son until he entered the School of Mines of Columbia University, in 1870, and several years later the University of Berlin, Germany. Returning to America, Dr. Ledoux spent a few months in a commercial laboratory, from which he was called to be the first state chemist of North Carolina. Dr. Ledoux organized a staff of assayers, and for three years had charge of all the analyses and experiments conducted by the state boards of health and agriculture and of investigations of the Geological Survey.

On resigning his position in North Carolina in 1880, the state university gave him the honorary degree of M. S. He then opened an office in New York City as consulting mining engineer and chemist, in partnership with Dr. P. de P. Ricketts, then instructor in assaying in Columbia. Dr. Ledoux retired in 1885, being succeeded by a younger brother, Augustus D. Ledoux, a well-known chemical engineer and recently the distinguished chairman of the Pyrites Committee of the War Industries Board.

The most important general contribution to the metal industry of this country by Dr. Ledoux, besides making hundreds of mine examinations, was his influence in changing the practice of European buyers of American ores, in such manner as to provide that British and Continental buyers, including the German government, should pay in New York for their purchases against Ledoux and Co.'s assays and certificates of weight. Theretofore, American producers had to accept settlement on the basis of European assays and weights, and to wait for 90 days before receiving payment.

Dr. Ledoux has been active as consulting engineer for many important mining and other corporations, and his professional reports would make a considerable volume if printed. He has been frequently called to testify as an expert in chemical and engineering cases. For some years he was retained by the Great Northern Ry. and personally examined and reported upon several sections through which it was proposed to build the western extension of this road, particularly upon the mineral resources of the Lake Kootenay region (1889), the geological and mineral development of the Sweet Grass Hill region, in northern Montana, and on the copper mines of Butte, Mont. Dr. Ledoux is also considered an authority on the pyrites deposits of the Alleghanies and Eastern states. As receiver of the Harney Peak Tin Mining, Milling, and Manufacturing Co., he had charge of the South Dakota properties, and conducted for Phelps, Dodge & Co. (Phelps Dodge Corporation) a thorough test of the tin deposits in the vicinity of Kings Mountain, North Carolina.

Albert R. Ledoux is one of the most versatile men of his generation in the science of mining. He is an able mining engineer, a brilliant writer, professionally and in literary composition, the latter being evidenced in his little volume called "Short Stories," published in 1896, and by contributions made to various magazines under the title of "Nature Sketches"; a distinguished churchman, having served as an officer of the Brick Church of New York for many years and which he represented as a Liberal in the trial of Dr. Briggs for heresy, and, finally, Dr. Ledoux is a noted philanthropist, being deeply interested in societies, hospitals, and other charitable and beneficent institutions.

Dr. Ledoux is a fellow of the American Association for the Advancement of Science, a member of the New York Academy of Sciences, the American Institute of Electrical Engineers, the American Chemical Society, the Society of Chemical Industry of Great Britain, the Society of Medical Jurisprudence, and the Canadian Mining Institute.

Henry Hobart Knox

Henry Hobart Knox, the recently elected president of the Mining and Metallurgical Society of America, and a charter member of the society, was born in New York in 1865. At the age of 18, he entered the course of mining engineering at the Royal Saxon School of Mines, Freiberg, Germany. He completed his education in 1886, and then spent five years in the active management of mining properties in Spain, when he was engaged by Phelps, Dodge & Co. in Arizona as assayer. In 1892, Mr. Knox was an expert witness in important mining litigation in Colorado. The following year he was appointed to the position of superintendent of the Sterling Iron and Railway Co., and later was directing the operations of the Exploration Mountain Copper Co., in California.

Since 1895, Mr. Knox has been actively engaged in general practice as a consulting mining engineer, and it may be said that in the capacity of adviser on general mining operations he possesses distinguished ability. The demands made on his services because of his great experience gained in the field of practical operations have been numerous and varied. His activities have brought him to many quarters of the earth, which, besides the United States, include Canada, Mexico, West Indies, South America, Africa, Europe, and Western Asia.

In 1903, Mr. Knox formed, with John H. Allen, the firm of Knox & Allen, mining and metallurgical engineers, with offices at present situated at 17 Madison Ave., New York, having removed from their quarters, occupied for many years, at 82 Beaver St. The London offices are at No. 62 London Wall, London, E. C. In addition to other professional work, Mr. Knox has acted as consulting engineer for the Caucasus Copper Co., Ltd., and the Pike Hill Mines, and at present he is connected with the Irtysh Corporation, Limited.

Mr. Knox has been a member of the American Institute of Mining and Metallurgical Engineers since 1892.

Frederick F. Sharpless

Frederick F. Sharpless, the recently elected vice-president of the Mining and Metallurgical Society of America, is one of its charter members and has taken a deep interest in the society since its foundation. Personally, he is more inclined to give credit for any success in life to the men with whom he came in contact at Ann Arbor, his alma mater: Cheever, Prescott, Pettee, and Alexander Mitchell—all men of lovable dispositions who instilled into their students an intense enthusiasm for the profession that they taught. His first work was at the Houghton School of Mines, now the Michigan College of Mines, where he acted as professor of metallurgy and where his work is highly regarded by such men as W. L. Honnold, William Wraith, Carl Davis, L. B. Sutton, William Parnell, and others.

After his departure from Houghton college in 1893 he donned overalls and began work at the bottom, in the Mother Lode mines and mills, acquiring his practical education by passing through the school of experience from mucker on the night shift to superintendent and manager. For a number of years he was associated with the Consolidated Mines Selective Co., of London, examining and reporting on mines in that company's behalf throughout all of the Americas, in Africa and Asia Minor. Of late years he has acted as consulting engineer, with offices in New York, his ripe experience making him a valued contributor to the columns of the *Journal*.

During the past year he has been secretary of the New York section of the Mining and Metallurgical Society of America.

February Pig-Iron Production

Production of pig iron in February amounted to 2,940,168 gross tons, as compared with 3,302,260 tons in January, according to *Iron Age*, and shows a loss in daily output of about 1500 tons. The February tonnage considerably exceeds that for the same month of the last two years, but is below the 3,087,212 tons produced in February, 1916. During the month 25 furnaces were blown out and 8 put in blast, leaving 306 stacks active Mar. 1, 18 less than on Mar. 1, 1918. Of ferroalloys, 28,105 gross tons was produced, or 1000 tons a day, only about 50 tons less a day than in the previous month.

Engineers To Aid in Reconstruction

In response to a request from Chairman Abram I. Elkus of the Reconstruction Commission of the State of New York, Engineering Council has appointed an advisory committee of five engineers, George W. Fuller, chairman; H. de B. Parsons, George F. Kunz, Paul G. Brown, and L. B. Stillwell, representing the several branches of the profession and the five member societies of Engineering Council. This committee is to confer with the commission on public works and other engineering matters, particularly the following: (1) The proposed vehicular tunnel under the Hudson River between Manhattan Island and Jersey City; (2) water-power development; (3) sewerage and sewage disposal; (4) garbage disposal and utilization, and (5) port development.

Molybdenum Deposits of proved commercial importance are few, although molybdenum minerals are widely distributed, according to *Iron and Coal Trades Review*. The largest producers in the past have been Queensland (111 tons in 1917), and New South Wales (70 tons in 1917), but the United States, Canada (121 tons in 1917), and Norway are now rapidly becoming important contributors to the world's supply. India produced 1.7 tons in 1917. Low-grade orebodies carrying molybdenite are of fairly common occurrence, but high-grade deposits such as were almost exclusively worked before the war are somewhat rare. About three-quarters of the world's output of molybdenum ore has been won from tungsten and bismuth deposits, and a smaller quantity has been obtained as a byproduct in the mining of tin.

The American Mining Congress*

SEVERAL who have spoken to you here have referred to the centralization of power in Washington. We had to relinquish many forms of control that we had exercised in the past, and give everything over to the Government in its prosecution of the war; but there is in that movement, now that peace has come, a serious menace to the individuality of the people of our country. It tends eternally toward socialism, toward the abandonment or loss of control of our operations, which we must combat. That cannot be done intermittently. Special committees or occasional committees sent to Washington to represent some particular industry or branch of an industry, or to support or oppose some special issue that is then before Congress, will not suffice. Continuous attention, watchfulness, are both necessary to take care of our interests in all legislation that comes before Congress. We cannot do that spasmodically. We may send down a special committee today, but that committee does not know the ropes; it has not the entrée; it has not the acquaintanceship with the heads of the Government departments or bureaus, nor with the members of Congress, which is essential to accomplish not only effective work, but sufficiently speedy work to insure the support or opposition that may be required with respect to pending legislation. Consequently, there is every reason for an organization at Washington to represent us at all times.

Until about two years ago the American Mining Congress was inadequately supported by those who should have been glad to contribute the moderate amount that is required to make its activities effective. For some years the coal men were practically its only financial support. I should say that they were most generous to the metal-mining interests. They did all possible—more than we had a right to expect—to help us in our problems; but we were not, I fear, as grateful as we should have been, and we certainly did not evince our gratitude by contributing as we should have done by joining the congress in such numbers as it deserved.

MINING CONGRESS AT WASHINGTON

One very important function of the Mining Congress at Washington is to inform the departments, the department heads, and members of Congress and Congressional committees of the facts in regard to any industry which may be under consideration, or concerning which legislation may be pending. When special committees go to Washington, or when special representatives—attorneys, as is often the case—go there to represent the metal-mining, oil, coal, or gas industry, often they and their statements are looked upon with suspicion. They are special representatives of special interests. They do not even speak, as a rule, for all of those concerned in the particular industry under consideration. Consequently, divergent opinions are often expressed, and Congress finds itself in doubt as to what are the facts and what should be done.

The plan Mr. Callbreath has outlined to you for an enlarged organization of the Mining Congress is an ambitious one, and one upon which we must embark slowly and deliberately, because it would eventually lead to the expenditure of a considerable sum of money; but it has for its purpose one important feature, which is to serve all the interests, all the industries combined in the Mining Congress, with the greatest efficiency and promptness.

Until about a year ago the Mining Congress was made up largely of small operators. The larger operators felt that they could stand alone; that when legislation threatened which they felt bound to oppose they could afford to send their representatives to Washington and deal with the problems only as they arose; but within the last year and a half in particular, since we have had extraordinary conditions to meet, I know from personal acquaintance with many of the larger operators that they realize that they cannot stand alone, that they must have the coöperation and association of all, so far as possible, of those who are engaged in the same industry. This, you will realize, makes it possible for the congress to do better work, bigger work, and to rely upon those who are interested to furnish the funds to enable it to carry on such work.

There is a bill before Congress for the relief of those who engaged in the production of chrome, manganese, pyrites, and similar minerals almost entirely at the instigation of the various bureaus and boards at Washington. I do not think this bill could have received the favorable consideration that it already has received, or that we could hope for its successful passage, if the Mining Congress had not been behind it. If representatives of those who are engaged in the production of chrome alone had gone to Washington, they would have been looked upon as special pleaders, and probably no bill could have been introduced with any prospect of success; but, by combining in a section all those who are similarly affected, we have been able to present our cause in such a manner that Congress is ready to recognize the justice of our plea—of our claim that there must be relief—and I think we can safely count on some form of remedy.

The other direction in which most has been accomplished is in the matter of taxation—the revenue law as its provisions are to be drawn, and as they are to be applied to our industry. One can hardly realize how instantly views of members of Congress change unless one is on the ground. Over night the opinion of a committee of Congress may change absolutely from one point of view to another; and it is only by having men on the ground who can present our case and present it well that we can hope to meet the changing opinions of committees of Congress and to meet them in time to avoid even temporary favorable action upon legislation that we cannot accept, or to further legislation that we may very much need.

MINING INDUSTRY AND THE MINING CONGRESS

If we have needed the Mining Congress in the past, and particularly in the last two years, we are going to need it to a far greater degree in the years to come, particularly in this present year. Our problems of the war have been, in a way, easy to meet, because we have known that we had to meet them, and, no matter what the sacrifice, we were prepared to meet them. But all that emergency feature of our operations and mode of doing business has now passed. We have got to get down to good, sane business; not reconstruction, as it seems to me, but readjustment. The congress can aid us immeasurably. It has the machinery; it has, so far as its funds permit, men who are of wide acquaintance in Washington, and who are trying to inform themselves of all our problems. The new plan of organization, when finally developed, will provide one man, a specialist, for each of the industries concerned. That will eventually insure you the most effective service, I believe, that can be developed in any manner. I think I can suggest to you that it is quite proper to look upon your membership in the American Mining Congress, and your subscription to its work, as you look upon insurance.

---

*Abstract from an address by Bulkeley Wells, president, before the California Chapter of the American Mining Congress upon its organization at San Francisco, Calif., on Jan. 16, 1919.

I realize that many of you would like to hear something about the work of the American Gold Conference; but I am unfortunately in the position of an attorney who has presented his case in court, and awaits the verdict of the judge or jury. We went to Washington in November and had the hearing before the committee of the Treasury Department appointed by Secretary McAdoo to investigate the gold situation. The committee was extremely sympathetic, and held hearings which were most pleasantly informal, so that we felt we were able to inform them thoroughly of the really critical situation that exists in the gold-mining industry. Unfortunately for our cause, and for the positive form or forms of relief which we felt were justified, and which we hoped to gain, the emergency of war conditions passed and the need of gold to support our greatly enlarged credits seems to have passed; but we were able, we believe, so thoroughly to impress upon the Treasury Department committee, and upon members of Congress with whom we discussed our problems, that the gold-mining industry was in a critical condition, that they could not deny relief; and we are all confident that the Government will take cognizance of the situation and will provide some form of relief The most probable method through which this may be secured seems to be in the provisions of the revenue law and in its application to mining. If the amendments and new provisions which the Mining Congress, through Mr. Callbreath's efforts, has been able to have at least temporarily inserted in the bill, are permitted to stand, we shall have relief in large degree, and our other problems we shall have to face and work out as best we may.

WAGES AND COST OF LIVING

It seems to me folly to attempt the reduction of wages or adjustment of wages until the cost of living has begun to fall. When that arrives, all of us who are reasoning men know perfectly well that wages will go down; but we must not, in my opinion, try to force the situation until conditions of that nature make it reasonable to ask that men take lower wages. If we are sane and reasonable about it; if we deal with our men open-mindedly and fairly, I believe that we can avert anything like serious industrial disturbances; but if we are quick-tempered, if we begin to force the issue of lower wages before conditions, particularly with respect to cost of living, may warrant it, we are sure to invite disaster, and I urge you all to approach this problem in a conciliatory spirit. The American Mining Congress at Washington can do a great deal to aid; but you in each case must deal with your own problems. I beg you to deal with them reasonably and fairly, as you know you should.

Mining in Eastern Australia

QUEENSLAND CORRESPONDENCE

The copper position here is a delicate one. The Mount Morgan management announces that there is no hope of shipping the product for many months, on account of lack of shipping facilities. A critical time is foreseen by the company, especially in the matter of financing its obligations, and what may be taken to be a definite warning has been issued that employees will have to coöperate efficiently with employers to tide over the crisis. This announcement followed the news of the closing down of several copper concerns in the Mount Elliot district, owing principally to the dislocation of normal operations caused by the influence of the extremist element in the labor party, the officially non-existent I. W. W.

The Australian Workers' Union, which practically covers all mining activity, is attempting the realization of the "one big union" idea. Ballots are being taken, but many local branches are opposed to the proposition. The idea of taking final decisions to a central body does not appeal to the extremist groups which are often found in scattered mining districts.

The Queensland government has taken over the Chillagoe Ry. and Mines, and also the smelteries. The company has had a checkered career, over $25,000,000 having been expended and no dividend declared throughout the 30 years of operation. Four times reconstructed, with share capital written down each time, the selling price is in the neighborhood of $350,000 less than the amount due to the first-mortgage debenture holders.

The state will work the railways, about 250 miles in all; but because of shortage of money the smelteries and mines must wait for a more favorable time. Copper, silver, lead, zinc, and gold are found within an easy radius of the smelteries.

The gold production of Queensland has steadily decreased for many years, and shows a further heavy decline for 1918. It is generally conceded that even when favorably situated and not too far from the coast, a mine, to be profitable, must produce 2-oz. ore as an average, unless in large quantity and easily mined. One mine, 200 miles from Cairns, and 25 miles from the railhead, is making 4 dwt. pay in a small way, but the ore is quarried and is very friable.

There is a slump in mining generally. Costs have risen to such an extent, and labor efficiency is so low, that discouragement is general. The Thermo-Electric Co., operating 100 miles from Cairns, rushed its new works to completion during the war, but is now slackening its activities in the tungsten region. It was expected that over $1,000,000 would have to be expended in mines and mill, but this is practically doubled, and still the output is small. As an example of labor hampering operations, one may quote the fact that the union insists that two men shall be employed on each one-man drill.

No move has yet been made toward promoting gold production in Australia by means of a bonus, but the journals are strongly advocating the measure.

Hair Driving Belts were first considered as an economic possibility as soon as the Chinese as a nation came to the conclusion that the possession of a pigtail was not an essential passport to heaven. A large number of discarded queues were utilized in the manufacture of driving belts, being made up with coarse camel hair and wool rejects

Canadian Mining Institute's Annual Meeting

THE twenty-first annual convention of the Canadian Mining Institute, held at the Windsor Hotel, Montreal, Mar. 5 to 7, was of more than ordinary interest and importance. Many of the papers and addresses had a bearing upon the reconstruction problems now engrossing so large a share of public attention, and a feature of especial significance was the international character of the joint discussions with representatives of American associations, with a view to coöperative action. President D. B. Dowling, of Ottawa, in his opening address gave expression to the general feeling of rejoicing at being able to welcome many of the members returning from service overseas. The Institute, he said, which had now attained its majority, had to do its part in showing the ability of Canada to recuperate under trying conditions. The joint meeting of the American Institute of Mining Engineers with Canadian mining engineers in New York has shown the close bond of sympathy existing between them, and the representatives of the American societies would receive a cordial welcome. Mr. Dowling then referred to the urgent necessity for increasing mining production in order to keep up the supply of raw material for existing industries and to create opportunities for new ones. The members of the Institute should realize their responsibilities in this regard, he said. Much of the success of the work undertaken by the government in developing national resources must be credited to the Geological Survey. An enlarged program of exploitation was being considered and the Minister of Mines was fully alive to the needs of the mining industry.

A number of amendments to the constitution were considered. The most important of these was a proposal by Dr. A. Stansfield to change the name to "The Canadian Institute of Mining and Metallurgy," which excited a keen discussion. It was opposed as being the "thin end of the wedge" to making the Institute a purely technical organization, though its advocates insisted that if it were desired to retain the iron and steel men the scope of the Institute must be broadened. It was finally decided that the matter be referred to the members to be determined by letter ballot. The same action was taken in regard to a proposed amendment as to the qualification of professional members. Amendments were adopted providing for six vice-presidents instead of four, and also that each province shall be represented by one vice-president and five councillors elected by members resident in the province, the maritime provinces being grouped as one province, Manitoba and Saskatchewan being also grouped, and the Yukon included with British Columbia.

John McLeish and T. W. Gibson presented reports of the mineral production of Canada and Ontario respectively. A resolution moved by Dr. W. L. Goodwin, that the Institute urge upon the government the need of paying better salaries to the technical officials of the Department of Mines and similar services, was adopted.

B. C. Lamble read a paper on "The Production of Ferromolybdenum at Orillia," describing the process of concentrating molybdenum ores employed, by which an extraction of 95% had been secured. Previous to the war three-fourths of the supply of molybdenum came from Australia, but production had been so stimulated by the war demand that Canada now produced one-third. H. H. Claudet discussed "Flotation Concentration of Molybdenum," stating that oil flotation had obtained satisfactory results in Norway for some years before the war, and giving a detailed description of the process. The production of molybdenum in Canada in 1918 was 364,000 lb., valued at $962,835. "The New Zinc and Lead Field of Gaspé Peninsula" was the subject of a paper by A. Mailhiot, who stated that mining operations had been carried on in the new township of Lemieux since 1915. The ore yielded about 8% of zinc and 4% lead, and geological conditions indicated that the veins continued downward to a considerable depth.

Dr. Robert Harvie presented a paper on "Occurrences of Chromite in the Eastern Townships," descriptive of the mines in the Black Lake district. In the discussion which followed, the point was brought out that, owing to the irregularity of the orebodies, a large margin of profit on the ore actually produced was necessary in order to make chromite mining remunerative. The main feature of the afternoon session was an illustrated address by G. C. Mackenzie on "An Investigation of Certain Canadian Platinum and Manganese Resources," which was undertaken at the request of the British government to increase the supply of war material. The speaker described the drilling processes employed in Saskatchewan, where the search did not yield satisfactory results, and told of the finding of platinum in the Tulameen district of British Columbia and the discoveries of manganese in that province. He stated that the mining of manganese there would not be commercially profitable unless cheaper power could be obtained, but that the platinum discoveries offered reasonable possibilities for commercial development. The afternoon session closed with an address by J. H. Cole on the salt industry, with special reference to the discovery of rock salt at Malagash, Nova Scotia.

In the evening, Dr. H. M. Ami gave an illustrated lecture on the operations of the British forces in Palestine, comprising a vivid and graphic account of the campaign of General Allenby, interspersed with frequent flashes of humor. The pictures shown were from the official photographs and presented a great variety of scenes showing the arduous character of the expedition and the characteristics of the country. K. G. Chipman, who accompanied the Steffanson exploring expedition to the Arctic regions, described the Coronation Gulf country, in which important discoveries of copper have been made.

On the second day, T. W. Gibson, Deputy Minister of Mines for Ontario, read a paper on the "Principles of Mine Taxation," as an introduction to a joint discussion of the subject with the American Institute of Mining and Metallurgical Engineers. The principal point emphasized by the speaker was that the burden of taxation should be placed on net earnings or profits. Where the value of a mine permitted unusual profits, proportionately heavy taxation was justified. Capital invested in mines should be exempt until returns were made in the form of dividends. The methods of taxation followed in Michigan and Minnesota made no allowance for the unexpected, and exhibited a tendency to discourage exploration.

S. W. Cohen thought that the risk of mining investments should be taken into consideration. There were often heavy preliminary expenditures before mining enterprises were undertaken.

Horace V. Winchell, the recently elected president of the American Institute of Mining and Metallurgical Engineers, who received an enthusiastic welcome, stated that the Michigan and Minnesota *ad valorem* systems of taxation were imposed on account of the necessity of raising a revenue. There was always value in mines, even if they were not producing, and the improvement in the art of concentrating rendered valuable large bodies of ore formerly regarded as worthless.

H. C. Parmelee of New York, editor of *Chemical and Metallurgical Engineering*, spoke on the subject of industrial coöperation, which, he said, was paramount to all political problems. The moral and spiritual forces must prevail in the solution of this question, as they had done in the war, and human relations must be placed on a lofty plane. Neither labor nor capital had a right to hold the community up to ransom. Mr. Parmelee gave instances of the progress of the movement to secure better relations between labor and capital, the first essential to a better understanding being a willingness to get together.

Sir John Willison, of Toronto, made an address on "The Readjustment of Industry, With Special Reference to Mining," urging the necessity for increased production to obtain new sources of revenue to meet the increased national obligations. He spoke of the liberality displayed by the government in encouraging agriculture and contended that the development of the mineral resources should have an equal degree of consideration. The country should not hesitate over giving bounties, if that were necessary to encourage mining. The raw material should be worked up at home, and every process of manufacture carried to the last stage in Canada, subject, however, to the obligations of neighborliness, as exhibited by the United States in making a fair division of the coal supply with Canada. There should be an actual partnership between labor and capital.

Dr. A. B. McCallum, chairman of the Advisory Council of Scientific and Industrial Research, reviewed the work of the Council during the last two years and pointed out the difficulties under which it labored owing to the few men who were qualified for the work. He gave an account of what other countries were doing in the direction of scientific research.

At the afternoon session, the secretary of the Institute read a number of letters received from members with the Canadian forces overseas, regretting that they would not be able to attend the convention and hoping that it might be a successful gathering. The leading feature of the session was the unveiling of the Institute's roll of honor, containing the names of 171 members, who had enlisted for the war, enclosed in an artistic and elaborate memorial tablet. The ceremony was performed by Brig.-Gen. W. O. H. Dodds, C. M. G., who in a feeling and appropriate address expressed his appreciation of the honor conferred upon him and paid a high tribute to the part taken by Canadian engineers in the war, describing some of the principal services in which they were engaged. He was followed by Captain Reynolds, who gave an account of the circumstances of the death of Captain Leroy, a former member, many of those present being deeply affected.

Dr. James F. Kemp, of New York, introduced the subject of a joint discussion with the American Institute of Mining and Metallurgical Engineers, by reading a paper on "A Uniform Mining Law for North America," which covered a very wide field. He spoke of the difficulties in the way of uniformity, owing to the differences in state legislation and the various classes of mines, but hoped for legislation in that direction, providing for square mining claims with vertical rights, only one claim to one man in each district, and leasehold instead of ownership. Vested rights in claims granted under existing laws would, of course, be respected.

Major Andres spoke, urging coöperation in reëstablishing mining engineers in civil life.

T. E. Godson, Mining Commissioner of Ontario, eulogized the Ontario mining laws as approaching perfection as nearly as possible. It was, he contended, a matter of indifference whether a mining claim was held by grant or lease, so long as continued development was an essential condition of possession. Inaction could be prevented by imposing a tax. He believed in the principle of making valuable discovery a condition to location of claim.

The election of officers for the ensuing year resulted as follows: D. H. McDougall, New Glasgow, N. S., president; B. Neilly, Cobalt, and John F. Stirling, Edmonton, Alta., vice-presidents; and Prof. John A. Allan, Edmonton, Alta.; R. C. Wallace, The Pas, Man.; Thomas Cantile, New Glasgow, N. S.; Alfred J. Yonge, Glace Bay, N. S.; Robert A. Bryce, Toronto; E. T. Corkill, Copper Cliff, Ont.; George H. Gillespie, Madoc, Ont.; James G. Ross, Montreal; and H. Y. Russell, Montreal, councillors.

In the evening of the second day a smoker was held, with an entertainment of moving pictures showing the Canadian troops on the Western front. Addresses were made by Maj. R. W. Coulthard, Capt. L. B. Reynolds, and other returned soldiers.

Iron, steel, and metallurgy were the main topics of the papers and discussions on Mar. 7, with D. H. McDougall, the newly elected president, in the chair. Dr. W. L. Goodwin discussed the "Titaniferous Iron Ores," which, he stated, were widely distributed in Canada, and of which there was a large deposit in the Rain River district of Ontario. He urged the development and smelting of these ores. Difficulties had been found in their treatment, but these could be overcome by a change in blast-furnace practice. Vanadium was present in the titaniferous ores and would be a valuable byproduct. In the discussion which followed Dr. Kemp, G. C. Mackenzie, H. B. Greensted and others expressed the opinion that no insuperable difficulty would be met in smelting of titaniferous ores, though furnace men were generally prejudiced against them. It was pointed out that one reason for this was that titaniferous ores were generally magnetites and required a greater degree of heat than hematite, and where they had been used mixed with other ores the results usually had been unsatisfactory.

Maj. R. W. Coulthard read a paper on "Tunnelling on the Western Front," giving a detailed description of the methods of underground military engineering, and a graphic description of mine explosions.

B. F. Haanel contributed a paper on "Liquid Fuels—Their Uses, Production, Consumption and Sources in Canada," which treated mainly of the possibilities of developing the oil shales to supply the rapidly increasing demand for oil. The annual consumption of oil in

Canada amounted to 387,000,000 gal. The oil fields were steadily declining, and the newly developed fields had not come up to expectations. The total annual production of all kinds of oil in Canada was about 27,000,000 gal. The shale-oil industry of Scotland, begun in 1860, yielded handsome profits, but the output was now decreasing. Efforts had been made to develop the New Brunswick oil shales, but they had been unsuccessful, owing to failure to employ men with an intimate knowledge of the industry. The Scotch shales yielded valuable byproducts. The paper also referred to the oil recovered as a coke byproduct, and from natural gas, and the alcohol produced from sulphite liquor.

At another meeting, attended by many of the members concurrently with the general proceedings, the proposal of the Advisory Council for Scientific and Industrial Research to establish a central laboratory at Ottawa on a large scale was the subject of a keen discussion. Strong objections were voiced by several, on the ground that hitherto researches of this kind had been carried on by the research departments of the universities, which should retain control of any movement in this direction.

The first paper presented at the afternoon session was by E. P. Mathewson and W. L. Wotherspoon on "The Application of Pulverized Fuel in Blast Furnaces." It described experiments carried on at the plants of the Tennessee Copper Co. and the International Nickel Co., which, it was claimed, had demonstrated that important economies could be effected by the use of pulverized coal, and had given the companies every inducement to continue working in this direction.

Dr. Alfred Wilson brought up the question of the proposals of the Advisory Council, on which the meeting held in the morning had taken no action. He said it was understood when the Council was created that its functions were merely advisory, but it was now taking the initiative. He moved that the matter be referred to the Executive Council of the Institute for consideration and investigation. The resolution was adopted.

"Some Equipment of a Modern Copper Smelter" was the subject of a paper by E. J. Carlyle.

A paper by E. E. Campbell gave a detailed account of "Mining Methods at the Granby Company's Copper Mines at Anyox, B. C.," which produce annually 30,000,000 lb. of copper. Operations are carried on to a depth of 1000 ft. There are large bodies of ore carrying an average of 2.37% copper, and other deposits, though low in copper, are high in sulphur. A valuable feature of the paper is a statement of the detailed costs for every year since the company began to operate.

R. W. Brigstocke urged coöperation among small mines, showing the advantage of combination among mine owners to secure the assistance of experts, and how economies could be effected by coöperative purchasing. Many projects for improving the condition of mine workers, which would be too costly to be undertaken by individual mine owners, could easily be carried out by united action.

A paper on "Iron Deposits on the Belcher Islands, Hudson Bay," was read by Dr. E. S. Moore. Though the iron formation is widely distributed over the islands, the better grade ore is interbedded with leaner material and Dr. Moore said he does not regard iron mining there as an economic possibility.

W. Fleet Robertson presented a paper on "Internal Corrosion of Wire Cables," having special reference to an accident in British Columbia occasioned by the breaking of an apparently strong cable, by which 16 miners lost their lives. The cable had been weakened by internal corrosion not visible upon the surface. Mr. Robertson stated that defects arising from this cause could be discovered by electrical tests. The only way to prevent such corrosion, he said was to lubricate cables with hot oil.

Many of the papers presented at the various sessions were illustrated with lantern views.

The annual banquet was held in the evening at the Montreal Club, the principal speaker being the Duke of Devonshire, Canadian Governor General, who was welcomed on behalf of the Institute by President D. H. McDougall and was accorded an enthusiastic reception. He congratulated the members of the Institute on the excellent work accomplished at the convention, and dwelt upon the need of research work if advantage were to be taken of the opportunities presented by the natural resources of the country. If the fullest use were made of them, the future could be faced with the greatest confidence. Prof. John A. Dresser, who officiated as toastmaster, proposed the health of the retiring and newly elected presidents, to which both gentlemen replied briefly. Horace V. Winchell extended the cordial greetings of the American Institute of Mining and Metallurgical Engineers to the Canadian Institute, and expressed the hope that the mutual good will and friendly coöperation now prevailing between Americans and Canadians might long continue. Speeches were also made by Dr. H. M. Payne, of the American Mining Congress; F. S. Keith, representing the Canadian Engineering Institute; A. D. McTier, vice-president of the Eastern lines, Canadian Pacific Ry.; Bradley Stoughton, on behalf of the American Institute of Mining and Metallurgical Engineers; Prof. E. A. Holbrook, of Washington, and others.

Keep Up the Habit

Those Americans who have not been in the fight, and who have sounds skins and good health, are still in the war and will be for some time. It was easy to economize, to stint oneself and actually go without some necessities under the stimulus of the fever of war. Patriotism impelled everyone to do what he thought was his share. That impelling force has disappeared since Nov. 11, but the necessity of real patriotism is just as imperative as it was before that date.

Patriotism may be the habit of good business, the habit of thoughtful buying, the habit of intelligent saving, the habit of investing safely. The merits of these habits no one may question. They do not belong to war times; they belong to all times. By careful spending, by getting the full value for every dollar spent, one is saving intelligently, and the saving, no matter how large or small, is worth placing to capital account. Self-interest and the interest of one's family demand that this be safely invested. The Government has made this easy and attractive by its issuance of thrift stamps and war-saving certificates. As far as it is humanly possible to make them so, these are safe and productive investments.

By conducting one's affairs on good business lines; taking no unnecessary risks, getting the worth of his money, and investing his savings intelligently, it is possible to do a large part of that which the Government and patriotism call for.

Company Reports

Ray Consolidated Copper Co.

The Ray Consolidated Copper Co. report for the fourth quarter of the calendar and fiscal year 1918 shows that the gross production of copper contained in concentrates was 19,601,149 lb., equivalent to an average monthly production of 6,533,716 lb. In addition to the copper derived from the concentrating ores, there was a total of 774,009 lb. contained in the ores sent direct to the smeltery, making the total gross production from both sources for the quarter, 20,375,158 lb., as compared with 21,180,199 lb. for the third quarter.

The gross production for the year 1918 was 86,919,270 lb., as compared with 92,207,356 lb. during 1917.

During the last quarter of 1918, 805,600 dry tons was milled, averaging 1.621% copper. This tonnage corresponds to a daily average of 8757 tons, as compared with 9189 tons for the previous quarter.

The mill extraction for the quarter was 75.05% of the total copper contained in concentrating ores, as compared with 75.18% for the previous quarter. The underground development for the quarter was 5639 ft., making the total development to date 685,276 ft. The milling cost for the quarter was $0.95647 per ton, as compared with $1.13340 for the previous quarter. The average mining cost of ore milled for the quarter was $1.90526 per ton, of which 10.301c. was the cost of coarse crushing, leaving the net mining cost $1.80225 per ton, as compared with $1.86493 for the previous quarter.

The average cost per lb. of all net copper produced for the quarter was 19.305c. This cost does not take into account any credits for the value of the gold or silver nor for miscellaneous income, and compares with a cost of 20.283c. for the previous quarter. These costs include a charge of 15c. per ton of ore milled for the retirement of mine-development expense.

The financial results of operation for the quarter, compared with the third, second, and first quarters of 1918, are as follows:

FINANCIAL OPERATIONS OF RAY CONSOLIDATED COPPER CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net operating profits	$294,013 96	$789,699 86	$2,132,427 17	$1,016,911 07
Miscellaneous income.	114,099 35	93,648 48	122,790 31	88,951 58
Total	$408,113 31	$883,348 14	$2,255,217 48	$1,105,862 65
Disbursements to stockholders	1,182,884 25	1,182,884 25	1,182,884 25	1,577,179 00
Net deficit for the quarter	$774,770.94	$299,535 91	$1,072,333 23a	$471,316 35
a Surplus				
Surplus Dec. 31, 1917			$16,890,195 62	
Total income		$4,652,541 78		
Dividend disbursements ($3.25 per share)		5,125,811 73		
Net deduction from surplus			473,289 97	
Surplus Dec. 31, 1918			$16,416,905 65	

These figures are subject to such adjustments in the annual report as may be necessitated by recomputation of taxes and other entries when the company's accounts are audited by its certified accountants.

A quarterly distribution to stockholders of 75c. per share was paid Dec. 31, 1918, and amounted to $1,182,884.25. Total of such distributions from beginning of company's operation to the end of fourth quarter amounted to $20,681,083.67.

Chino Copper Co.

The report of the Chino Copper Co. for the fourth quarter of the calendar and fiscal year 1918 shows that the gross production of copper contained in the concentrate from milling operations was 20,121,391 lb., or an average monthly production of 6,707,130 lb. In addition to the copper extracted in concentrate form, a total of 101 dry tons of crude ore was shipped from the mine, containing 17,577 lb. The total gross production, therefore, from all sources for the fourth quarter of 1918 was 20,138,968 lb. The total gross production of copper from all sources for the year 1918 was 79,340,372 lb., as compared with 83,339,782 lb. for 1917.

The total amount of ore treated for the last three months of 1918 was 991,400 tons, being an average of 10,776 tons per day. This average daily tonnage is 646 tons per day more than for the third quarter of 1918. The average copper content of the ore treated in the mill for the fourth quarter was 1.705%, compared to 1.623% copper during the third quarter of 1918.

The extraction per ton of ore milled for the fourth quarter of 1918 was 20.30 lb. gross, compared to 20.87 lb. gross for the third quarter of 1918. A total of 73,719 dry tons of concentrate was produced, averaging 13.65% copper, compared to 71,881 dry tons, averaging 13.53% copper, for the third quarter of 1918.

The cost per lb. of net copper produced from milling operations and the crude ore shipped to the smeltery for the fourth quarter, after allowing for smeltery deductions, was 18.10c., compared to 19.08c. for the third quarter. The gold and silver paid for from concentrate produced during the fourth quarter amounted in value to $14,344.27. The net revenue from miscellaneous income in the fourth quarter amounted to $25,046.96. The character of the ore treated during the fourth quarter was less favorable to concentration than that of the ore treated during any quarter of the year 1918, owing to the high carbonate, oxide, and copper silicate content.

These figures are subject to such adjustments in the annual report as may be necessary because of recalculation of taxes and other entries when the company's accounts are audited by its public accountants.

The earnings for the fourth quarter are based on a price for copper of 18.24c. per lb., compared to 24.65c. per lb. for the third quarter, 26.61c. for the second quarter and 20.97c. for the first quarter. A dividend amounting to $1 per share was declared in the fourth quarter of 1918.

During the fourth quarter the steam shovels at Santa Rita removed a total of 1,141,070 cu.yd. of material, or an average of 380,357 cu.yd. per month, compared to a total of 1,225,530 cu.yd. of material during the third quarter, or an average of 408,510 cu.yd. per month. Of the total material removed during the fourth quarter, 717,482 cu.yd. was stripping, the remainder being equivalent to 845,092 tons of ore of an average grade of 1.73% copper. During this quarter a total of 39,234 tons of ore was removed from the No. 1 ore stockpile and shipped to the mill. The ore removed from the stockpile contained an average of 1.195% copper.

The financial results of the company's operations for the fourth quarter, compared with the preceding quarters of the year, are as follows:

FINANCIAL OPERATIONS OF CHINO COPPER CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net operating profit, miscellaneous income, etc.	$66,800.92	$1,035,749.22	$1,916,513.11	$1,124,253.96
Dividends paid	869,980.00	869,980 00	869,980.00	1,304,970.00
Net surplus		$165,769.22	$1,046,533.11	
Net deficit	$803,179.08			$180,716.04

		Per Share
Total income	$4,143,317.21	$4 76
Dividend disbursements	3,914,910.00	4.50
Net addition to surplus from operations	$228,407.21	$0.26

Utah Copper Co.

The statement of the Utah Copper Co. for the fourth quarter of the calendar and fiscal year 1918 shows that the total amount of copper contained in concentrates was 48,303,692 lb., or an average monthly production of 16,101,231 lb. In addition, 180,220 lb. of copper was contained in copper sulphide ore shipped direct to the smeltery, and 754,164 lb. contained in precipitates from the leaching plant, making a total gross production for the quarter of 49,238,076 lb. The total gross production of copper for 1918 from sulphide-ore shipments was 1,378,392 lb.; from mine precipitates, 35,481 lb., and from leaching plant precipitates, 2,396,095 pounds. The total gross production for 1918 was therefore 197,978,557 lb., as compared with 206,174,442 lb. for 1917.

The total quantity of ore milled during the quarter was 3,047,400 tons, or a decrease of 365,300 tons as compared with the third quarter. The average grade of the ore was 1.23% copper, as compared with 1.20% copper for the third quarter of the year, and the average extraction was 64.43%. The percentage of recovery was low, partly because of the unsettled operating conditions in the mills, owing to the various improvements under way, but principally because of the unusually large tonnage treated and the comparatively low copper content in the headings.

The average cost per lb. of net copper produced from concentrates was 17.65c., and the cost per net lb. of all copper produced from concentrates, sulphide ore, and leaching plant precipitates was 17.88c. per lb., as compared with 16.81c. for the previous quarter. No credits are made to costs in either case on account of income from gold and silver or miscellaneous sources. The value of the gold and silver in ore and concentrates totaled $378,989.59, and the miscellaneous income amounted to $254,214.95. These items combined are equal to 1.35c. per net lb. of copper produced. The comparatively high cost for the quarter was due partly to the increased smelting and refining charges, increased freight rates, and high wages, and also partly to decreased production.

The financial results of the operations for the quarter, as compared with the preceding quarters of the year, are as follows:

FINANCIAL OPERATIONS OF UTAH COPPER CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net profit from operations	$1,577,138 21	$4,169,697 66	$5,483,812 74	$2,576,654 04
Other income, rents, etc., in Utah	254,214 95	139,938 93	259,188.83	233,509.60
Income from Nevada Cons. Copper Co. dividends	750,375 00	750,375 00	750,375.00	1,000,500.00
Income from Bingham & Garfield Ry. Co. dividends	750,000.00	250,000 00		
Total net profit	$3,331,728 16	$5,310,011.59	$6,493,376.57	$3,810,663.64
Disbursements to stockholders	4,061,225.00	4,061,225.00	4,061,225.00	4,061,225 00
Net surplus		$1,248,786.59	$2,432,151.57	
Net deficit	$729,496.84			$250,561.36

		Per Share
Total net income	$18,945,779.96	$11 66
Dividend disbursements	16,244,900.00	10.00
Net addition to surplus from operations	$2,700,879 96	$1 66

The earnings for the fourth quarter are computed on the basis of 20.44c. per lb. for copper, as against a basis of 24.04c. for the third quarter, 25.21c. for the second quarter, and 21.26c. for the first quarter. The comparatively low carrying price of copper for the fourth quarter is due to the sales having been considerably less than the production. The regular quarterly cash dividend of $2.50 per share was paid on Dec. 31.

During the period a total of 925,606 cu.yd. of capping was removed, as compared with 1,082,280 cu.yd. for the previous quarter. The total amount of capping removed during 1918 was 4,064,091 cu.yd., being an average of 1,016,023 cu.yd. per quarter and 338,674 cu.yd. per month, as compared with 4,271,868 cu.yd., 1,067,967 cu.yd. and 355,989 cu.yd., respectively, during 1917.

United Verde Extension Mining Co.

A report of the operations of the United Verde Extension Mining Co. for the year ended Dec. 31, 1918, shows that the new smeltery was put in operation in July and is now treating all the ores produced by the company's mine. Since starting operations 71,257 tons of company ore has been treated, which produced 23,229,335 lb. of copper, 2431 oz. gold, and 279,414 oz. silver, an average of 326 lb. of copper, 0.0341 oz. gold, and 3.92 oz. silver per ton. The plant also treated 3435 tons of custom ore, which produced 292,951 lb. copper, 59 oz. gold, and 4657 oz. silver.

Prior to starting of operations at the smeltery, the company shipped during 1918 to the different custom smelters 62,277 tons of ore.

The new plant is a model one in every particular, equipped with every modern improvement and capable of the most economical operation. It has a capacity of approximately 1000 tons daily, and was designed by A. G. McGregor and staff, of Warren, Ariz. T. A. Stiles was superintendent of construction, assisted by Barry Hogarty, who is now superintendent of the plant.

On Jan. 1, 1918, a total of 20,860,622 lb. of copper was on hand, represented by ore in transit, bullion in transit, and bullion in process of refining. This, added to production for the fiscal year, makes a total of 82,110,916 lb. Of this amount the company has sold 54,126,107 lb., at an average price of 24.145c. per pound.

Mine—Underground development work done in 1918 amounted to 10,919 ft., consisting of 1583 ft. of drifts, 1880 ft. of raises, 301 ft. of shaft, and 7155 ft. of haulage tunnel.

No prospecting work was done in 1918, and no new orebody developed. Development work will be undertaken in an active manner on the completion of the Audrey shaft. During the year this shaft was concreted and completed to the 1400 level and is in operation to that depth. Further, it has been sunk to the 1700 level, with a good sump in the bottom. The cutting of a pump station and ore pockets for the shaft is now in progress. Preparation for concreting the lower 300 ft. has been made, and it is expected that this work will be completed by Apr. 1, when drifts will be started on the 1500, 1600, and 1700 levels, and it will be necessary to drift a distance of about 900 ft. to get under the orebody.

TONNAGE SMELTED AND COPPER PRODUCTION OF UNITED VERDE EXTENSION MINING CO., 1918

	Tons	Copper, Lb.	Gold, Oz.	Silver, Oz.
Company ore by custom smelters.	62,277	32,261,742	615	224,325
Company ore by company smeltery.	71,258	23,229,335	2,431	279,414
Total company ore	133,535	55,491,077	3,046	503,739
Custom ore by company smeltery	3,435	292,951	58	4,657
Totals	136,970	55,784,028	3,104	508,396
On hand at company smeltery:				
Company ore	15,577	3,955,359	467	102,270
Custom ore	3,458	194,598	30	1,395
Byproducts		1,316,309	129	17,379
Totals	19,035	5,466,266	626	121,044

	Copper, Lb.	Gold, Oz.	Silver, Oz.
Average per ton company ore shipped to custom smelters	518	0.001	3.60
Average per ton company ore shipped to company smeltery	328	0.035	4.59
Total average per ton company ore	407	0.024	4.18

As the result of increasing knowledge of the orebody, and because of the ability to handle the lower-grade ores at a profit at the smeltery, the methods of mining have been improved. The adoption of new systems of stoping is resulting in greater security and the lowering of costs. A system of waste raises from the stopes to the surface, to provide cheap and sufficient filling for the stopes, has been partly completed. A ventilation raise has been driven to the surface to provide for future ventilation, and a second connection to the Daisy shaft has been provided for present needs. Measures for the promotion of safety in the mine have been introduced, with a resulting decrease in the number of accidents to the men.

Electric Sub-Station—An electric sub-station has been installed at the mine, together with high-voltage lines connecting both the company's smeltery and the Arizona Power Co.'s sub-station. Through this medium high-voltage current can be taken from either the smeltery lines or the Arizona Power Co.'s lines and transformed into proper voltage for mine use. The company is now in a position to cope with the serious power interruptions formerly occasioned by electric storms.

Tunnel—The main haulage tunnel, after considerable difficulty had been experienced with water and soft ground between the Texas shaft and the portal, has been opened through in that section and is progressing rapidly between the Texas shaft and the section east of the Audrey shaft. At Dec. 31, 1918, only 1180 ft. remained to drive to complete the connection. Work on finishing of the tunnel has begun at the portal. The sides will be trimmed down and supported by timber or concrete through the soft ground. Ample provision is being made for handling the water which is now running or which may be encountered from the lower levels of the mine. This work will necessarily be slow in some portions where heavy ground has been encountered. It is difficult, therefore, to estimate when the tunnel will be fully completed and put in operation. When completed, all ore will be shipped direct from the mine to the smeltery without change of cars, and the use of the present aërial tramway, the capacity of which has been severely taxed, will be discontinued.

New Buildings—The company hotel, situated in close proximity to the mine, has been completed, and furnishes comfortable quarters for about 80 of the employees, and is a desirable and attractive feature of the company's surface equipment.

Additions have been made to the mine office buildings, providing more suitable quarters for the general manager and the engineering staff. Twelve houses for mine and smeltery employees have been constructed at convenient locations. The company has also leased ground and loaned the necessary money to employees who desire to build their own houses. Under this arrangement about 20 houses have been built and are being paid for by the company's employees in monthly installments.

Plans for the new town to be built near the smeltery have been completed, grading of the streets has begun, and construction of houses will be started at an early date. An ice plant with a capacity of 20 tons a day has been constructed and put in operation.

Management—In conclusion, the directors mention George Kingdon, general manager, in terms of commendation, and express their appreciation of the loyalty and coöperation shown by the heads of departments, superintendents, foremen, and other employees in 1918.

Mount Morgan Gold Mining Co., Ltd.

The semi-annual report of the Mount Morgan Gold Mining Co., Ltd., of Mount Morgan, Queensland, covering the latter half of 1918, shows that the total revenue from all sources amounted to £548,485 12s. 10d. Expenditure charged to profit and loss account, including development and depreciation, was £462,000 6s. 9d., leaving a surplus of £86,485 6s. 1d., from which one dividend, aggregating £50,000, was paid on Aug. 1. The balance brought forward from last account amounted to £98,735 11s. 0d., making a total balance to be carried forward of £155,220 17s. 1d.

The contract for the sale of the Australian output of refined copper, through the Copper Producers' Association Proprietary, Ltd., expired on June 30. After long negotiation, the association was successful in securing the assent of the British munitions department to a renewal of the contract. This extension expired on Dec. 31, 1918, and all efforts to obtain a further contract were unsuccessful.

At the concentrator, 115,466 tons of ore was treated and 41,321 tons of concentrate produced. The final products amounted to 3580 tons of refined copper and 42,942 oz. of gold.

Ore Dressing and Metallurgy

The value of subaëration as a factor in successful flotation work on certain types of material has been demonstrated in many instances. The notes on this subject which follow were written by a well-known authority, whose researches have contributed, in no small measure, to metallurgical advance during recent years.

Replacing a laced belt on a pulley involves some danger, even to an experienced millman, apart from the possibility of straining the shaft or weakening the belt joint. The suggestion offered will add another feasible method for achieving the desired result, although experimenters will wisely refrain from expecting immunity from danger without exercising care. In many cases the belt is narrow and the task is easy. In other instances it may happen that a risk must be taken to save time or labor.

Many contrivances have been designed to permit adequate and facile control of valves and similar regulating apparatus. In the account here given a device is described which has been designed to permit the alteration of direction of the flow of gas used as fuel in a gas-fired furnace, and several novel features will be noticed.

Function of Sub-aëration in Flotation*

By H. K. Picard

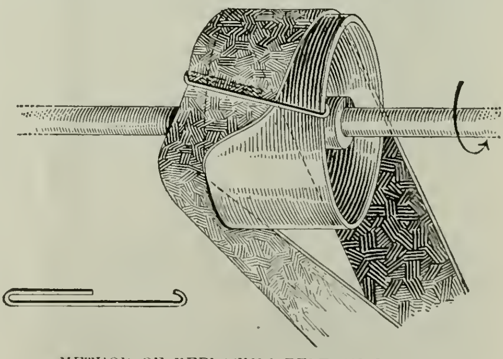
In sub-aëration plants the air is introduced in regulated quantities, as desired, at the bottom of the separation vessel, the top being baffled to prevent further air from being drawn in by vortex action. The latter was the method of aëration usually adopted in the standard type of separating unit, where it was not necessary to limit the air supply closely, and large volumes were introduced into the pulp by vortex-effect. Sub-aëration was specially valuable in the differential flotation treatment of slimes, though not so efficient for the general flotation of coarser material. Less oil was demanded in sub-aëration; and this was of importance when treating slime, as with the larger amount of oil required in the ordinary process, portions of fine gangue slime tended to absorb some of the oil, and to become flocculated; and in this condition they were liable to be caught up in the mineral froth and thus to lower its grade.

The influence of sub-aëration as one means for aiding in selective flotation here became evident. At first, flotation practice was limited to the separation of *all* the more readily floatable minerals (mainly sulphides) from those less easily floated (gangue and oxides)—between which a wide difference exists. As it became apparent that smaller differences in floatability also existed between the various sulphides themselves, methods (indiscriminately termed "selective," "differential," or "preferential") were devised to take advantage of the fact. Obviously, these developed along the line of limiting the factors conducive to flotation—both in nature and extent—to a degree which would permit the flotation only of the more readily floated sulphides, i.e. those which tended to float under "minimal" conditions. As many factors were concerned, and sharp differentiation between these was not possible. Selective flotation did not yet afford close separations between mixed sulphides; thus the results obtainable are rather of the order "less or more." The amount of oil or other flotation agent, the volume of air, conditions which affect flocculation or the reverse, acidity or alkalinity of circuit, being some of the main factors, it would be evident that sub-aëration plant items in which the induction of air could be carefully controlled are indicated as one type of apparatus capable of giving effect to this and other limiting conditions.

Replacing Transmission Belts*

The accompanying illustration shows a simple device for replacing belts on pulleys in those cases where it is necessary to shut down to do so.

A piece of $\frac{5}{16}$- or $\frac{3}{8}$-in. round iron is bent as shown. The end with the shorter hook is placed against the pulley iron and the other under the belt, as indicated. Power is applied slowly; and, when the belt is in position, and provided that the iron used is sufficiently light, the short hook will straighten out and the device disengage itself without the necessity of again stopping the machinery.



METHOD OF REPLACING BELT ON PULLEY

---

*Abstracted from *Bull.* 171, I. M. M., Dec. 12, 1918.

*Abstracted from *Coal Age*, Dec. 19, 1918, p. 1105.

Reducing Wear on Conveyor Belts

The life of a conveyor belt is often shortened unnecessarily because of the damage done by the constant impact of sharp-edged pieces of material on the rubber surface. This may be reduced to a considerable extent by passing the ore over a screen and by delivering the undersize to the belt before the coarser particles.

The bottom of the chute leading to the belt conveyor is removed and replaced by a small grizzly, with the bars spaced so that only fine material will pass through. In the operation of this modification, such material will form a bed on which the coarser particles will impinge, thus reducing, to a considerable extent, the damage usually done to the surface of the belt.

Stationary grizzlies of this kind are unsuitable if the feed is at all damp or sticky, so that the method described is of practical application only in those instances where efficient screening under such conditions is possible.

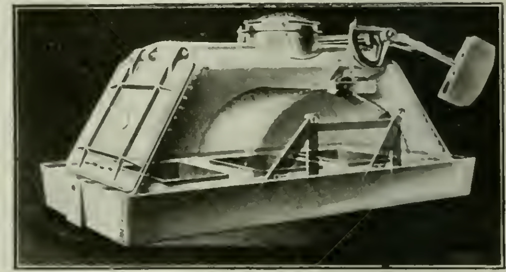
A New Gas-Reversing Valve

In the operation of any gas-fired furnace it is highly desirable that the valve controlling the direction of the flow of gas shall operate rapidly and easily. The design of a new gas-reversing valve which has been placed upon the market by the Wellman-Seaver-Morgan Co., of Cleveland, Ohio, permits a 36-in. hand-operated valve to be reversed in from 3 to 7½ sec. with a pressure of not over 25 lb. This is accomplished by a perfectly balanced hood and counterweights. An equally important feature is that the operating mechanism is outside of the casing, where it is easily accessible and always cool.

The general design and construction of the new valve, which is similar in principle to the well-known Forter valve and is interchangeable as to ports and clearances, are clearly shown in the phantom view. The valve consists of an outer casing, a base with three ports, a hood to connect two ports, and the operating mechanism. The center port is connected to the chimney. Waste gases from the furnace flow from whichever outside port the hood is covering to the chimney port. This leaves a clear passage for the fuel gas or the air entering the casing through the mushroom valve at the top to pass through the third port to the furnace regenerator. Reversal of the flow of gas or air is accomplished by moving the hood to a position over the center port and the one previously uncovered. The base of the valve is a cast-iron rectangular pan with three walled circular openings or ports. The hood which covers the center and one end port is semi-elliptic in form and made of steel plates with angles at the bottom to support a fire-brick lining.

The base pan holds a quantity of water so that when the hood is covering the ports a water seal is formed to prevent the escape of gas. The base pan has a tapped hole at each end for a water pipe. There is a perforated strainer at the intake end and a dam plate at the other end to hold the water at such a level as to allow the hood to extend 3 in. into the water forming the seal. The outer casing is made of steel plate and lined with fire brick. It has cast-iron door frames and a door at each end through which the hood may be removed or inserted. Each door has a small peek-hole with a swinging cover which makes possible inspection at any time. On the top of the casing is a cast-iron neck which connects either with the fuel-gas flue or the air intake, depending upon the purpose for which the valve is used.

The hood is moved by a series of levers and coupling shafts which extend through the water under the casing and into sockets on the hood. The shafts move on chilled-iron bearings. With all hand-operated valves, a special stand is furnished as well as six sheaves with hangers, clamps, and feet of wire rope. At each side of the valve is a counterweight attached to an arm and sector over which passes a chain connecting with the supports of the hood. The form of this sector is such that the counterweights balance the weight of the hood at any position.



PHANTOM VIEW OF GAS-REVERSING VALVE

The Wellman-Seaver-Morgan valve has the following distinct advantages, the combination of which will be found in no other valve used for reversing the gases of melting or heating furnaces: The semi-elliptical form of the hood allows free flow of the gas, as there are no abrupt turns or constricted areas in the passage formed by the ports and hood. This feature is important in obtaining maximum efficiency from the stack draft. All leakage or waste of gas is prevented by the water seal. Such a seal does away with all packing, tightening, and adjusting, the only attention required being the flow of a small quantity of water into the bed plate to replace the amount evaporated. Owing to its compactness, the valve requires comparatively little floor space and adapts itself to various arrangements of flues from the regenerators to the stack. The weight of the hood is counterbalanced by the weights of the lever arm in such a way that the hood is in balance at any position, so that to move the hood it is necessary to exert only enough force to overcome friction. This is an important feature in hand-operated valves.

The hood and casing are lined with fire brick, and all working joints are protected from the hot gas. Bearings and wearing parts are designed with a high factor of safety. There are chilled bearings in the bed plate for the rocker arms and hardened links and pins on the hood-supporting arms. The construction is such that all parts may be easily inspected and removed. The doors at each end of the outer casing are large enough to allow the hood to be removed. The reversing mechanism does not require the removal of bolts or nuts in placing or removing. The levers, links, and pins of the operating mechanism are on the outside, thus permitting oiling and adjustment and insuring long life and easy operation.

Industrial News from Washington

By Paul Wooton, Special Correspondent

New Industrial Board Plans Campaign

Pilgrimages to Washington by the producers of basic raw materials, as well as by representatives of finished-products industries, are soon to begin again if attention is paid to the appeal of the new Industrial Board of the Department of Commerce. The board, which is headed by George N. Peek, formerly a member of the War Industries Board, has been at work quietly for more than a month and has its campaign prepared. The plan is to center efforts in a sharp, intensive movement, the success of which, it is admitted, will depend entirely on the degree of coöperation which will be accorded by private enterprise. What it is hoped to accomplish is shown by the following excerpt from a statement authorized by the board on March 10:

(a) The condition must be cured as it was caused. It was not caused by the normal operation of the law of supply and demand, but by general, comprehensive coöperation and agreement between industry and the Government. It must be cured by the same kind of coöperation and agreement—a consummation possible only at the instance and with the approval of the Government.

(b) Wholesome coöperation in American business at governmental instance was proved in the War Industries Board. Governmental control, as practiced by the War Industries Board, is no longer necessary, but coöperation and agreement in industry at governmental instance and with governmental approval is necessary to bring the law of supply and demand back into normal operation and to let loose prosperity.

(c) To this end the President has authorized a board, largely of War Industries Board men, operating on War Industries Board ideals, minus War Industries Board control, to call industry together group by group, and let them decide on prices to be offered to the nation as the governmentally approved adjustment of assembled industry on a price scale low enough to be stable, homogeneous throughout the whole fabric and founded so solidly on a comprehensive review of conditions as to encourage general buying, including that of the railroads and other governmental agencies, and the resumption of normal activities.

In its consultation with industry, the board has met certain objections, which it has attempted to answer. These objections and the answers are:

Objection (a). Business resents governmental interference and control, which is to be avoided rather than encouraged. Let conditions alone, and the law of supply and demand will cure all evils.

Answer: The war developed a new thing in Government—coöperation and mutual help between Government and industry in which Government appeared not as a policeman and not as a jealous guardian of a suspicious character, but as a friend and helper. This idea proved itself. What is proposed is not governmental control. The board has no power of control. It is proposed to provide a forum in which industry can meet and agree on a policy for itself at the instance and with the approval of the Government, which will help the law of supply and demand over the gap between holdover war prices and a stable level.

Objection (b). Business and industry will not come into a governmental conference unless there is a power of compulsion.

Answer: The experience of the War Industries Board utterly disproves this criticism. It has been argued that patriotism impelled business and industry to the War Industries Board. Patriotism is not adjourned with the closing of the war.

Objection (c). War prices were fixed at such a level as to insure the production of many high-cost and inefficient producers. What is proposed would shut off this production.

Answer: This production is not needed in peace. The American people cannot be expected to support inefficiency in the enterprises that serve them with the necessaries of life or to maintain production not normally needed. Inflated production above that which would be supported by the law of supply and demand must cease.

Objection (d). Such readjustment must necessarily require redistribution and readjustment of labor.

Answer: This is quite true. It is necessary. The distribution and allocation of labor to war industries have upset the normal pattern in this country for four years. What is proposed is a stimulated peace industry which will employ as much or more labor as did war industries, especially considering the loss of man-power, due to decreased immigration, loss by influenza, war, and probably increased Army and Navy. That it will employ them in different places and at different tasks is inevitable, whether the proposed step is taken or not.

Objection (e). A general reduction in selling prices now will force industry and commerce to take a loss on products purchased at war prices.

Answer: This is true and inevitable, whether the proposed plan is attempted or not, but under the proposed plan better adjustments are possible: Buying will begin immediately, the overhead of continuing high-cost operations through a period of stagnation is eliminated, and, finally, much of the loss will be recouped by buying at fair prices and selling in the inevitably increasing market that will result from the normal operation of the law of supply and demand under prosperous conditions.

The personnel of the board is as follows: George N. Peek, chairman, Moline, Ill., formerly vice-president Deere & Co.; Samuel P. Bush, Columbus, Ohio, president, Buckeye Steel Castings Co.; Anthony Caminetti, Washington, D. C., Commissioner of General Immigration, Department of Labor; Thomas K. Glenn, Atlanta, Ga., president, Atlantic Steel Co.; George R. James, Memphis, Tenn., president, William R. Moore Drygoods Co.; T. C. Powell, Cincinnati, Ohio, director, capital expenditures, Railroad Administration; and William M. Riter, West Virginia, president, W. M. Ritter Lumber Company.

Restriction of Potash Imports Asked

Failing in his effort to secure consideration of his bill licensing the importation of potash, Senator Henderson has presented a petition, signed by 35 members of the Senate, to the War Trade Board, asking that imports be restricted to the point where the domestic industry will be able to live. Though the board has taken no action as yet on this petition, it declined a similar request some months ago made by Van. H. Manning, director of the U. S. Bureau of Mines. At that time, the War Trade Board held that its powers were not intended to cover the granting of what is tantamount to a protective tariff.

War-Minerals Commission Authorized

Awards under the new statute providing for relief to certain producers of war minerals will be passed upon by a commission just authorized by the Secretary of the Interior. It is to be known as the War-Minerals Relief Commission, and will consist of three members. Former Senator Shafroth, of Colorado, and former Representative Foster, of Illinois, have been designated by Van. H. Manning, director of the U. S. Bureau of Mines, as two members of the commission. The third member is to be a mining engineer of national reputation, Mr. Manning states.

The regulations under which the commission will work, and its policy, have not been determined upon. Messrs. Shafroth and Foster now are engaged in preliminary work to that end.

Frederick Hobart

Frederick Hobart, long a member of the editorial staff of the *Engineering and Mining Journal*, died at his home in Flushing, N. Y., on Mar. 9, in his 77th year. He had been in retirement for several years previously.

Frederick Hobart was born in New York City, and was graduated from the College of the City of New York in 1860. Immediately following his graduation he entered the Federal Army, and served with the 9th New Jersey Cavalry throughout the war, attaining the rank of captain. Returning to civil life, he became connected with the Jersey City Locomotive Works, the Bullock Ore Dressing Machine Co., the Wrigley Machine Works, and was assistant editor of the *Railroad Gazette*, as well as a contributor to several technical periodicals and the translator of "Notes on Steam."

He joined the staff of the *Engineering and Mining Journal* as assistant editor in 1893, serving under R. P. Rothwell, and incidentally directing the work of *The Mineral Industry*, Vols 3 and 4. On Apr. 17, 1901, Mr. Rothwell died, and Mr. Hobart took over and carried on the editorial work until the close of 1902. This was a trying time, because the sudden demise of Mr. Rothwell, who had kept at work until a day or two before the end, left a gap which could never be thoroughly filled. Friends of the *Journal* rendered generous assistance, but great credit is due to Mr. Hobart for the manner in which he preserved the organization.

Mr. Hobart continued as assistant editor under subsequent incumbents of the chair and served usefully and faithfully until a few years ago, when failing health led to his gradual retirement. However, he continued to come to the office until the winter of 1917, but, having met with a severe accident about a year previously, it finally became impossible for him to be present any longer, although right up to the end he was always hoping to come back.

Captain Hobart, or "the colonel," as he was affectionately called, was an indefatigable worker and exhibited always sound judgment. Therefore, when he was in his prime, he was a perfect assistant; faithful, intelligent, and reliable. The present editor has a high appreciation of the support that Captain Hobart always gave and the comfortable feeling with which the paper could be turned over to his hands whenever that became necessary.

Mr Hobart was twice married, the last time to Miss Charlotte A. Clarke, of Brooklyn, who survives him.

Joint Meeting of Engineering Societies

An important meeting at which a number of engineering societies will be represented is to be held under the auspices of the local sections of the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers on March 26, in the auditorium of the Engineers' Building, at 8 p.m. Inasmuch as the constitutional requirements of the American Society of Civil Engineers do not permit action of the local members without authority of the board of directors, and as the American Institute of Mechanical Engineers has no local section, these societies will be invited to attend. Invitations will also be extended to the membership of the four founder societies, the Society of Automotive Engineers and, through the secretaries, to members of the Electrochemical Society, Chemical Society, Refrigerating Engineers, Heating and Ventilating Engineers, Chemical Engineers and Illuminating Engineers and others that may be interested.

The papers to be presented at the meeting will be: "The Civic Responsibility of the Engineer"; "The Relation of the Engineer to Legislation"; "The Relation of the Engineer to the Administration of Public Affairs"; "The Engineer in Relation to Public Opinion"; and "The Engineer in Relation to Production and Distribution." The speakers on each of these topics have not yet been definitely announced.

Consolidated Interstate-Callahan

The following statement has been issued by the New York office of the Consolidated Interstate-Callahan Mining Co. regarding the present situation of the company.

During February the Consolidated Interstate-Callahan Mining Co. produced and shipped 6150 tons of zinc and lead-silver ores. Reduced to pounds, this gives a production of 1,180,000 lb. of zinc, 1,750,000 lb. of lead, and 30,600 oz. of silver, which is the largest production for any month since August, 1917. The lead shipments for February were the largest made in any one month in the history of the company, exceeding January by 476 tons.

However, owing to the high cost of supplies and labor entering into the cost of production, and the low prices for lead and zinc, (a combination which makes it impossible to operate with any profit) the directors, after careful consideration, deemed it for the best interests of the stockholders to suspend operations until such time as the industrial situation will allow the company a fair margin of profit on its product. The mine was therefore closed on Mar. 1, retaining only a force sufficient to guard and care for the property and carry on development work on No. 9 level during the time the mine is idle.

The mine never has been in as good physical condition for production as at the present time, having three years' ore supply blocked out at the present rate of production, and the changes and improvements recently completed in the mill have brought the plant up to the highest point of efficiency. The purpose of these changes in the mill was to make a better separation of the lead and zinc, and to obtain a higher metal recovery. The quality and quantity of the February production gives evidence that this has been accomplished, for although the percentage of lead in the zinc mined has showed a continual increase, yet the percentage of lead in the zinc concentrates has been reduced well below the penalty point imposed by the zinc smelters. This better separation has also increased the tonnage of lead concentrates and has raised the lead content while reducing the zinc in the lead shipments, thus lowering the penalties at the lead smelters. The closer separation of the lead and zinc in our ores has been a matter of careful study by the mill management for a long time, and it is gratifying to know that this result has been attained, as shown by the February production.

However, as is well known, the spelter market has been depressed to a point where the Prime Western producers (of which Interstate-Callahan is one) are able to show a small profit, if any, over the present high operating costs. Consequently, in spite of the splendid condition of the mine, and a highly efficient milling plant, the company finds it cannot operate profitably under the present conditions. Confronted with this situation, it had the choice of depleting its valuable ore reserves without hope of any reasonable profit, or suspending production and awaiting the readjustment of the industrial affairs of the country.

Though the prices for lead and zinc have fallen to a peace basis, the cost of mining and milling has remained practically the same as during the war To illustrate this condition, the price of powder in carload lots before the war was around 12c per lb Although it has been almost four months since the war ended, the price of powder has shown but slight decrease, the quotation now being 22c. per lb. in car lots, which is almost double the normal price. Drill steel is another example Before the war it was 5½c. per lb., now it is 14c. Labor costs remain the same as during the war, and prices of all commodities entering into mining operations are still on a war basis, in some cases having advanced In contrast with these high figures, the prices of zinc and lead have fallen to practically a peace-time basis. In other words, the producer of these metals is forced to pay war-time prices for what he buys, and to receive peace-time prices for what he sells, and no company is justified in continuing operations for long under such conditions

27th To Go First to Camp Merritt

The 27th Engineers will be quartered at Camp Merritt, N. J., about 15 miles from New York, for a week or two after it lands on this side, which we are now informed from Washington will be on Mar. 20. After that it will be scattered among various camps, namely, Camps Devens, Dodge, Grant, Pike, Custer, Dix, Lewis, and Sherman. The destination of headquarters has not been designated as yet, so far as can be learned.

Incidentally, it was not until Mar. 7 that the transport on which the mining regiment had embarked finally sailed from St. Nazaire. However, this was but another of the unavoidable delays to which the men had already become accustomed. With the regiment back at Camp Merritt, whence part of it started, the most eventful chapter in the lives of the men will almost be complete. It remains for the industry which they represented at the front to absorb them and to live up to all the kind sentiments that have been expressed about the men in their absence.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including interest	$19,745.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
W. L. Strauss	10.00
Employees Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5.00
Carl J. Trauerman (second contribution)	5.00
Carl Tombo	6.00
Charles Le Vasseur (monthly)	5.00
February interest	16.44
D. W. Hall	10.00
Total	$19,996.90

British Refractories Output

Some interesting figures on British refractories manufacture under the stimulus of war are given in the *Times Engineering Supplement*, January, 1919. The output of silica brick was formerly about 7,500,000 per month, but during the war it rose to between 11,000,000 and 12,000,000 bricks. About 500,000 magnesite brick per month are being produced, though it is admitted that the English bricks are somewhat inferior to the Austrian. The imperial resources in magnesite are still insufficient, and Grecian magnesite is being imported to supplement the supplies from Canada, India, and Australia. The total output in refractories is now about 200,000 tons per month, or approximately 720,000,000 bricks per year.

Gold in Indian Silver Coinage*

In a presidential address to the Mining and Geological Institute of India, Lieut.-Col. F. C. Hughes said:

"A great opportunity was lost by not having refineries in connection with the Indian mints about 10 years ago. At that time immense quantities of 1835 and 1840 rupees were being remelted and recoined. These issues contain notable quantities of gold. In 1913 I undertook an exhaustive analysis of the different issues of rupees, the results of which were embodied in the Mint Reports, 1913-14. I then found that the 1835 rupees contained 1.34 per mill of gold and the 1840 rupees of the first issue as much as 1.81 per mill. The second issue of 1840 proved to be much less auriferous.

"The question may be asked as to how much crude gold bullion might have passed through these refineries, assuming that the output from Indian mines has been treated in this way. One may be sure that, in addition to this source, much Indian commercial gold would have come in for treatment, as it could be refined much cheaper than by the local refiners. After neglecting other sources, it might be assumed that out of 600,000 oz. of gold produced annually by the Indian mines, 500,000 oz. only passed through the refineries; then 1,000,000 oz. of silver at least would be required for inquartation, and this silver could have been obtained by utilizing the auriferous rupees.

"It may be assumed, further, that, on an average, one part per mill of gold only was extracted from them; actually the coins contain considerably more—viz., about 1.5 per mill. Taking, however, the former figure as a conservative estimate, 2700 tolas[1] of gold would have been extracted from them and added to the refined gold produced. That is to say, the refineries would have produced annually Rs. 64,800 worth of gold as a byproduct from rupees, which gold is now disseminated throughout the new issues of coinage and lost.

"I have made a calculation from the mint reports which shows that 44,225,000 tolas of these issues—viz., 1835 and 1840 first issue—were remitted in the Indian mints during the 10 years from 1906 to 1915. This gives a yearly average of 4,422,500 tolas available for refining purposes. This source of income would, of course, gradually diminish as the stock of auriferous rupees became exhausted, but in the meantime about 45,000 tolas of gold might have been recovered, which would go a long way toward defraying the cost of refining. The refineries even without this adventitious aid would undoubtedly have been very paying concerns, and would have rendered the gold produced in the country fit for the arts or coinage without the risks and expense of shipping to Europe. It has been calculated that during the last five years 52,857 troy oz. of gold, worth over 34 lakhs[2] of rupees, has passed into the silver coinage."

Use of Molybdenum During War

"It is an interesting fact," says George Otis Smith, director of the U. S. Geological Survey, "that before the war the price of molybdenite was comparatively low until about two years before the actual beginning of hostilities, when it suddenly rose to as much as $4 per lb. for the contained MoS_2 in concentrates carrying 92% or more MoS_2. The reason for this was apparently that Germany, looking forward to the war and knowing that it was impossible to lay up enough tungsten, was buying molybdenite to take its place.

"Similarly, after the war began and the tremendous demand for tools to cut steel developed, both England and France found themselves short of tungsten, and they used molybdenum to take its place, apparently using molybdenum to replace about one-half of the tungsten in the high-speed steels. As soon as tungsten became more plentiful, which it soon did, the demand for molybdenum decreased greatly. The French also used molybdenum in the breech blocks of a part of their field guns, but never, as had been so frequently stated, in the shells, armor plate, or gun linings.

"Meanwhile in this country it was reiterated over and over that molybdenum was being used in great quantities in armor plate and in large guns. The Survey immediately began inquiries from the military authorities of the Allies to find what foundation there

---

*Abstracted from the *Mining Journal*, Jan. 11, 1919, p. 24.

[1] A tola is an Indian weight equivalent to 180 grains.

[2] One lakh equals 100,000.

was for this report. The United States, the French, and the English authorities all replied that they were not using it, and analyses of captured German guns showed that it was not being used by the Germans.

"Late in the war, a company brought to the attention of the War Department small pieces of light armor plate ½ to ¾ in. thick which were of exceedingly good quality. The company stated that it could make such armor plate with molybdenum, and contracts were entered into to make similar plate without specifying that it should contain molybdenum. Companies concerned in the manufacture of the steel entered into large contracts for molybdenum, but before the steel was actually put to use the war ended. One of the companies concerned also used less than 1% of molybdenum in making crankshafts and connecting rods for Liberty motors."

Argentine Mineral Production

According to a recent report from Consul General W. Henry Robertson, published in a supplement to *Commerce Reports*, the most important mining products of Argentina are petroleum and wolfram, although mica was much more in demand in 1917 than before. The output of petroleum from the Comodoro Rivadavia wells in 1917 was 168,984 metric tons, or 181,704 cubic meters, compared with 120,695 tons, or 129,780 cubic meters, in 1916. The increase in petroleum production has been steady since 1912, when 6938 metric tons, or 7461 cubic meters, was produced.

Exports of wolfram, which represent practically the entire output, amounted to 2,175,119 lb. in 1917, an increase of 498,749 lb. over 1916.

The production and export of mica increased from 11,257 lb. in 1916, to 154,305 lb. in 1917, most of the product being shipped to the United States.

Argentina produces no coal, and shortage of supplies has resulted in a serious state of affairs for the railways, the industries, and the domestic needs. Imports of coal into Argentina for the last four years have been as follows: In 1913, 4,046,278 metric tons; 1914, 3,421,526; 1915, 2,543,887; 1916, 1,884,781; 1917, 707,712 metric tons.

Antimony Data Compiled

WASHINGTON CORRESPONDENCE

The United States has always been dependent mainly on foreign sources for its antimony supplies, China and Japan being the principal contributors, although Mexico and Bolivia have also furnished significant amounts, according to a review of the antimony situation, by the U. S. Geological Survey, which has led to the compilation of the following data: This dependence is a reflection of the higher wage scale in this country as compared with that of certain foreign countries, particularly China; it is due, also, to the comparative poverty of the United States in antimony resources, although little information of a quantitative nature has been collected concerning these resources, and they may possibly be greater than has generally been assumed.

For many years prior to the Great War the New York prices of the ordinary grades of metallic antimony ranged from 6 to 8c. per lb. The imports, calculated as antimony metal, ranged from about 4000 to 7500 short tons, and the production from ores mined in this country was negligible. With the outbreak of the war the price of antimony began to rise rapidly, because of the need of the metal in the manufacture of shrapnel bullets. Continuance of supplies from abroad was uncertain, and numerous mines in the Western states and several in Alaska were put in operation. By the end of 1915 the New York price had reached 40c. per lb. and by March, 1916, the quotation attained a maximum, for ordinary grades, of about 44c. These high prices drew out in the United States in 1915 a production of ore carrying about 2100 short tons of antimony and in 1916 ore containing about 1770 short tons. The high prices also greatly stimulated imports, forcing down the prices of ordinary grades to 11 or 12c. in the latter part of 1916, and making it impossible for most of the new domestic mines to operate at a profit. By the end of 1916 many of these mines had closed and others were in a precarious position.

In anticipation of the entrance of the United States into the war, there was a notable recovery in prices, ordinary grades reaching about 33c. in April. This increase again stimulated imports, which proved to be far in excess of the demands and not only forced a rapid decline in price to a fairly constant level of about 14c. during the last half of 1917, but also built up large stocks in bonded warehouses and in the hands of dealers and consumers. Stocks in bonded warehouses alone, which early in 1917 were negligible, amounted to more than 10,000,000 lb. at the end of the year. The 1917 decline in prices dealt a final blow to domestic antimony mining, which during the year produced ore carrying only about 390 short tons of metallic antimony. Before the end of the year nearly all domestic mines had ceased operation. The experience of some of the larger operators seems to have indicated that during 1917 and 1918 mining and treatment of domestic ores could not be profitably conducted unless the market price for ordinary grades of antimony was at least 20 cents.

In view of the large differential between the cost of production of antimony here and in China, a reversion to an almost complete dependence upon foreign supplies is to be expected with the return of normal conditions. The fostering of a domestic antimony industry through protective tariff legislation involves grave considerations of public policy, including a careful weighing of the interests of domestic consumers as well as producers and of the commercial and political importance of our foreign trade relations.

Employment for Engineers

For the convenience of engineers returning from military service, a list of agencies is here given which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau: Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service: A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service: George W. Kirchwey, state director, 16 East 42d St., New York City.

The record of the hearings on the potash bill conducted by the Senate Committee on Mines and Mining contains extensive data with regard to that industry. A copy of the volume on this subject can be obtained gratis by requesting it of our Washington correspondent, Paul Wooton, 307 Union Trust Bldg., Washington, D. C.

Editorials

War-Minerals Relief

THE Henderson bill, as finally agreed upon, is eminently fair in its working, compensating, as it does, only those who produced or attempted to produce chrome ore, manganese, pyrites, or tungsten in compliance with the request or demand of the agencies of the Government. Those who made investments merely for speculative purposes are not to be reimbursed from the funds appropriated.

This bill should satisfy all who have legitimate claims, and we think that the sum appropriated, $8,500,000, will amply cover their losses and the expense of adjustment. Whether it is sufficiently large to provide for a careful investigation of all claims that may be made, is another matter.

As noted in our editorial prior to the passage of this bill, we see difficulties ahead of the department in drawing a line between the two classes of investments, those undertaken at Government request and those of a speculative nature. That there were some cases falling within each of these classes there can be no doubt; the evidence is clear as to that.

Unionism—an Opportunity

MINERS throughout the United States can well point with pride to the action of the Butte miners in holding to their contract and accepting reduced wages with the fall in the price of copper. But will they consider it as an exhibition of honesty and good judgment, or will they regard it as the act of "weak-kneed brothers who would not insist on their rights"?

Strikes for higher wages and shorter hours throughout the country indicate that a large percentage of manual workers have no sympathy with such loyalty. On the other hand, the absence of strikes or threats of strikes in mining districts generally, indicates that miners as well as operators are alive to the conditions that confront the metal industries and that they are anxious to do their share in keeping the mines in active operation.

With the shortage of metals, and with rising prices, it was easy to demand and easy to grant successive increases in wages. Now that the demand has gone, and with prices falling or not obtainable at all, it should be easy for the reverse to proceed in an orderly manner, but such is not the case.

Although selling little or nothing, and buying supplies on credit, even though he must borrow for his payroll on the strength of his good name, the employer still hesitates to reduce wages or discharge worthy employees. The employee, thinking of the good times that he has recently enjoyed—plenty of work when he wanted it, short hours and high pay—is loath to forego "what labor has gained for itself." With hesitation on the part of both, there is likely to be a crash in more than one industry. And right here is the opportunity for union leaders and unionism to save their members, the employers, and their industries from wreck and ruin.

There is no sane employer who would not be glad to see his workers receive as high a wage as they did during the war, but he knows that they cannot get it unless they earn it. With little or no demand for his goods, he must make concessions in price if he would sell at all. The manufacturer can reduce the price of his product until he receives no profit, but beyond this the burden comes on labor; it must either receive less or produce more units of the product in the course of a day's work. While the war was in progress, and labor was pampered in every direction, the mere obtaining of a dollar was simple, but in peace times and under normal conditions it requires some effort to earn a dollar.

This should be clear to every man of average intelligence; it is clear, perfectly so, to practically every union leader in the country. These leaders are not fools; they are generally men of more than ordinary intelligence, and it is within their power to put the case clearly and fairly before their members. Labor has been taught to be suspicious of its employer, but, having chosen its own leaders, more deference is paid to the opinions of the latter, and many of them are in the enviable position of being able to guide a large following.

During the last year we have learned that economic laws cannot be broken by Government or legislative action; they are inexorable. No more can they be broken by employers or by unions. Attempts to control economic laws lead only to suffering for some one, and often it is brought upon those for whose benefit it was intended. An economic law of considerable interest at the present moment is that remuneration must be in proportion to production or *vice versa*. Twist it as one will, bring forward exceptions, cite examples of poverty and riches, in the ultimate analysis, barring illegal acts, this relation maintains. The leader who continually advocates less labor with higher pay—and, alas! there are many such leaders—may be taking the course of least resistance, but, though perhaps retaining the esteem of his fellow members, he is surely leading them into serious trouble, for he is advocating and promoting an economic fallacy.

The leader who threatens to tie up the industries of a community like New York, and attempts to gain his point through the suffering and inconvenience of the people because he believes he has the physical strength, rather than through an appeal to the intelligence of those served, knows in his own mind that he is not advocating a just cause, and that he has no argument with which to convince the public. Such a leader has not the welfare of his union or that of the public at heart.

Never was there such an opportunity for union labor to make good as today; never such an opportunity for leaders to guide their members along the path that would tend to hold their industries in fit condition during the period of restricted output which we knew would come, which we all recognize is here, and which we hope may not last for long.

Capital and labor are both damaging themselves by putting off that day when they must recognize and boldly face the situation that compensation and effort must be proportional. Every state in the Union and nearly every community of every state has been discussing the matter of work for the unemployed and the unrest of labor. A matter of perhaps greater moment is the unreasonableness of labor.

At the recent conference of governors and mayors in Washington, called by President Wilson to discuss reconstruction and labor conditions, Governor Catts of Florida spoke very much to the point when he said, according to the New York *Times*: "We need labor. We could use 2,000,000 laborers in the truck gardens, orange groves, and fisheries of Florida, but they must come down to common-sense business, every-day business, every-day United States of America talk, before the people are going to turn loose their money on them. But labor does not want work at reasonable wages. That is the condition that exists in Florida, and there is no use in beating about the bush respecting it." Governor Catts may have been the only one to point to this condition, but there were others present who knew where work could be found, as well as the money with which to pay for it, but they lacked the nerve to say that wages paid would not be in excess of the services rendered.

The Need of Prevention

IN AN ARTICLE by E. M. Weston on "Mining Conditions in South Africa," in the *Journal* of Feb. 22, appears a statement to the effect that "the whole industry spent £2,850,012 on phthisis prevention and treatment during the five years ending July 31, 1917." This is over $2,750,000 a year. The items for prevention and treatment respectively are not separated, but it is probable that a part of this expenditure was made necessary because in earlier years there had not been a full realization of the seriousness of this factor in the economy of mining.

The present importance of miners' phthisis from an economic point of view is measured to some extent at least by the annual expense necessary for its control. But this is not by any means all of the loss. Death and sickness removed a large number of workmen from those available for work in the mines, thus diminishing the ever-inadequate supply and raising the wages where the margin of profit was already small.

Though the compensation paid by mining companies has been generous, the patients and their families have been a heavy tax on the charity of the community, and there has been much suffering not computable in dollars and cents. In these figures and in others available from South Africa there is an important lesson for Americans—the old, old lesson that an ounce of prevention is worth a pound of cure. Fortunately, we have not many districts where the quartz is so hard and dry as in South Africa, districts where it is necessary to adopt special methods to keep the air free from the dust that so seriously affects the lungs. Comparatively few other localities contain mines where the ores produce so dangerous a dust. Operators in our own mining districts are fully alive to their responsibilities and are making serious attempts under the leadership of the Bureau of Mines to mitigate dangerous conditions where they exist. It is at the isolated mine that particular attention should be paid by the management to the subject of dust. Without history or previous experience in the district for a guide, the insidious effect of dry quartz dust may creep into the camp before its presence has been suspected. The damage will have been done and the liability incurred only when results have shown that carelessness existed.

It may be said that the South African mines are paying the penalty of lack of foresight. With the experience of that country before us, its repetition in the United States will not be through a lack of foresight, but because of gross carelessness on the part of the mining industry.

The Gas Mask in Industry

THE popular fancy is quick to seize upon apparent facts without questioning. The belief that the war gas mask is universally applicable to all conditions is a case in point. The war gas mask was devised to meet battle conditions that arose through the dissemination of poisonous gases. The gas mask filtered the air through absorbents that removed the dangerous gases. The proportion of oxygen in the filtered air is practically the same as in normal air. The gas mask cannot supply a deficiency of oxygen, nor has any absorbent been discovered that will effectively dispose of carbon monoxide.

In an article published elsewhere in this issue the Bureau of Mines sounds a warning against the use of these masks in irrespirable atmospheres such as result in mines during or after a fire. The warning is timely and should be given careful attention by managers, superintendents, foremen, and others who may have the direction of fire-fighting squads. The only appliance that has so far been devised for fighting mine fires with a fair degree of safety to the user is the oxygen breathing apparatus. The work of the Bureau of Mines in perfecting this appliance and in seeking to train mine crews to use it safely is worthy of the highest commendation.

The Rehabilitation of Cripples

THE rehabilitation of men crippled by war or industry, as advocated by Douglas C. McMurtrie in an article in this issue, is worthy of the support of labor unions, mining engineers, and mining companies. The subject is of immediate importance, for it is estimated that over 20,000 soldiers are returning to our country in a permanently crippled condition. How many more represent the annual toll of the mining and metallurgical industries is not known. As Mr. McMurtrie so clearly states, prevention of accidents and accident compensation are essential, but only partly meet the situation. What is needed is the establishment of training schools where the permanently crippled workers may receive careful consideration of their individual needs and may be taught a suitable trade that will prevent them from becoming idlers or charges upon the community.

Aside from present efforts in behalf of our crippled soldiers, little has been done for industrial cripples. The problem is a broad one, and should be met by a national rather than a state response. It is a specialized part of vocational training that, in our judgment, requires separate handling. Vocational training is appropriate wherever there are a sufficient number of young people to warrant the establishment of a suitable school. The training of industrial cripples should be localized within industrial areas rather than within the geographical limits of a state. We must guard against the establishment of many inadequately supported schools of this kind, and concentrate our efforts upon a few that should be thoroughly developed and financially supported. As such schools will serve adults, there will not be precisely the same problems that vocational schools for younger people have encountered. The greatest need in a school of this kind would be a sympathetic understanding of the life, work, and limitations of the miner and the reduction-plant worker. The vocations that would be taught would necessarily have to cover a wide field, in order to cope with the individual disabilities, which would be of a varied nature, but this fact should not be allowed to interfere with the attainment of the objective desired.

The whole idea of rehabilitation is sound and wholesomely constructive. We are glad to see the movement start, and hope that there will be an early consummation in concrete form.

BY THE WAY

Secretary Lane announced on Feb. 27 that hereafter the reclamation project in Nevada now known as the Truckee-Carson project will be known as the Newlands project, in commemoration of the late Senator Francis G. Newlands, who died last year, and who was the father of the reclamation law.

Herbert Hoover, U. S. Food Administrator and lately appointed director-general of the inter-Allied relief organization, is to cease his relief work in the summer. This was indicated in a statement issued on Mar. 9 by Mr. Hoover concerning the wheat situation. He intimated that a majority of his co-workers also would return to private life. Speaking of various problems connected with the wheat situation, Mr. Hoover said that they would need to be solved by some one else, "because neither myself nor most of the men in the Food Administration will be able to continue in the service of the Government after next July." Mr. Hoover added, "We also must earn a living."

The board of governors of the Rocky Mountain Club has voted to expend the interest on all Liberty bonds and Canadian Victory bonds owned by the club in entertaining Western soldiers while they are in New York on their way home from France. Besides investing its surplus funds in the various Liberty loans and the Canadian bond issue, 160 members of the club paid dues for 10 years in advance, and the proceeds were invested in the third and fourth Liberty loans, according to a statement issued by the club. Herbert Wall, the secretary, also announced the receipt of a check for $5000 from a citizen of Arizona to aid in welcoming the returning troops, an appropriation of $5000 by the State of New Mexico, and a telegram from the Governor of Washington saying he would endeavor to get an appropriation through the Legislature for welcoming the returning Western troops, when that body met, and expressing his appreciation of the club's assistance in welcoming the home-coming soldiers.

Many weird communications were received before the armistice by various departments in Washington, coming from people who were eager to aid in winning the war by whatever means they had at their disposal. One enthusiastic patriot wrote as follows to the U. S. Bureau of Mines:

> I am writing this to call your attention to a new metal discovered in Modoc County, California, and in Nevada. It is a form of tungsten acid crystallized and has the property of hardening steel and copper. A piece of steel one-quarter inch thick treated with it is so hard and tough that it can neither be broken nor drilled. It would make dandy armor plate, as four inches of it is as strong as 22 inches of common armor plate. It will harden copper so that it will drill steel. You can weld potmetal treated with it so that it can't be broken. It stands about 6000° F. without melting.

Continuing, the writer offered the Government a large deposit of manganese iron in Oregon for the use of the Navy Department.

The Australian climate has its extremes, and many are the efforts made to brave the elements in outback mining camps, where habitations are often of flimsy construction. This is well illustrated in a recent issue of the Sydney *Bulletin*, wherein "Eddyson" says: "McMurie built his bit hoose on a crag on the unlikeliest spur of Hammer Head. He liked the 'magneeficent view fra the stoop.' The house was only a one-roofed slab affair with a shingle roof to begin with, and Mac, with improvement of prospects, saw no necessity of enlarging his abode. Fortunately there were no little McMuries to be 'tumblin' oot of the hoose every twa minutes,' and Mrs. Mac was a careful body who could be relied upon not to overstep the bounds and fall off their limited residential area; but time was at work, erosion was rapidly eating out the stability of the happy home, and eventually a heavy storm left the house in a very precarious position. It might slip its moorings and canter into the farm far below at any moment. McMurie was equal to the occasion. At the sale of the effects of the Three Pigs Gold Mining Co. he purchased a hauling rope, ran it twice round his house and once round a granite hunk as stable as the range itself, and rested happy in the satisfaction of having effected a complete insurance. Then came the mighty storm of July 11, 1914, which shook the whole district, deluged half the country and almost tore Hammer Head off its handle. The storm had detained McMurie at Croft's store in Four-roads all night. He rushed homeward in the morning through flood and ruin, accompanied by two volunteers. His home hung from the spur like a plumb-bob, its foundations blasted and washed away. His friends watched Mac swarm down the rope monkey-wise. The Scotchman was going home. He reached the roof, leaned over and knocked on the front wall. Three times he knocked, then uttered a piercing wail. "Maggie McMurie, wammin; are ye not at hame?' They found Mrs. McMurie against a tree a quarter of a mile lower down, wet and bedraggled, but not much the worse for wear and tear. McMurie wagged an admonitory forefinger under her nose. 'Wammin,' he said, 'let this be war-r-nin' to yeh. Didna I caution yeh never ta leave the hoose?' 'Aye, that's a' verra weel,' replied Maggie feebly, 'but what would ye ha' a body do stayin' at hame when the whole floor droppit oot wi' her?' "

NEW PUBLICATIONS

Report of the Secretary for Mines, Tasmania, for Year Ended Dec. 31, 1917. Pp. 105; illus.; paper. Secretary of Mines, Hobart, Tasmania.

A pamphlet outlining in detail the developed and undeveloped mineral resources of Tasmania.

Metallurgia Generale e Siderurgia. By Capisaldi E. Riassunti. 6½ x 9½; pp. 529; illus.; paper; Ulrico Hoepli, Milano, Italy.

A book outlining metallurgy in general, and especially that of iron and steel.

The Fusibility of Coal Ash and the Determination of the Softening Temperature. By Arno C. Fieldner, Albert E. Hall, and Alexander L. Field. Pp. 146; illus. Bull. 129, U. S. Bureau of Mines, Washington, D. C.

Laboratory methods are outlined for determining the fusibility of coal ash and the bearing of the results upon clinker formation.

Applied Mechanics. Vol. II, Strength of Materials. By Charles E. Fuller and William A. Johnston. 6 x 9¼, pp. 556, illus. John Wiley & Sons, New York.

An excellent textbook for the use of students of applied mechanics. The treatment is mathematical and the book follows conventional lines. For the engineer interested in the strength of materials there is much basic information in this book.

The Upper Chitina Valley, Alaska. By Fred H. Moffitt. And, Description of the Igneous Rocks. By R. M. Overbeck. Pp. 82; illus. U. S. Geological Survey, Washington, D. C.

This pamphlet describes the results of the topographic and geologic reconnaissance survey in the upper Chitina Valley, showing probable economic deposits of copper-bearing rocks and placer gold similar to those of low Chitina Valley.

The Occurrence, Chemistry, Metallurgy and Uses of Tungsten, with Special Reference to the Black Hills of South Dakota. By J. J. Runner and M. L. Hartman. Including a Bibliography of Tungsten. By M. L. Hartman. Pp. 264, illus. Bull. 12. South Dakota School of Mines, Rapid City, S. D.

The bulletin is divided into two parts, of which Part I covers a summary of the geological occurrence of tungsten ores, with special reference to the Black Hills, and Part II, the chemistry, metallurgy and uses of tungsten. The compilation and presentation of this information will be appreciated to a high degree by those interested in the tungsten industry.

Mining and Milling of Lead and Zinc Ores in the Missouri-Kansas-Oklahoma Zinc District. By Clarence A. Wright. Pp. 134, illus. Bulletin 154, U. S. Bureau of Mines, Washington, D. C.

This report of investigations gives the methods used in mining and milling, and indicates in detail the conditions that affect the efficiency of those processes. Although the lead and zinc ores are closely associated, the proportion of zinc ore mined at present is far greater than in former years. For this reason, and because the losses in the treatment of zinc ores are proportionally greater than with lead ores, the former are given most consideration. Several tests were made to determine the efficiency of the practice in the district and to discover at what stage of the process the losses were greatest. The author has endeavored to avoid the use of technical terms and phrases, so that all statements may be clear and easily understood.

Preliminary Report on the Geology of East Central Minnesota, Including the Cuyuna Iron-Ore District. By E. C. Harder and A. W. Johnston. Pp. 174, illus., maps. Bull. 15, Minn. Geological Survey, University of Minnesota, Minneapolis, Minn.

As stated in this bulletin, the report is a preliminary one, but it includes much valuable matter concerning the geology and rocks of East Central Minnesota. A part of the volume deals with the history, geology, and rock structures of the Cuyuna Range, including a special chapter on the geology of individual mines. A bibliography of East Central Minnesota and the Cuyuna district is included. The report is well compiled, contains much of original work, and will be found an excellent reference.

Melting Brass in a Rocking Electric Furnace. By H. W. Gillett and A. E. Rhoads. Pp. 131; illus. Bull. 171, U. S. Bureau of Mines, Washington, D. C.

The object of this paper is to set forth in detail the possibilities and limitations of a rocking electric brass furnace. The general problem of electric brass furnaces is discussed, and various types of furnaces are compared only so far as is necessary for the purpose of the report. Information on such other furnaces as have found commercial use is obtainable from the makers of the various furnaces. Reference to some of the more important articles in scientific and technical publications, dealing with the general subject of electric brass melting and with the performances of various specific types of furnaces, is made to enable interested persons to pursue the subject further.

Practical Oil Geology. By Dorsey Hager. 5 x 7½, pp. 253, illus. Third edition. McGraw-Hill Book Co., New York.

This little book merits a better title than it has been given. Indeed, its foreword might well be its title—"To the practical oil man of America, with the hope that this book will bring him to a better understanding of the relation of the geologist to the petroleum industry." A worthy subject that is concisely treated. It is seldom that a handbook is published that more fully realizes the intention of the author. Every word and thought can be fully understood by the layman. No mystery is made of what the geologist can do for the practical oil man, and the limitations are clearly defined. No intelligent investor in oil prospects, no practical oil driller, can read this book without benefiting from its orderly presentation of the subject of geology as applied to drilling for oil. The reader will not acquire from the book a knowledge of geology that will enable him to go into the field and locate oil pools, but he will gain sufficient knowledge of the subject to be thoroughly convinced of the fact that drilling should be done under the guidance of a geologist.

Symbols. By Frederick A. Parkhurst. Pp. 165; price, $2. John A. Wiley & Sons, New York.

The author of this volume deals with a subject that has hitherto received little attention. In describing a system of practical application, he contends that the use of symbols expedites the routine of the day's work by a saving of time and a greater saving of space in the matter of record keeping, and maintains that symbols give a brevity, simplicity and stimulus to accuracy in the keeping of records, and permit facile statistical comparison that cannot be obtained by any other means.

Symbols may be used in practically all branches of human endeavor, and really constitute a language in themselves. A few suggestive characters replace many times the number of letters that would ordinarily be required to describe the same thing in the words usually, of necessity, employed.

We are familiar with the use of symbols in the chemical industry, where the idea is thoroughly appreciated. Mr. Parkhurst's book will help to extend the usage of a method that will do much in other phases of technical and industrial work, to conserve labor and simplify reference and classification.

Personals

Jasper T. Robertson has opened an office in the Hobart Bldg., San Francisco.

Roy L. Cornell, recently with the Emerald Isle Copper Co., is resident engineer with the Standard Minerals Co. at Kingman, Arizona.

Alan M. Bateman, of the department of economic geology, Yale University, has been elected editor of the "Journal of Economic Geology."

John F. Cleveland, former Secretary of State of Arizona, has been elected vice-president and a director of the Hudson Oil Company.

Charles P. McLure, purchasing agent, and **William Rose,** chief mining engineer, of Pickands, Mather & Co., have returned from Hot Springs, Arkansas.

Fred J. Donkin and **Leonard C. Stevens** have incorporated the firm of Donkin & Stevens Co., construction and mining engineers, Edmonton, Alberta.

W. H. Blackburn, consulting engineer of the Tonopah Mining Co., Tonopah, Nev., is in Nicaragua on company business pertaining to the Eden Mining Co., a subsidiary.

J. H. McMillan has resigned as district inspector of mines for British Columbia and will assume the position of general manager for the Jasper Park Collieries, Ltd., in Alberta.

Roscoe Smith, of the M. A. Hanna Co.'s engineering force at Virginia, Minn., has sailed for the Belgian Congo, where he has accepted a position with a gold-mining concern.

Ben Williams, who, with his brother Lewis, for years managed the Copper Queen property in Arizona, is revisiting Bisbee and Douglas, the guest of his niece. Mrs. J. S. Douglas.

Henry S. Drinker, president of Lehigh University and formerly general solicitor of the Lehigh Valley R.R., has been elected a director of the road, succeeding the late R. Butler.

G. W. Eade, formerly employed at the Winona mine, in the Michigan copper district, has been appointed to succeed **Joseph Mette** as chief electrician of the Wolverine and Mohawk mines.

George E. Thackary, of Johnstown, Penn., has been appointed a member of the American Engineering Standards Committee by the president of the American Institute of Mining and Metallurgical Engineers.

Alexander M. Boyle, of Reno, Nev., and **Weldon B. Morris,** of Goldfield, have formed a partnership, and hereafter will conduct a consulting engineering practice with offices in the Nixon Bldg., Reno, Nevada.

H. A. Megraw, of the Kennedy-Van Saun Manufacturing and Engineering Corporation, 120 Broadway, New York, has just returned from a professional visit to the West Shining Tree district, in Ontario, Canada.

C. L. Nabers, for two years with the Clark interests at Jerome, has become director of the Stephen-Mackay interests in Arizona, with headquarters at Phoenix, especially covering the Dundee and Queen Creek companies.

Major Clem D. Webb, proprietor of the "South African Mining Journal," has returned to Johannesburg after three years of active service in the British Army. Major Webb has resumed his former connections with that publication.

Capt. Edward Steidle, formerly in charge of one of the mine-rescue cars of the Bureau of Mines, was seriously wounded, resulting in the loss of his right eye, during the fighting immediately preceding the signing of the armistice.

H. Robinson Plate has moved his office from 14 Wall St., New York, to the Hobart Bldg., San Francisco; Code, Bedford McNeil. He is president of the Golden Gate Exploration Co., and will take charge of the operating end of the affairs of this company.

Captain George Sykes, of the British War Mission, who has been in this country for the last four years, will return to London in May. He will be connected with Messrs. Dutilh-Smith-McMillan Co., as London manager of their engineering and railroad departments.

W. H. Cameron, general manager of the National Safety Council, Chicago, has resigned. His successor has not yet been appointed. Mr. Cameron is largely responsible for the growth of this institution, as its activities have been solely under his direction since it was organized.

E. J. Maney, general manager of the Shenango Furnace Co.; **F. J. Webb,** general manager of the Republic Iron and Steel; **Clement K. Quinn,** independent operator, and **A. B. Coates,** independent operator, all of Duluth, were present at the tonnage tax hearing before the Minnesota Legislature.

Robert J. Anderson has resigned as research metallurgist with the Bureau of Aircraft Production, Detroit, and will join the staff of the Bureau of Mines. He will make special investigation in the metallurgy of aluminum and other non-ferrous metals, at the experiment station at Pittsburgh.

Koji Inouye, chief director of Furukawa & Co., accompanied by **Dr. K. Yamaguchi, K. Matsumura,** and **T. Wada,** will investigate mining and smelting operations in the United States. The party, while en route to New York, plans to stop off at Chicago to investigate the electrolytic refining of lead.

William Loeb, Jr., director and member of the executive committee of the American S. and R. Co., is in Mexico City, with other officers of the company, conferring with the Carranza government, regarding protection of the company's properties. Recent developments in Chihuahua have been unfavorable, owing to the renewed ascendancy of the bandit forces under Villa.

Major Henry H. Armstead has received his discharge from the Corps of Engineers, U. S. Army, and has been recommissioned a major in the Reserve Corps. He will resume the active direction of the Armstead Mines, Inc., operating at Talache, Idaho, and Kaslo, B. C. During Major Armstead's absence the work at Talache has been in charge of **D. G. McLachlan,** and under direction of general manager, **W. F. Caldwell,** in British Columbia.

Lieut.-Col. J. C. Greenway, who has returned from France, and is still suffering from wounds and the effects of gas, has been spending some time at Chandler, Ariz., with Dr. L. D. Ricketts, who has a winter residence there. He was discharged from the Army on Jan. 7, with recommendations for the distinguished service medal and the French Croix de Guerre. A banquet was given in his honor in Bisbee at the Warren District Country Club by several hundred business and mining men.

Obituary

J. S. Austin, president of the Tonopah Mining Co., Tonopah, Nev., died in Philadelphia on Feb. 27 from acute indigestion.

William H. Yawkey, one of the largest fee owners of iron properties on the Minnesota ranges, died recently at Augusta, Ga. He was at one time president of the Detroit American Baseball Club, which in 1904 he, together with Frank J. Navin, purchased. At the death of his father, William C. Yawkey, he inherited extensive lumber and mining interests.

Captain Harry Sincock died at Biwabik, Minn., on Feb. 27. He was a pioneer in the mining industry of Minnesota and Michigan, coming to this country from Cornwall when 12 years old. After several years' mining experience at Ironwood, Mich., he came to Biwabik before the railroad was constructed and spent many years in the development of that district. He then returned to Michigan, and a few years ago returned to Biwabik to aid in the development of the Ajax mine.

Societies

The Duluth Engineers' Club held its regular monthly meeting at the Commercial Club rooms on Feb. 19.

Engineers' Society of Western Pennsylvania held a regular meeting of the mechanical section on Mar. 4. F. L. Egan, engineer of the Carnegie Steel Co., read a paper, illustrated with lantern slides, on "Steam-Power Plants as Applied to Vehicles for Common Roads."

American Welding Society, a new organization, will be formed by merging the welding committee of the Emergency Fleet Corporation and the National Welding Council and any others who may be interested. The purpose of the society is the disinterested distribution of information on welding for the benefit of manufacturers and purchasers of welded goods. H. C. Forbes is secretary of the temporary association, situated at 33 West 39th St., New York.

Industrial News

Allis-Chalmers Manufacturing Co. has elected to the directorate C. E. Albright and Charles Hayden, of Hayden, Stone & Company.

Morse Chain Co. of Ithaca, N. Y., announce the removal of the Kansas City quarters of the company's Western representatives, the Morse Engineering Co., in the R. A. Long Bldg., to suite 211-212 Finance Bldg. W. V. Warner is the office district manager.

American Blower Co. has recently purchased a tract of 20 acres in the Northeastern section of Detroit. It is reported that the company plans to erect a $750,000 building to house its manufacturing business, the main plant of which is now at 1400 Russell St., Detroit. The company also operates several foundries in that city, and branch factories in Windsor, Ont., and at Troy, N. Y. The consideration for the real estate is understood to have been $125,000. Completion of the new plant is expected to largely increase the company's facilities and to allow an increase in the working force.

New Jersey Zinc Co. gave a reception to the trade press representatives on Mar. 7 in the company's new building at No. 160 Front St., New York. The various steps in the manufacture of zinc oxide were shown by a motion picture. Views of the operations at the celebrated mines at Franklin, N. J., including the hoisting of ore out of the shaft, weighing charge cars, working a zinc-oxide furnace, the baghouse and the packing of the zinc oxide in barrels and paper bags, were thrown on the screen. In connection with the latter the company operates its own barrel-manufacturing plant. George C. Heckel explained the various processes as they were pictured, and afterward F. C. Ryan, formerly of the Bureau of Mines and now sales engineer of the company, addressed the gathering on the various uses for zinc and the development of the manufactured products, including strips, sheets, and wire zinc. Other speakers stated that zinc could be spun, formed, stamped, or plated in the same manner as other metals. The guests then inspected the building, in which the use of zinc for door fittings, electric fixtures, push-button plates, window fittings and in a number of other ways is demonstrated.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Metallic Dust, Manufacture of. Everett J. Hall, New York, N. Y., assignor to Metals Disintegrating Co., Inc., New York, N. Y. (U. S. No. 1,290,181; Jan. 7, 1919.)

Metallizing Process and Apparatus. John M. Longyear, and John T. Jones, Marquette, Mich., assignors to New Metals-Process Co., Chicago, Ill. (U. S. No. 1,289,834, Dec. 31, 1918.)

Metallurgical Mass—Porous Air-Charged Mass of Metal Containing Masses of Carbon. Daniel Eppelsheimer, Middletown, Ohio. (U. S. No. 1,290,143; Jan. 7, 1919.)

Mill Liner. Walter S. McKee, Chicago, Ill., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,289,501; Dec. 31, 1918.)

Mill, Tube. Andrew P. Hachtmann, Allentown, Penn., assignor to Lehigh Pulverizer Mill Co., Catasauqua, Penn. (U. S. No. 1,290,178; Jan. 7, 1919.)

Mine Car Wheel and Axle. Thatcher A Parker, Brazil, Ind. (U. S. No. 1,289,249; Dec. 31, 1918.)

Miner's Lamp—Attaching Device for Cap Lamp. John Maurice Brock, Brooklyn, N. Y. (U. S. No. 1,289,631; Dec. 31, 1918.)

Nickel from Silicate Ores, Extraction of Henry William Coupe Annable, Egham, England, assignor to Nickel Concentration Ltd., London, England. (U. S. No. 1,289,072, Dec. 31, 1918.)

Well Drilling—Pipe, Drill-Rod, and Casing Puller. Joseph Saul Gendron, Loma, N. D. (U. S. No. 1,287,956; Dec. 17, 1918.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Mar. 7

The Alaska Juneau Gold Mining Co. has been authorized by the Commissioner of Corporations of California to issue $2,500,000 aggregate of its first mortgage 7% gold bonds. These bonds are to be issued for a period of 10 years, beginning Mar. 15, 1919. Of this amount $1,500,000 aggregate face value is to be used for the purpose of funding, by exchange or otherwise, the floating debt of the company, and $500,000 will be required for alterations and enlargements of the company's mill and to effect more extensive or more economic operations of its property.

Two Important Tungsten Mines in Inyo County, the Round Valley and Pine Creek properties, are temporarily closed, awaiting the restoration of profitable prices for their product. It is expected that the former will resume about Apr. 1, and the Pine Creek mine as soon as weather conditions permit. If the market does not offer inducements for shipping, the concentrates will be stored. The low price of $10 to $12 resultant from the cessation of the war, and the importation of 2000 tons from China marketed at $10, induced Cooper Shapley, manager of the two properties named, to limit production, and the most economical way to do so seemed to close, especially at Pine Creek, where the snow is 5½ ft. deep on the summit and more than 2 ft. at Pine Creek Falls. Eighty-two men were released by the shutdown. The Tungsten Mines Co., at Tungsten, six miles out of Bishop, is still operating. This property and the Round Valley were two of the five important producing mines in the United States. The Loring mines, in Nevada, closed several weeks ago.

PIOCHE, NEV.—Mar. 6

The Mineral Production of Lincoln County, Nevada, in 1918, according to annual report of State Controller George A. Cole, was as follows: In the Pioche district, the Prince Consolidated was the largest shipper, with an output of 60,000 tons, chiefly iron-manganese fluxing ore, but with a few cars of high-grade silver-lead ore, having a gross value of $531,695.68, produced and marketed at a cost of $489,870.30, and yielding a net profit of $41,825.38. The Virginia-Louise Mining Co., which made its initial appearance in the producing class in September, shipped 3556 tons of iron-manganese fluxing ore and performed 1650 ft. of development work. The Amalgamated Pioche shipped 3900 tons; the Consolidated Nevada-Utah, 2900 tons; the Combined Metals lease, 2200 tons of silver-lead-zinc ore and concentrates; the Mascot lease on the Providence Mines, 68 tons; and the Mendha mine, 35 tons. In the British district, the Nevada Copper Co., operating the Bristol mine, shipped 2400 tons of oxidized copper ore. In the Groom district, the Groom mine shipped 1000 tons of silver-lead ore and jig concentrates, having a gross value of $81,895.05, produced and marketed at a cost of $71,932.65, and yielding a net profit of $9,962.40.

PHOENIX, ARIZ.—Mar. 6

The Bill Requiring Electric Blasting to be employed in shafts and winzes has been defeated in the Arizona Legislature; likewise a bill providing $250,000 for a miners' hospital. Strong opposition has developed to the "Americanization" bill that would keep foreign labor from mines and quarries. The Legislature has been asked by Governor Campbell for funds to permit a reconnaissance of the Grand Canyon country, with a view to developing whatever mineral or agricultural resources the region may possess. A legislative committee is to be formed for investigating alleged fraudulent operations of several oil-development companies.

BUTTE, MONT.—Mar. 5

Clark Montana Realty Co.'s Suit against Butte & Superior Mining Co., which was brought in U. S. Supreme Court to determine ownership of veins also claimed by Butte & Superior, was decided against the latter on Mar. 3. Clark company is held to be owner of Rainbow vein through prior location of Elm Orlu claim, and Butte & Superior is restrained from entering vein. The decree also awards the Clark company $178,000 in damages for ores extracted by Butte & Superior from the disputed vein. This decision affirms that of the Appellate Court at San Francisco in the case of Elm Orlu against Butte & Superior, the latter affirming also Federal Judge G. M. Bourquin, who upheld Elm Orlu on all points. Upon the affirmative action by the Supreme Court hinges supplemental proceedings instituted by the Elm Orlu. This supplemental suit claims, by virtue of the proving of the Pyle vein throughout the length of the Elm Orlu claim since the hearing of the original suit just decided by the Supreme Court, an additional 520 ft. along the course of the Rainbow vein under the surface of the Black Rock claim below a depth of about 1100 ft. The tonnage represented in this additional vein area claimed is much greater than in that portion of the Rainbow vein now decreed by the Supreme Court to belong to Elm Orlu. Butte & Superior has been mining in this controverted ground from the 1800 level up, ore proceeds being deposited with the clerk of the Federal Court pending outcome of the supplemental suit. In addition, Butte & Superior has put up as security about $700,000 in Liberty bonds. Judge Bourquin decided Elm Orlu had the prior location and that the Pyle vein united with the Rainbow and that the Rainbow became the Pyle vein below junction of the two, but he reserved decision as to ownership below the junction, as the court stated the apex of Pyle vein at that time was not proved. Immediately the Elm Orlu interests began work of proving it, and they claim to have opened and proved it throughout the length of surface of the Elm Orlu tract.

SALT LAKE CITY, UTAH—Mar. 6

Wage Reductions have been made at a number of camps in Utah. At Tintic there has been a general reduction of 75c. per shift, making wages at present in force $4.50 per day for machine men and $4 per day for muckers. At Bingham a reduction of 75c. per day was made in February, followed by a further reduction of 25c. going into effect Mar. 1. At Park City the reduction is 75c. per shift. Work is proceeding as usual in all of the camps, and there has been no trouble. Labor is growing more plentiful.

DULUTH, MINN.—Mar. 8

Iron Ore on Docks at Lake Erie Ports on Feb. 1 amounted to 8,633,956 tons, as compared with 10,069,592 tons on Feb. 1, 1918. Indications are for a normal year of iron-ore production on the Minnesota ranges.

The Tonnage Tax Situation in the Minnesota Legislature, which was to have come to a head on Mar. 5, when the two bills before the House were to have been voted upon, became instead more complicated. Representative Bendixen has introduced a third bill calling for 4% super tax on gross value of the ore, but allowing a deduction to cover labor and freight costs, or, roughly, about 70% of the mining costs.

The American Federation of Labor is making a strong effort to organize the labor of the Minnesota mines. To aid in this a weekly newspaper has been started at Virginia, and mass meetings have been held at various important centers of the Mesabi Range. The mines of the Minnesota ranges have been operated with non-union labor throughout their entire history. In 1907, the old Western Federation brought on a strike and attempted to organize during the throes of it, and in 1916 the I. W. W. repeated the performance, each without success. The American Federation of Labor is working along much more conservative lines, and claims to have a large membership among the mine laborers.

HOUGHTON, MICH.—Mar. 8

The Larger Producers of Copper in northern Michigan are announcing to their employees that they are prepared to continue under existing conditions for a period of at least three months and possibly for six months, notwithstanding the situations that may exist in other industrial centers. Employees as well as officials realize the seriousness of the situation. Under the circumstances there is a general appreciation of the fact that the larger properties were wise in maintaining surpluses of substantial proportions when the metal market was good. These are carried in negotiable paper which makes it possible for the companies to carry on their work and meet their payrolls regularly. From the point of view of the average workman of the district, there is an argument for large corporations in the present situation, for he knows that none but the very strong organizations are operating now or can be expected to. Copper stocks continue to pile up on the docks, and all shipments to the order of foreign governments have ceased.

JOPLIN, MO.—Mar. 8

The Pittsburg Zinc Co.'s Smeltery at Pittsburg, Kan., has been purchased by the Newkirk Smelter Co., just organized, and will be moved at once to Newkirk, Okla. It is an 8-block, 16-furnace plant, and was operated steadily until about a year ago. It has always been a coal-fired distillery, but natural gas will be used at Newkirk, the buying company controlling all the gas in that particular field. Concentrates for the smeltery are to be obtained from the Joplin district. The Newkirk company already owns three mines, situated about four miles north of Joplin, and is just completing a concentrator on one, has one mill already built, and will erect another this spring. Hugh W. Thomasson, of St. Louis, is president of the company. The management will rest with an executive board consisting of Joe S. Hays, of Newkirk; F. E. Chappell, of Endin, and William E. Willis, of Joplin.

The Coahuila Lead and Zinc Co. has closed its mine near Duenweg, Mo., after 10 years' operation. The original mill was started in February, 1909, and operated continuously until September, 1916, when a new and larger plant was erected to treat all of the concentrates. During the 10-year period the company hoisted 2,040,031 tons of rock, the best year being 1917, when 362,506 tons was handled. During the last three years the rock cost has ranged from $1.16 to $1.25 a ton. The total power-plant cost since 1916, including fuel, labor, oil, repairs, and maintenance, has averaged from 17 to 19c. per ton. The mill recovery has been 79%. The company will continue, for the present at least, to operate its mine at Carthage. It also owns other mining ground in the district, outside the sheet-ground zone, which it may develop. Capt. C. S. Smith, district manager for the company, has just returned from France.

VICTORIA, B. C.—Mar. 8

An Amendment to the Mineral Survey and Development Act of British Columbia, giving the resident mining engineers of the province power to enter into mines and plants in connection therewith for inspection purposes, has passed the Provincial Legislature and will become law on receiving the assent of the Lieutenant Governor.

The Recent Reduction in Ore Payments by the Tacoma smeltery has effected a number of shipping mines in British Columbia, as well as others more immediately tributary to the plant. Production in most cases has been reduced from 40 to 50%, and it is becoming in most instances on the part of the shippers a case of continuing operation merely for the sake of maintaining an organization that will be ready when market conditions improve. The smeltery is operating only one furnace, whereas it had three in blast a year ago. A reduction in the wages of employees amounting to 12½% of what has been paid took effect on Mar. 1, the minimum wage for common labor being now $3.75 a day.

The Proposal to Reduce Wages and to revert to the sliding scale in effect before the war made by the Granby Consolidated Mining, Smelting and Power Co. to its employees, had certain interesting features: It had been announced that from Mar. 1 the sliding scale based on the price of copper would be effective. Concessions were granted, however, to assure the workmen a living return during the period of depression. To assimilate the extra cost of living until wholesale prices were reduced, the company offered to pay a bonus of 50c. a day to each man. It was also announced by the company that it would absorb a loss at its own store of purchases made by married employees living with their families at Anyox in a flat reduction of 10% on all purchases made there. It was planned also to reduce the cost of board with every two-cent reduction in the price of copper until a minimum of $1 a day for board was reached. Beginning with the price of copper at 21 and 23c., the special 50c. bonus, according to the announcement, was to be reduced to 10c. therefrom for each 2c. increase in the price of copper until the special provision for the present cost of necessities was eliminated at a point where the scale rate being paid is on the basis of copper at 29 and 31 cents.

TORONTO, ONT.—Mar. 7

Establishment of a Briquetting Plant in Saskatchewan will not be hastened by the report made by R. deL. French, one of the engineers appointed by the Lignite Utilization Board to make preliminary inquiries before their work of establishing a briquetting plant in Saskatchewan was undertaken. Mr. French states that after inspecting the briquetting plants of the United States and Canada, he found some still in the experimental stage, and none of a type that could be recommended as suitable for Saskatchewan. At one Eastern plant successive changes had been found necessary which had run the outlay up to $750,000. In this case the byproducts were regarded as the main consideration, but in the projected undertaking the byproducts would not be considered.

The Gold Production of Canada in 1918 was $14,628,000, a slight decrease from that of the preceding year. It is interesting to note that the Hollinger mine, in Porcupine, accounted for practically 40% of this. Silver, with 21,284,000 oz., showed a falling off of 1,000,000 oz., but the value was greater, on account of the increased price. Production of pig iron was 1,194,000 tons, an increase of 24,000 tons; steel ingots and castings, 1,893,000 tons, an increase of 150,000 tons; coal, 15,180,000 tons, an increase of 1,150,000 tons; copper, 115,000,000 lb., an increase of 6,000,000 lb.; zinc, 35,000,000 lb., an increase of 6,000,000 lb.; nickel, 92,000,000 lb., an increase of 10,000,000 lb.; and lead, 43,846,000 lb., an increase of 11,300,000 pounds.

The Mining News

ALASKA

ALASKA GOLD (Juneau)—In February milled 162,400 tons ore, averaging $.837 per ton (January, 151,515 tons milled). Extraction, 77.3%; tailings loss, 19c. per ton.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee) — February production of copper was 2,872,000 lb.; January, 2,284,000 pounds

PHELPS DODGE (Bisbee)—February production of copper was 9,185,000 lb. (January, 11,878,733 lb.) of which 8,443,000 lb. came from company's mines and 742,000 lb. from custom ores. Company's Mexican mines contributed 1,775,000 lb. to total.

SHATTUCK ARIZONA (Bisbee) — February production was: 376,166 lb. copper (January, 622,226 lb.); 181,679 lb. lead; 11,725 oz. silver; and 58.40 oz. gold.

JOHNSON DEVELOPMENT (Johnson) —Breakdown of hoist forced suspension of work until parts can be received from factory.

KEYSTONE COPPER (Johnson)—Operations resumed Feb. 20 with one shift on development work. Property shut down Feb. 1.

MAMMOTH LEASE (Johnson)—Closed down and equipment moved to Klondyke, Graham County, and installed on lead-silver property being worked by same company. Robert Mackay, manager.

THUNDERBOLT (Johnson)—Putting in foundations for 125-hp. four-cylinder Lawson oil engine, 600-ft. Ingersoll-Rand belt-driven compressor, and Leyner drill-sharpener, all of which are on ground ready for installation. Contract let to sink shaft 500 ft. from 300 level. V. C. Joslyn, manager.

Gila County

OLD DOMINION (Globe)—February production of copper by smeltery was 2,360,000 lb.; January, 2,812,000 pounds.

INSPIRATION (Miami)—February production of copper was 6,600,000 lb.; January, 6,500,000 pounds.

MIAMI (Miami)—February production of copper was 4,462,578 lb.; January, 5,273,260 pounds.

Pima County

NEW CORNELIA (Ajo)—February production of copper was 5,028,000 lb.; January, 4,318,000 pounds.

Santa Cruz County

BLAND (Patagonia)—Putting in new hoist; will sink to 250 feet.

MAGNIFICENT (Patagonia) — Under development by E. T. Sheehy.

MORNING GLORY (Patagonia)—Under development by Southern Arizona Mining and Smelting Co., with E. R. Shaw in charge. Property lies west of the Mowry.

Yavapai County

JEROME MINES have cut wages 25c. more, with the understanding that this will be final. Miners now receive $4.90. Relatively few men retained in United Verde and United Verde Extension for care of workings and machinery. Preparations being made for much construction and development work.

GRAND ISLAND (Jerome)—Crosscut on 500 level now about 170 ft. from shaft and in iron-stained schist. Water increasing.

VERDE COMBINATION (Jerome)—Completed 50 x 12 x 18 ft. station, and drifting both ways on schist contact on 1300 level.

CALIFORNIA

Calaveras County

SHEEP RANCH (San Andreas)—Development discloses large ore reserves at 1500-ft. depth. Large producer in early days. Now operated by Golden Gate Exploration Company.

UNION (San Andreas)—Reported optioned by W. J. Loring. Mine formerly a large producer. Situated on east branch of Mother Lode.

Nevada County

EUREKA (Grass Valley)—Roanise Mining Co. dissolves corporation, formed in 1885, and distributes assets. Mine recently sold to Fred W. McNear, of San Francisco.

Placer County

PLACER CLAIMS on American River, adjoining bars dredged by Guggenheims and other operators, recent sold at trustees' sale for about $10,000. Dredge included in sale. B. J. Corrigan, of Stockton, Calif., was successful bidder.

Plumas County

ENGELS (Engelmine)—Wages of surface men cut 50c. per day and bonus system discontinued underground. Straight pay for overtime and Sundays. New office building to be constructed at lower mine.

Shasta County

MAMMOTH (Kennett)—February production of copper was 1,506,000 pounds.

Tuolumne County

CHROME ORE of high grade taken from McCormick mine, recently purchased by San Francisco buyers, said to be first shipment since drop in price following armistice. Mine a gold producer.

COLORADO

Clear Creek County

BIG FIVE (Idaho Springs)—New tunneling machine installed about 500 ft. from portal by W. E. Dean and P. M. McConnell, of Superior, Wis. Test run being watched with interest. First tunneling machine to be tried in district since failure of Sigafoos machine, installed several years ago near Georgetown. Machine is designed to cut 6 by 8-ft. tunnel. Inventors claim it will cut about 20 ft. of tunnel per day. Machine consists of eight horizontally disposed hammers or stamps, which punch the rock in tunnel breast. Power supplied by four electric motors.

Gilpin County

BECKY SHARP (Russell Gulch)—Property under development during last six months by Hughes & Threewit. Four-foot vein opened, from which five carloads have been shipped averaging about $90 a ton.

FAIRFIELD (Russell Gulch)—New compressor and other equipment recently installed. J. N. Thouvenell, manager.

San Miguel County

TELLURIDE SHIPMENTS in February were: Tomboy, 37 cars concentrates; Smuggler-Union and Black Bear, 70; total, 107. Shipments for February, 1918, were 141 cars.

Teller County

AMERICAN EAGLES (Cripple Creek)—Being developed by Stratton Cripple Creek Mining and Development Co. Lessees producing ore on split-check leasing system. Ore hauled from Midway station by teams of Colorado Trading and Transfer Company.

DEERHORN (Cripple Creek)—Development will be resumed by W. C. Green under lease from Stratton Cripple Creek Mining and Development Company.

JERRY JOHNSON (Cripple Creek)—Development in progress on three lower levels, deepest being at 950 ft. from surface, also between third level and surface. Opening considerable milling ore. Shipments will be resumed in near future. J. W. Graham, of Denver, is president and general manager.

YELLOW BIRD (Cripple Creek)—Being developed and operated under lease by Murray Colgin, of Cripple Creek. Three-foot vein of merchantable ore opened 25 ft. below surface.

CRESSON (Victor)—Drifting in progress on ninth, tenth, and eleventh levels, with promising results. Network of small veins opened on eleventh level for distance of 100 ft. A. L. Bloomfield, general manager.

VICTOR (Victor)—Property being developed and operated by Komat Leasing Co., under lease from Smith-Moffatt Mines Co. About 400 tons of ore produced during January, and about 340 tons during February. Ore is of milling grade, averaging about $12.50 per ton; shipped to Golden Cycle plant, Colorado Springs, for treatment.

IDAHO

Lewis County

DEER CREEK (Forest)—Installation of 125-ton mill completed, replacing plant destroyed by fire in 1916. Equipped for amalgamation, concentration, and flotation. W. J. Orr, president and manager.

Shoshone County

ARMSTEAD MINES (Talache)—Six-hundred-foot raise completed from No. 3 to No. 2 tunnel, giving point of exit through No. 3 for 1600 ft. of ore reserves above No. 3. Talache property now ready for a mill, mine being well proved and opened up. Expected that Maj. H. H. Armstead, just discharged from service, will take up problem of construction upon arrival. O. B. Hofstrand, of Salt Lake City, will be in charge of construction.

INTERSTATE CALLAHAN (Wallace)—Production suspended on Mar. 1. Detailed official statement given elsewhere in this issue.

TAMARACK & CUSTER (Wallace)—Directors reëlected. Stockholders ratified purchase of control of adjoining Union group for $135,000, of which $63,000 is to be spent in development. Purchase of Indus group adjoining also ratified

KANSAS

Joplin District

FEDERAL M. AND S. (Hockerville, Okla.)—New concentrator on Brewster tract almost completed. At Lucky O K. mine, near by, Federal company produced 380 tons of concentrates in February

LOUISIANA

Calcasieu Parish

UNION SULPHUR (Sulphur)—Company's suit against Freeport-Texas Co dismissed on Mar. 4, Union company's patents being held invalid. Opinion filed by Judge Buffington, of U. S Circuit Court of Appeals, case having been appealed from U S District Court of Delaware.

MICHIGAN

Copper District

WOLVERINE (Kearsarge)—Practically every drift finished to boundary a month ago. Work now confined to back stoping and to such operations in upper levels as openings beyond footwall indicate may prove valuable in copper return Rock tonnage maintained without difficulty. Policy pursued of taking out everything that can be mined at profit

MOHAWK (Mohawk)—Teritory south of No. 6 shaft continuing to show up well. New openings throughout mine indicate general physical betterment. Working full time on reduced pay.

Gogebic Range

PABST (Ironwood) — Has completed sinking of "H" shaft.

BROTHERTON (Wakefield) — Closed permanently, owing to lack of merchantable ore. Sunday Lake mine also closed, but temporarily.

Menominee Range

CHATHAM (Stambaugh)—Mine worked out and closed. Tully, Tobin, Zimmerman, and Wauseca, also in the Iron River-Crystal Falls district, closed down.

MINNESOTA

Cuyuna Range

MANGAN No. 2 (Ironton)—Surface plant of this underground mine of Mangan Iron and Steel Co. dismantled. Property leased late in 1918 to Mahnomen Mining Co., and will be stripped as extension to Mahnomen pit.

BESSEMER IRON (Manganese)—Company dissolved by Judge Dickenson in Minneapolis on Feb. 27 on stockholders' petition. Was active during winter of 1917-1918, and sunk shaft on property in Section 6-46-29, stopping operations in April, 1918 on account of lack of merchantable ore

PRESTON (Manganese)—Manganiferous iron property partially developed by Coates & Tweed in latter half of 1918, and closed down Dec. 1, 1918, and later turned back to fee owners, was taken over Feb. 21 by Canadian syndicate, which promisea development

IDA MAE (Trommald)—Shut down Feb 27 until conditions improve.

MERRITT (Trommald)—Production and all work suspended on Feb. 27, with exception of driving drift between Nos. 1 and 2 shafts, and enlarging of No 1 shaft to permit installing two skips and deepening from 120 to 220 level Shutdown temporary pending developments in labor, ore price and taxation situations

NORTH RANGE IRON (Trommald)—Company organized by Adams interests to handle lease on N½ of NW¼ of Section 1-16-29 which Adhar Development Co has been developing under option Drilling and underground development work has disclosed large body of merchantable and washable iron ore Now making small shipment of wash material for test purposes Wages cut 50c per day on Mar 1 without opposition from employes

Mesabi Range

DEACON (Kinney)—Abandoned on Feb 14, at which time lease expired Mine originally opened to liquidate advance royalty payments and has been a troublesome operation throughout It produced about 150,000 tons during last year of operation

WACOOTAH (Mountain Iron)—Open pit of Pitt Iron Mining Co. being equipped with modern machine shop. C. E Moore, superintendent.

MONTANA

Sanders County

SILVER KING (Thompson Falls)—Silver King Mining Co. incorporated by Kellogg, Idaho, men to operate Silver King mine. Following officers named: D. W. Price, president; D. W. Haefeli, vice-president; Thomas Fluke, secretary-treasurer. Directors include these, and also A. J. Brainard and R. R. Price.

Silver Bow County

ANACONDA (Butte)—February production of copper was 12,400,000 lb.; January, 15,900,000 pounds.

BUTTE & SUPERIOR (Butte) — February production was 4,175,000 lb. zinc in concentrates (January, 9,450,000 lb.) and 78,000 oz. silver (January, 178,000 oz.). The recovery was 94% both months.

EAST BUTTE (Butte)—February production of copper by smeltery was 633,560 lb.; January, 2,291,950 lb. Decrease directly due to recent labor strike.

TUOLUMNE COPPER (Butte)—February production was 123,824 lb. copper; 19,965 oz. silver and 21.3 oz. gold

NEVADA

Nye County

TONOPAH SHIPMENTS for week ended Mar. 1 were 7568 tons, having gross milling value of $128,656. Shippers were: Tonopah Belmont, 2260 tons; Tonopah Mining, 1100; Tonopah Extension, 2056; West End, 858; Montana, 341; Jim Butler, 342; Tonopah Divide, 245; MacNamara, 210; Halifax, 101; and North Star, 55.

OKLAHOMA

Joplin District

LUCKY JENNY (Hockerville)—Leased by owners to L. Argyle and George Sullivan, of Miami, Okla. Property has practically new concentrator.

SEALS & CO. (Joplin)—To erect mill to handle tailings at old New State mine, at Commerce, Oklahoma.

DENNY BROS. (Miami)—Will operate Poor Boy mine, recently taken over. Will use hand jigs only for the present. Poor Boy north of Miami.

INDIAN QUEEN (Miami)—Will sink to second ore level. W. W. Hanlon, of St. Louis, Mo., elected president. J. E. Ernhart, of Miami, Okla., is manager.

LITTLE JEWEL (Miami)—Has bought Miami Sunrise mine, near Quapaw.

OKO LEAD AND ZINC (Picher)—Has taken over Southland lease in North Century and expects to build mill this spring. Development in progress.

SOUTH DAKOTA

Pennington County

AMERICAN TIN AND TUNGSTEN (Hill City)—Name changed recently at stockholders' meeting to American Tin Mining Co. Additional equipment authorized. Ralph A. Meyer, engineer in charge.

UTAH

Juab County

TINTIC SHIPMENTS in February were 585 cars from 21 shippers. In January 667 cars shipped Weather mild until lately, when heavy snow fell. Quarantine due to influenza lifted Mar. 2.

PROVO MINING (Eureka)—New interests in control; J S Berry, president Adjoins Tintic Standard

TINTIC PAYMASTER (Eureka)—Recently incorporated to develop large acreage in Tintic district New equipment to be installed W. I Snyder, president; J Will Knight, vice-president

TINTIC STANDARD (Eureka)—New electric-driven hoist in operation at No 2 shaft. Installed back of old hoist; latter transferred to No. 1 or old shaft New spur to Denver & Rio Grande at Alberta to be completed by July 1

Salt Lake County

ALBION CONSOLIDATED (Alta) — Consolidation of Albion and Alta Germania, controlled by Watson interests, of South Hecla, Utah, and Mineral Flat property, controlled by Knights. Comprises in all 600 acres extending from Alta into American Fork. Officers G H Watson, president; Herman Bamberger vice-president; H T. Hatfield, J W Harrington, J William Knight and R E Allen, directors.

UNITED BINGHAM (Bingham Canyon)—Reorganization of old Bingham Amalgamated meeting support. Stockholders on payment of 1c. a share to receive share for share in new company, capitalization 1,000,000 shares, and $100,000 in treasury. Funds from 1c. payment to be used in clearing up debts. A. L. Marks president.

Summit County

PARK CITY SHIPMENTS week ended Mar. 1 were 4,279,260 lb. crude ore and concentrates.

SILVER KING COALITION (Park City)—Conditions underground improved in last 30 days. Mill running at half capacity, or about 150 tons per day. Statement by Lafayette Hanchett, consulting engineer Shipped 1,282,520 lb. crude ore and concentrates week ended Mar. 1.

NAILDRIVER (Park City)—Under lease to J. D. Fisher and C. L. Rood. Raise from 700 level up 110 ft.; ore followed 60 ft. vertically. Work to be continued to 350 level upward and to 950 downward.

WASHINGTON

Stevens County

UNITED COPPER (Chewelah)—Gray copper ore carrying silver struck in 50-ft. winze sunk from 1300 level. Find causing comment.

NORTHPORT S. AND M. (Northport)—Smeltery closed indefinitely.

CANADA

British Columbia

GRANBY CONSOLIDATED (Anyox)—Fire on Mar. 2 damaged smeltery roof and converter building stopping operations.

RAMBLER-CARIBOO (Three Forks)—Post office at Three Forks closed temporarily. Communications to company should be addressed to Sandon, B. C. Branch office at 503 Spokane & Eastern Bldg., Spokane, Wash. A F. McClaine is president.

TUDHOPE ELECTRIC METALS (Vancouver)—Erecting small electric furnace on False Creek, primarily for reduction of scrap metal.

Ontario

MONDEAU (Boston Creek)—Option held by Timmins interests has been dropped.

ADANAC (Cobalt)—Shipping milling ore to Dominion Reduction Co. for treatment.

McKINLEY DARRAGH (Cobalt)—Ore reserves estimated to contain 852,754 oz. after production for year of 1,014,678 ounces.

OPHIR (Cobalt)—oCbalt vein with low silver values cut on 580 level. Property under option to Nipissing.

INTERNATIONAL NICKEL (Copper Cliff)—Production now 2000 tons of matte a month, with talk of cutting still further to 1000 tons. During 1918 production was about 6500 tons a month. Large numbers laid off, but complete organization is being retained.

BURNSIDE (Kirkland Lake)—Negotiations under way for amalgamation with Tough Oakes and Sylvanite. Tough Oakes has good mill and no ore; the others have no mills, but are supposed to have good orebodies.

MEXICO

LA CUAUHTEMOC M AND S CO., of Seattle, Wash., which has developed properties in Morelos and Guerrero, Mexico, is about to resume operations after being shut down for several years owing to disturbed conditions, according to official statement Charles E. Littlefield, vice-president, arrived in Mexico City on Mar 8 to arrange necessary preliminaries Company owns Cuauhtemoc and Tres Estrellas mines, silver-lead producers

Baja California

COMPAGNIE DU BOLEO (Santa Rosalia)—January production of copper was 1,654,240 lb, December 1,785,840 pounds

Sonora

GREENE-CANANEA (La Cananea)—February production was 3,000,000 lb. copper (January, same), 112,870 oz silver, and 650 oz gold

PERU

Junin

CERRO DE PASCO (La Fundicion)—February production of copper was 4,586,000 lb, January, 5,836,000 pounds

BELGIAN CONGO

UNION MINIERE DE HAUT KATANGA (Elisabethville)—January production of copper was 3,306,900 lb December 2,513,244 pounds

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver		Mar.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
6	4.7575	101⅛	47¾	10	4.7575	101⅛	47¾
7	4 7575	101⅛	47¾	11	4.7575	101⅛	47¾
8	4.7575	101⅛	47¾	12	4.7575	101⅛	47¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
6	14¾ @14⅞	68	5.25	5.05 @5.10	6.12½ @6.17½
7	14¾ @14⅞	68	5.25	5.05	6.10 @6.15
8	14¾ @14⅞	68	5.25	5.05	6.10 @6.15
10	14¾ @14⅞	68	5.25	5.05	6.05 @6.10
11	14¾ @14⅞	68	5.22½ @5 25	5.00 @5.05	6.00 @6.05
12	14⅝ @14⅞	68	5 22½ @5 25	5.00 @5.05	6.00 @6 05

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

Mar.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
6	74	70¼	(a)	234½	226½	28	25	37½
7	74	70¼	(a)	239	232½	28	25½	38
8	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
10	77	73	(a)	242½	235	28	25½	38
11	77	73¼	(a)	238½	232	28	25½	38
12	76½	72½	(a)	236	229	28	25½	38

(a) No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Mar. 12, 1919

A fair business was done in copper, lead, and zinc during the week at substantially unchanged prices, except in the case of spelter, which declined further. At the close copper was also weaker.

The stocks of metals in the possession of the British Ministry of Munitions on Mar. 1 and at the beginning of previous months were as follows, in tons of 2000 pounds:

	Jan. 1	Feb. 1	Mch. 1
Copper	40,320	46,907	57,538
Lead	70,394	96,872	112,070
Zinc	33,925	35,435	40,660
Aluminum	13,392	14,664	14,564
Nickel	2,325	2,674	2,612
Antimony	3,929	4,178	4,844

During January, 1919, Great Britain imported copper, lead, and zinc as follows: Copper from United States, 8847 tons; from Chile, 1943; from Australia, 517. Lead from Spain, 5447; from United States (Mexican lead) 11,504; from Australia, 4329. Zinc, 11,187 tons. The January importation represents, of course, metals that were afloat in December or shipments from stocks in foreign countries, and these arrivals explain the increase in the stocks in Great Britain during January. Doubtless the same condition continued during February.

The London metal prices for Mar. 5, which were not received at the time of going to press with the Mar. 8 issue, are as follows: Spot copper, £74; 3-mo. copper £70¼; electrolytic copper, no quotation; spot tin, £230; 3-mo. tin, £222½; spot lead, £28; 3-mo. lead, £23½; spot zinc, £38.

Copper—After the time of closing our review last week, an additional sale of 2,000,000 lb. was made, making the total for the week 22,500,000 lb. of electrolytic copper. This week the sales have been lighter, the aggregate of our reports being a little more than 10,000,000 lb., which included one large sale for future delivery. The rest of the business was done in lots of 100,000 to 500,000 lb., the daily totals showing no great differences. The business was shared by all of the producers. In general the price was 15c., delivered, but if a buyer demanded the old terms of "delivered, 30 days" he was likely to get it, numerous sales being actually made on that basis during the last week, wherefore the New York net cash equivalents were 14⅝c. @14⅞c. It is much to be regretted that the copper business, which during the war became established on a cash basis, shows signs of reverting to the old conditions of time for payment. However, this is a buyers' market, and sellers have to defer to demands more than they would otherwise.

During the afternoon of Mar. 12 copper was freely offered at 14⅝c., and a considerable lot was sold for export at that price. Advices from London, both by mail and cable, indicate that more interest is being shown in copper there, the price having fallen to a level that attracts the notice of consumers, who exhibit new confidence. The quoted prices are probably above actual sale values. American copper is being offered in many forms, one lot of 1000 tons of "shell bands" having been going the rounds both in Great Britain and France. The sales that have been effected abroad have been the result of sharp cutting of prices.

On Mar. 10 the wire drawers reduced their price for wire to 17@17¼c., corresponding to 14⅞@15c. for wire bars, according to how the differential is figured. There is a good deal of variation in differentials at present.

We hear that in Siberia the Kyshtim company has a stock of several thousand tons of copper, for which at present it has no market, owing to the general disorganization of affairs, especially of the Siberian railway.

Referring to the conference with the copper producers in New York Mar. 3, the Director of Sales of the War Department authorizes the following statement:

"The producers present at this conference represented approximately 90% of the copper production. A tentative agreement was reached whereby the copper producers will market the Government surplus copper at the prevailing market price, charging the Government the actual cost of so doing. It will be distributed by the producers in connection with their own product, the minimum monthly amount being fixed and the actual amount disposed of being a certain percentage of their total sales, if this exceeds the minimum amount. It was also agreed that the copper will be entirely distributed within 15 months. Final arrangements regarding this sale will be completed within a short time."

Negotiations for the actual contract are well under way and no doubt will soon be closed in a mutually satisfactory manner.

British trade papers report that the quantity of copper salvaged from the battlefields of France and Flanders is so much greater than expected that the War Trade Department has been authorized to issue licenses for its exportation.

Copper Sheets—The base price of copper sheets is 22½c. per pound.

Lead—The business of the week was only moderate in volume, the sales of the principal producers amounting to about 1800 tons. Throughout the week an easier tone was exhibited, and in the latter part this was reflected in a shading of quotations. This afternoon lead was reported offered by an interest, not a producer, at 5.15c., New York.

Tin—Business in American tin, 99% grade, was done from day to day at 68c. Straits tin was offered at 47½c. for delivery after all restrictions are removed. It was rumored that the restriction on the importation of tin ore into the United States may be lifted June 1.

Zinc—This market was dull and declining, prices yielding a little from day to day. The accumulation of stocks is large, and it is doubtful if curtailment of production has been as extensive as ought to be. Some smelters have announced reduction of wages, which have been accepted by the men in good part. Reliable reports have been received that some galvanizers have suspended operations.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Unchanged.

Antimony—Some small sales were made, but there was not much interest in this market. We quote spot at 7c. and futures at 6⅝ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—During the week there was a further decline, and at the close we quote the market weak at $73@75. San Francisco reports, by telegraph, $73.

Silver and Platinum

Silver—Owing to the stabilizing of exchange, which still continues, the silver market remains unchanged and without new features. London reports that the requirements for the trade are fair. India still remains the chief buyer, with no change in sight as to her position. Shipments of silver bullion to London for the week ended Mar. 8th, 185,000 ounces.

Mexican dollars at New York: Mar. 6, 77½. Mar. 7, 77½; Mar. 8, 77½; Mar. 10, 77½; Mar. 11, 77½; Mar. 12, 77½.

Platinum—Refined ingot, $97.50@100.

Palladium—$115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 8—Blende, per ton, high, $47.50; basis, 60% zinc; premium, $45; Class B, $42.50; Prime Western, $42@41; sludge, $40@38; calamine, basis 40% zinc, $28@27. Average selling prices: Blende, $42.08; calamine, $31.57; all zinc ores, $41.73.

Lead, high, $65.95; basis 80% lead, $65@60; average selling price, all grades of lead, $59.84 per ton.

Shipments the week: Blende, 11,262, calamine, 375; lead, 1377 tons. Value, all ores the week, $568,100.

With an encouraging advance in lead prices came a weak zinc-ore market, with light demand and prices dropping $1 to $1.50 per ton. With zinc prices rather firm around $42@42.50 the output has grown steadily for several weeks among producers who can operate at a slight profit on those prices. It has been said that a return to a $41@40 basis would reduce the production, but with the liberal advance in lead, if maintained, most of the big mines, being lead outputters, can be operated.

Platteville, Wis., Mar. 8—Blende, basis 60% zinc, $45 base for premium grade and $42 base for high-lead blende. Lead ore, basis 80% lead, $55 per ton.

Shipments reported for the week are 1965 tons blende, and 152 tons galena. For the year to date the totals are 17,330 tons blende, 869 tons galena, and 73 tons sulphur ore. During the week 3065 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—No change in the situation.

Manganese Ore—Still in oversupply.

Molybdenum Ore—Quoted nominally at 85c. per lb. of molybdenum sulphide.

Tungsten Ore—No business reported. There were some inquiries, but the prices intimated by buyers as to what they would pay were very low.

Pyrites—Spanish pyrites unchanged at 16.5c. per unit on the basis of 10s. ocean freight.

Iron Trade Review

PITTSBURGH—Mar. 11

The pig-iron and steel markets had been moving slowly, and naturally they came to a standstill when it became apparent that the "price suggestion" plan of Secretary Redfield, for deflation of war-time prices, would probably be adopted. As a matter of policy the steel producers exhibited no enthusiasm over the Redfield plan, but as a matter of fact the majority welcomed it, because they realized that some price reductions should be made, whereas, because of the provisions of the Sherman Law, the path to really fair prices was beset with difficulties. The establishment of the Industrial Board of the Department of Commerce provided the means for a frank discussion of prices between representatives of the industry and representatives of the Government. At a meeting of about 130 representative producers of Lake Superior iron ore, pig iron and steel, last Thursday, the project was unanimously approved and a committee was appointed, with full power to deal with the board. The board and the committee will meet in Washington next week, but it is hardly likely that this one meeting will result in the formulation of a schedule of prices that can be given to the public and made effective at once. The investigation and negotiations will probably be protracted, and it seems to be the idea in the trade that it will be close to Apr. 1 before the new prices are announced.

Pig Iron—The pig-iron markets have continued to soften. Southern furnaces were calling their market nominally $31, Birmingham, on No. 2 foundry, but when the Standard Sanitary Manufacturing Co., of this city, inquired for 1500 tons for March delivery to its Louisville plant, it was able to buy at $28.25, Birmingham, and took only 500 tons, deferring purchase of the remainder until still lower prices should be quoted. At least two eastern Pennsylvania furnaces have started quoting f.o.b. furnace, abandoning the Pittsburgh basing which the War Industries Board accorded them in the adjustment of late September, this making an average decline of about $2 at usual delivered points. Two or three Valley furnaces have offered to sell No. 2 foundry at $28 or less at furnace, the nominal market having been $31 in accordance with the $3 reduction from Government limits at the first of the year. There has been no inquiry for bessemer or basic, hence lower prices have not been developed on these grades. We quote: Bessemer, $32.20; basic, $30; No. 2 foundry, $28; forge, $27, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—Naturally there has been no improvement in this already dull market in the face of probabilities that a general reduction in prices would soon become effective. Makers' quotations are unaltered. Billets, $43.50; sheet bars and small billets, $47; slabs, $46, f.o.b. mill, Pittsburgh or Youngstown, rods, $57, f.o.b. mill, Pittsburgh.

Ferromanganese—The market continues on the basis of re-sale material, about $150, seller's works, for 80%, and $135@140 for 70%. Makers' quotations remain at $200 for 80%, and $170 for 70%, delivered. Spiegeleisen is about $45, f.o.b. furnace, for 16%.

Coke—Only small tonnages of demurrage coke are pressing on the market but operators are willing to sell the prospective make at lower prices, and so the market is no higher. Furnace coke for spot shipment or shipment over March is readily available at $4; foundry coke is $4.50 and upward, according to brand. One contract for furnace coke has been adjusted to $4.50 for March, but most adjustments have been at $4.25. Production is being so curtailed as to fairly well balance the requirements.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	....	36.410	43.620	.....
April	73.875	95.346	....	36.963	47.215	....
May	74.745	99.505	.....	37.940	48.980	
June	76.971	99.500	....	39.065	48.875	.....
July	79.010	99.625	....	40.110	48.813	.....
Aug	85.407	100.292	....	43.418	49.077	......
Sept	100.740	101.125	. .	50.920	49.500	
Oct	87.332	101.125	. .	44.324	49.500	
Nov	85.891	101.125		43.584	48.969	
Dec.	85.960	101.125	.	43.052	48.492	
Year	81.417	96.772	....	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan	23.500	(a)	110.000	92.238	125.000	106.619
Feb	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	.	110.000		125.000	. . .
April	23.500		110.000		125.000	. . .
May	23.500		110.000		125.000	.
June	23.500	.	110.000		125.000	.
July	25.904	.	119.913		134.913	
Aug.	26.000	.	122.000		137.000	.
Sept	26.000	.	122.000	. .	137.000	
Oct	26.000	.	122.000	.	137.000	.
Nov.	26.000		122.000	.	137.000	..
Dec.	(a)		118.447	.	133.167	
Year	24.628	. . .	115.530	. .	136.507	

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	02.000	66.801	311.525	223.963
March	(a)		318.875	.
April	(a)		329.905	
May	(a)	.	364.217	
June	(a)		331.925	
July	(a)		360.347	
August	(a)		380.900	
September	(a)	......	343.905	....
October	(a)	......	335.543	....
November	(a)	......	323.550	....
December	(a)	......	267.736	....
Av. year	(a)	......	330.138	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	6.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	.	7.091	.	29.00	
April	6.772		6.701		29.00	
May	6.818		6.704	.	29.00	
June	7.611	.	7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050	.	7.750		29.00	
October	8.050		7.750		29.00	
November	8.056		7.750		31.20	.
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461		7.286		54.000	
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		64.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25		33.95		33.95	
April	36.15		32.95		33.95	
May	36.20		33.00		34.00	
June	36.36		33.16		34.16	.
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67	.	$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar 11
Alaska Gold M.	4
Alaska Juneau	2½
Am.Sm.&Ref.,com.	71
Am.Sm.&Ref., pf.	104½
Am.Sm.Sec., pf., A.	93½
Am. Zinc	12¼
Am. Zinc, pf.	42
Anaconda	62½
Batopilas Min	1¼
Bethlehem Steel	69¾
Butte & Superior	19½
Butte Cop. & Zinc	6½
Cerro de Pasco	32
Chile Cop	18½
Chino	34½
Colo. Fuel & Iron	42
Crucible Steel	67½
Crucible Steel, pf.	95
Dome Mines	13½
Federal M. & S.	11
Federal M. & S., pf.	38¾
Great Nor., ore ctf	43
Greene Cananea	43¾
Gulf States Steel	56½
Homestake	97½
Inspiration Con.	47¾
International Nickel	25½
Kennecott	30¾
Lackawanna Steel	71
Mexican Petrol	189½
Miami Copper	23½
Nat'l Lead, com.	69½
National Lead, pf.	107
Nev. Consol	16½
Ontario Min.	7¼
Ray Con	20
Republic I.&S.,com.	85
Republic I.&S., pf.	102½
Sloss-Sheffield	55½
Tennessee C. & C.	13½
U. S. Steel, com.	97½
U. S. Steel, pf.	114¾
Utah Copper	73½
Va. Iron C. & C.	56
Worthington Pump	67

BOSTON CURB*	Mar. 11
Alaska Mines Corp.	‡.12
Boston Ely	.95
Boston & Mont.	.48
Butte & Lon'n Dev	13
Calaveras	1
Chief Con.	3½
Contact	.05
Corbin	‡.25
Cortez	.13
Crown Reserve	.50
Crystal Cop.	22
Eagle & Blue Bell	2½
First Nat. Cop.	1½
Houghton Copper	30
Intermountain	‡.05
Iron Blossom	.43
Iron Cap	11½
Majestic	.17
Mexican Metals	.26
Mines of America	‡.05
Mojave Tungsten	.07
Nat. Zinc & Lead	.08
Nevada-Douglas	.20
New Baltic	1
Oneco	25
Pacific Mines	‡.35
Rex Cons.	‡.05
Yukon Gold	.75

SAN FRAN.*	Mar 11
Alta	.01
Andes	.07
Best & Belcher	.04
Caledonia	.05
Challenge Con	‡.03
Confidence	‡.03
Con. Virginia	.19
Gould & Curry	.02
Hale & Norcross	.19
Jacket-Cr. Pt	.04
Mexican	.14
Occidental	.40
Ophir	.27
Overman	.01
Savage	.09
Sierra Nevada	.05
Union Con	.16
Utah Con	‡.02
Belmont	3.50
Jim Butler	.38
MacNamara	.49
Midway	.31
Mont.-Tonopah	.15
North Star	.07
Rescue Eula	.08
West End Con	1.05
Atlanta	.05
Booth	.11
Comb. Frac	1.02
Florence	.34
Jumbo Extension	.13
Kewanas	.05
Nevada Hills	.02
Nevada Packard	.20
Round Mountain	.41
Silver Pick	.06
White Caps	.15

COLO. SPRINGS*	Mar. 10
Cresson Con	4.81
Doctor Jack Pot	.03
Elkton Con	.05
El Paso	.15
Gold Sovereign	‡.02
Golden Cycle	1.75
Granite	.11
Isabella	.05
Mary McKinney	.07
Portland	.75
United Gold M.	.11
Vindicator	.41

BOSTON EXCH.†	Mar 11
Adventure	75
Ahmeek	67
Algomah	‡ 30
Allouez	40
Ariz. Com	12
Arnold	‡.20
Bingham Mines	‡8½
Bonanza	‡.10
Butte-Balaklava	‡.22
Calumet & Ariz.	69½
Calumet & Hecla	405
Centennial	13
Copper Range	41½
Daly West	3
Davis-Daly	5½
East Butte	8½
Franklin	3½
Granby	70
Hancock	5½
Hedley	‡12
Helvetia	.22
Indiana	‡ 75
Isle Royale	24½
Keweenaw	‡ 99
Lake	3½
La Salle	‡2½
Mason Valley	2½
Mass	‡4
Mayflower	3½
Michigan	‡2½
Mohawk	54
New Arcadian	‡1½
New Cornelia	15
New Idria	9½
North Butte	10½
North Lake	50
Ojibway	‡1½
Old Dominion	34
Osceola	49
Quincy	57½
St. Mary's M. L.	‡42½
Santa Fe	‡ 25
Seneca	14
Shannon	2½
Shattuck-Ariz.	‡14½
So. Lake	1
So. Utah	‡.14
Superior	5
Superior & Bost.	2½
Trinity	2½
Tuolumne	82
U. S. Smelting	50½
U. S. Smelting, pf	49½
Utah Apex	2½
Utah Con	8½
Utah Metal	1½
Victoria	1½
Winona	90
Wolverine	17½

N. Y. CURB†	Mar 11
Big Ledge	.56½
Butte & N. Y.	.50
Butte Detroit	.05
Caledonia	.31
Calumet & Jerome	.50
Can. Cop. Corpn	1.81
Carlisle	‡2
Cashboy	‡.06
Con. Ariz. Sm	1.06
Con. Coppermines	5
Goldfield Con	.18
Goldfield Merger	.06
Greenmonster	⅛
Hecla Min	4½
Howe Sound	13½
Jerome Verde	⅛
Louisiana	
Magma	‡27
Marsh	‡.03
McKinley-Dar-Sa	.44
Milford	‡.75
Mother Lode	.37
Nixon Nevada	.40
Ohio Cop	1⅛
Rawley	‡2½
Ray Hercules	2½
Richmond	‡.56
Rochester Mines	.17
St. Joseph Lead	11
Standard S. L.	1
Stewart	.15
Success	‡.05
Tonopah	13½
Tonopah Ex	2½
Tribullion	1½
Troy Arizona	‡.10
United Eastern	4½
United Verde Ext.	32½
United Zinc	
Utica Mines	‡.08

TORONTO*	Mar 11
Adanac	.18
Bailey	.04
Beaver Con	.42
Chambers Ferland	.09
Coniagas	2.00
Hargraves	.02
Kerr Lake	‡5.12½
La Rose	.31½
Lake Shore	.91
Min. Corp. of Can	2.00
Nipissing	‡8.75
Peterson Lake	.07
Temiskaming	.30
Wettlaufer-Lor	.03
Davidson	‡.55
Dome Exten	.29
Dome Lake	‡.23
Hollinger	6.12
McIntyre	1.62
Newray	.12
Porcu. Crown	.27
Teck-Hughes	.20
Vipond	.25
West Dome	.14

* Bid prices. † Closing Prices. ‡ Last quotations.

Engineering and Mining Journal

March 22, 1919

Volume 107 Number 12

THE VILLAGE OF LIBERTAD, REPUBLIC OF COLOMBIA

The Guamoco District of Colombia—I

By S. FORD EATON*

The Guamoco district of the Republic of Colombia is little known to the outside world, and the paper which follows should be welcome, as it gives comprehensive data of the history of mining in that country. Details of travel and the physical characteristics of the mineral deposits are also presented. In a later issue a concluding installment will contain practical information on the progress of mining, working conditions, and other vital factors influencing industrial development of the Guamoco district, which should prove of value to many engineers

IN ALL probability the mining world knows less and hears less concerning the Guamoco region of Colombia, South America, than of any other mining district of an equivalent area. It is, however, essentially a mining district, the only other industry being farming, which is practiced only to an extent required to supply the needs of the few operating mines.

Guamoco has no well-defined boundaries, the name covering that section of country lying between the Nechi and Magdalena rivers. A northern boundary can be roughly indicated on the map by a line drawn from the town of Nechi, at the confluence of the Nechi and Cauca rivers, due east; and the southern limits may be determined approximately by a line running east from the town of Zaragoza, on the Nechi River. By laying off a 50-mile square within these limits, with the north and south center line somewhat closer to the Nechi than to the Magdalena, one can form a general idea of the extent of the hills of Guamoco.

In all probability the name Guamoco has come down from the Indians who originally occupied these Colombian hills. Accurate data regarding the earlier periods are hard to obtain. Many tales are told by the older natives, but when one is familiar with their mental characteristics, it is impossible to distinguish fact from fancy. However, indications are everywhere present of the work done by the earliest Indians and the later Spaniards. Placer mining was carried on to such an extent that scarcely a creek or river can be found which does not show that work has been done. Only the surface was worked, however, as any excavations found in the quartz ledges do not extend to a depth of more than 40 to 50 ft. Old trails and roads have been found, and in many places there are indications of the existence of settlements or towns of considerable size.

---

*Consulting mining engineer, Rocky Mountain Club, 65 West 44th St., New York.

Extensive Spanish workings are to be noted at considerable altitudes, some distance from any constant supply of water. Leading to these are found the remains of well-constructed ditches, many being several miles long, and in some cases surprisingly well preserved. With a small amount of work they have been used by modern miners as trails or to bring in water. Exhaustive testing of some of the placer fields proves beyond doubt that the material is and was low grade. History relates that the Spaniards imported thousands of African slaves, forcing these, together with Indian captives, to work for a bare subsistence.

Interest in Mining Was Revived in 1890

For many years after the Spaniards had left Guamoco, the district was practically deserted. Authentic records of modern mining activity go back 75 years, and indicate that it was not until about 1890 that the vanguard of present-day operators arrived. One of the first to start systematic work was an American named Dustin. He found an old mine called the Guarico, which had been worked by the Spaniards, 50 years before the coming of Dustin. An Englishman and two Cubans had worked the same property. They used a wooden mill and arrastra, apparently working the surface only. Among the interesting features to be seen in the remains of this old plant are the heavy, square-iron stamp shoes, which were undoubtedly imported from England.

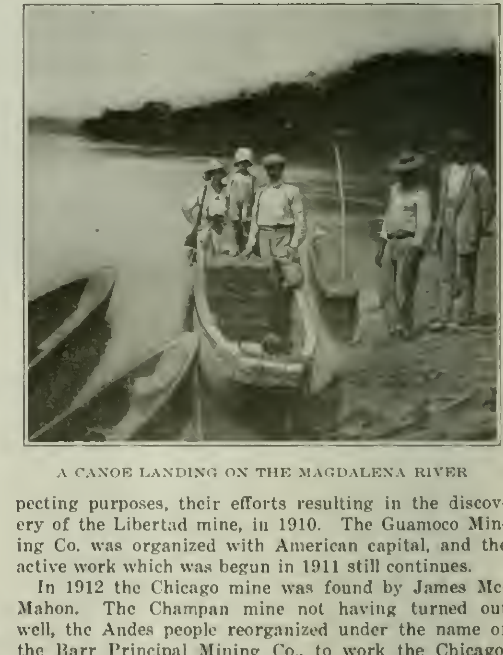
Dustin eventually brought in a complete assaying outfit, built a small experimental mill of the native type, and also installed a crude apparatus for making cyanide tests. After considerable experimenting and underground work, he came to the United States, purchased a small Californian mill, and returned with it as far as La Llana, just off the Nechi River. Here, unfortunately, he died, and his outfit can still be seen on the river bank at that point. About this time a number of other parties came into Guamoco, including the representatives of a French company. Work was started, but apparently the handicaps were too great, as no mining operations of any note resulted.

Thumb-Stringing—a Native Pastime

About 1903 a mining engineer named Cunningham traveled through Colombia on a scouting trip. From the mining districts in the Department of Antioquia, he gradually worked his way north through the jungle. Passing through the heart of Guamoco he saw, among other things, the Andando-dias mine, which was being worked by natives. His journey's course eventually terminated in the lowlands at Simiti, practically on the Magdalena River. Those were troublesome times in Colombia, revolutions being the order of the day. In fact, a fracas was occurring when Cunningham reached Simiti. He arrived when a number of peones were thumb-stringing a native of the better class. Cunningham interfered and succeeded in getting the crowd to release their victim, who proved to be Don Felipe Alcocer, a citizen of means and an owner of considerable property and numerous so-called mines in Guamoco. Included among the latter was the Andando-dias mine, which Cunningham had visited and on which he secured an option, the price to be $5000. It is supposed that Don Felipe purposely placed a low value on the mine through gratitude toward Cunningham. The Andando-dias Co. was organized in the United States, and the mine purchased. Work was started at once, and a steam-power, five-stamp California mill brought in and installed. Among those employed by the company was W. C. Burdett.

Organization of the Andes Mining Company

About this time two other Americans, influenced by reports of Cunningham, came into Guamoco, W. C Parrish and Francis Breed, and they were instrumental in organizing the Andes Mining Co. The purpose of the company was to find and exploit gold mines in Guamoco, and H. B. Small was employed as engineer. In 1907, the company purchased the Champan mine. A five-stamp California mill was installed, good ore was found, and operations started well. Soon after this the Andando-dias property failed to pay expenses, and was shut down. Small and Burdett joined forces for prospecting purposes, their efforts resulting in the discovery of the Libertad mine, in 1910. The Guamoco Mining Co. was organized with American capital, and the active work which was begun in 1911 still continues.



A CANOE LANDING ON THE MAGDALENA RIVER

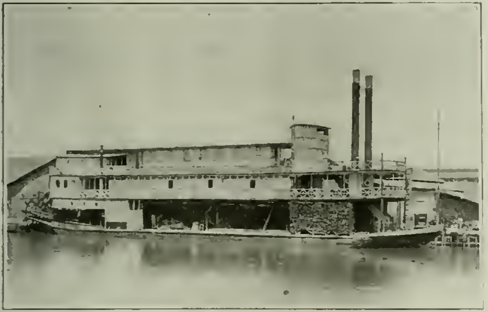
In 1912 the Chicago mine was found by James McMahon. The Champan mine not having turned out well, the Andes people reorganized under the name of the Barr Principal Mining Co., to work the Chicago. A mill was installed for treating the oxide ores by amalgamation and cyaniding. Indifferent success met their efforts, and failure resulted when the sulphides were reached. Eventually the plant was closed. In 1917 the Barr Principal Leasing Co. was organized by some of the original stockholders to treat the sulphides by means of the counter-current decantation cyanide process. W. B. Rhodes was placed in charge and the mill resumed operations in 1918.

About 12 miles west of the Chicago mine is the La Cruz. This property was opened a few years ago by W. C. Parrish, and a Colombia stamp mill and arrastra were erected. A number of rich pockets were found, but returns did not prove consistent, and the mine is now being worked by the original owners. Los Chispiados, a new property, has been opened by Colombians, and a small stamp mill is apparently operating successfully.

The above notes form a rough summary of the principal operations in Guamoco. Other prospects have been found and worked, but no important developments worthy of note have occurred. High costs and the difficulties of transportation are serious handicaps for intensive prospecting on a large scale. Hand placer work, by the natives, goes on continually throughout the hills, but the returns, although constant, are comparatively low.

TRAVELING IN THE GUAMOCO DISTRICT

There are three ways to enter Guamoco—one from the Magdalena River, one from the Cauca, and the third from the Nechi. The first mentioned is the longest, hardest, and least used. The ocean steamers land one at Cartagena or Puerto Colombia. The journey from Cartagena to Calamar is by rail. Going in by way of Puerto Colombia, the river boats can be boarded at Barranquilla. The steamers go direct to Badillo, and from there to Simiti is a few hours' trip by canoe. From Simiti it is a four- to six-day hike to Culata, the central point of Guamoco. Mules can be used on this trail, but travel is light and so it is safer and easier to walk. Practically the only traffic over this route is by means of pack-oxen trains, with supplies for the mines.



A SHALLOW-DRAUGHT BOAT ON THE MAGDALENA RIVER

The second route is via Boca de la Raya on the Cauca River. Magdalena boats are taken to Magangue, and from there the journey is continued on the smaller Cauca boats, which stop at La Raya. From La Raya it is a 24-hour canoe trip up the San Marcos River to Buena Vista. From Buena Vista to Libertad is 45 miles over a good trail maintained by the Guamoco Mining Co.—a journey that can be made in two days by mule.

For the third way, the traveler stays on the Cauca steamer until Puerto Andes is reached. From this point it is a 2½-day mule-back trip to the Chicago mine. From the Chicago one can get to other points of importance by mule back, in a day's ride or less.

PHYSICAL CHARACTERISTICS OF THE REGION

The physical characteristics of the region are not varied. After leaving the lowlands near the two main rivers, one encounters range after range of jungle-covered mountains. These ranges run north and south, and the strike of the rock formation is practically the same. In the northeastern section there are some high-level plains, or "vegas." Occasionally in the lower altitudes the canyons will open out into moderate sized flats, which are favorable for agricultural purposes. Most of the larger streams are impassable in the upper reaches, except by strenuous detours.

Gold is the only metal that has been mined to date, and is found throughout the district. Quartz veins abound, ranging from 1-in. stringers to 40-ft. ledges. Practically all the streams have, at some point or other, gold-bearing gravel beds. The gold in the ores is, for the most part, remarkably free and of high fineness, although sulphides are found in small amounts. Lead is contained in the commercial ores, and is usually a good indication of the presence of gold and low content of silver. The country rock varies from soft schist and slate to a hard diorite. Some granite is found, and there is one pronounced band of limestone formation.

Experience in the Guamoco mines proves beyond doubt that the valuable minerals are in pockets. There seems to be no rule or reason for their occurrence or location. A face being advanced in the quartz may change from barren rock to $40 or $50 ore, or vice versa. Occasionally, extremely rich stringers are encountered, but their extent is always problematical. The veins are erratic in their strength, a decrease from 15 or 20 ft. in width to 2 or 3 ft. (or the reverse) within a few hundred feet of strike or depth, is not uncommon.

(To be continued)

Manganese and Chromium in California

A report entitled "Manganese and Chromium in California," known as Bulletin No. 76, is now being distributed by the State Mining Bureau. California has long been known to contain deposits of commercial ores of both chromium and manganese; but only a limited production was made for many years, owing to the high cost of placing these materials on the principal markets, in the Eastern states.

During the period of the Great War the prices and requirement for these ores were raised greatly, on account of the curtailing of imports from the principal foreign sources and because of the increased demand for steel products. So far as possible, all known occurrences of these ores in California were visited and examined by members of the field staff of the State Mining Bureau; and the results of these examinations are embodied in this new bulletin.

The situation with regard to both manganese and chrome changes so rapidly from day to day and from week to week, that the scene has been entirely transformed in the interim of completing the manuscript for such a report as this, and its issuance from the printer's hands. Meanwhile, also, hostilities have ceased. However, the volume is still of value in that it is the only publication of recent date containing comprehensive and detailed data on the manganese and chromium resources of the entire State of California. Considerable information is given regarding concentration of these ores, particularly of chromite. The volume is well illustrated with photographs and maps.

Copies of Bulletin No. 76 may be obtained for 50c. postpaid, from the State Mining Bureau, Ferry Bldg., San Francisco, or Room 512, Union League Bldg., Los Angeles.

The Theory of the Precipitation of Gold By Charcoal*

By A. W. ALLEN

RECENT research work in connection with the precipitation of gold or a gold compound by charcoal seems to have centered around a determined effort to prove that carbon monoxide gas is the cause. The investigations of Morris Green[1] lent a considerable weight to this theory. His conclusion that the carbon monoxide occluded in the pores of the charcoal was the active agent for the precipitation of gold from cyanide solution was based on experimental work, which went to show that charcoal from which the gases had been withdrawn, *after considerable heating*, was a poor precipitant when compared with charcoal not so treated.

A table (No. I), showing the volumes of gases abstracted under various conditions, is given herewith, and has been compiled from Green's monograph. By removing the amounts shown in Cols. 1 and 2, the ability of the charcoal to precipitate gold was practically unimpaired. In Col. 3 a test is shown when the charcoal was subjected to moderate heat and high vacuum without appreciably affecting its precipitating power. The figures given in Col. 4 indicate the volumes of gases recovered by subjecting the charcoal to a high temperature (just above the decomposition point of carbon monoxide into carbon dioxide and oxygen). After this test the charcoal was cooled away from the atmosphere and afterward used as a precipitant. Tests showed that its power had been considerably reduced. The conclusion with reference to the action of carbon monoxide gas was based on a comparison of these results with the well-known fact that inert or exhausted charcoal, after heating in contact with the atmosphere, becomes revivified, and its precipitating powers largely restored.

TABLE I. EVOLUTION OF GASES FROM CHARCOAL

Gas	I. 5 gm. Freshly Ignited Charcoal to 20-in. Vacuum. c.c.	II. 5 gm. Exposed Charcoal to 20-in. Vacuum. c.c.	III. Charcoal From II Heated to 70° High Vacuum. c.c.	IV Charcoal From II Heated to 500° High Vacuum. c.c.
CO_2 ..	0 0	0 16	1 50	155 00
O....	10 76	18 28	8 58	8 75
CO... .	12 30	0 90	0 40	327 50
Methane .	0 00	0 49	0 52	0 00
H.. . . .	22 75	45 10	5 85	31 25
N	15 68	17 05	48 16	727 50
Total Volume of Gases Expelled	61 49	81 98	65 1	1250 00

MORRIS GREEN'S EXPLANATIONS OF THE REACTION

Green's conclusions relied on the inference that the immense volume of carbon monoxide gas, which may be obtained by heating and exhausting charcoal, existed in the same chemical composition, although in a much more condensed and active state, on the surface of the charcoal particles. The negative results obtained by a comparison of the precipitating powers of charcoal before and after abstraction of the carbon monoxide at low vacuum and normal or moderate temperatures were explained by the assumption that the "loosely held gases" were valueless in this connection, an inference which was perhaps only a repetition of the fact that carbon monoxide has no action whatever as a precipitant of gold from cyanide solution when applied experimentally.

The work of Rhead and Wheeler[2] on the combustion of charcoal is of pertinent application in considering the precipitation of gold from aurocyanide solution. Starting with the assumption that the carbon molecule contains not less than 12 atoms, they summarize their conclusions by stating that "in the normal burning of carbon the CO_2 and CO, found as the apparently primary products of combustion, arises from the decomposition, *at the temperature of combustion*, of a complex whose formation is the first result of the encounter of oxygen and carbon molecules. This complex, to which the hypothetical formula C_xO_y has been given, shows variation in composition and cannot be isolated by physical means. When released *by increase of temperature and exhaustion* it appears as CO and CO_2." The italics are mine, and have been added especially to emphasize an important point.

CHARCOAL PRECIPITATION OCCURS AT NORMAL TEMPERATURE AND PRESSURE

O. C. Ralston[3] referred to this fact as explaining the sudden evolution of a great volume of oxides of carbon when Green[4] heated his charcoal *in vacuo* to 500° C., as a preliminary to the only test of this kind which resulted in appreciably decreasing the precipitating power of the charcoal. It is somewhat difficult to see how this fact can be used in support of the carbon-monoxide theory when the gases are not formed or liberated without an increase of temperature and decrease of pressure incompatible with practical precipitation conditions with aurocyanide solution.

W. R. Feldtmann's researches[5] were in the nature of an endeavor satisfactorily to prove and explain the conclusions formed by Mr. Green, and a number of tests made by him led to the conclusion that a gold compound such as carbon aurocyanide—AuCN, CO, C_2N,—was formed. Feldtmann favored the assumption that the carbon monoxide was the prime precipitating agent and held that the metal was precipitated in the form of the compound referred to. According to him, adsorption plays an insignificant role in the reaction, the principal result being apparently a chemical precipitation. A statement of the variation in result with solution of graduated gold content is given in Table II. This is compiled from Feldtmann's paper, and it will be noticed that the third column contains figures referring to what he considered adsorbed gold. These were adduced by the following method: "Of the 200 c.c. of solution, applied to the charcoal in each test, ex-

---

*Abstracted from *Bull.* 171, I. M. M.

[1] *Trans.* I. M. M., Vol. 23, pp. 65-78.

[2] *Journ. Chem. Soc.*, Vol. 113.

[3] *Min. & Sci. Press*, July 17, 1915.

[4] *Ibid.*

[5] *Trans.* I. M. M., Vol. 24, pp. 329-43.

actly one-half was filtered off and the gold in it determined. The remainder of the solution was then passed through the same filter and the charcoal washed with a copious supply of water. The second half of the solution (plus washes) was then assayed. . . . In each case this contained slightly more gold than the first half, showing that, by virtue of surface action, there is a small but distinct concentration of the soluble (and therefore presumably unchanged) gold salt on the charcoal. This concentration of salts in solution is an effect which, as will be noted from the above series of tests, is different in nature and of a different order from permanent precipitation. The precipitation results are based on the amount of gold originally in the 200 c.c. of solution, minus the amount contained in the whole of the solution and washes after precipitation."

This explanation infers a conception of adsorption which is somewhat different from the generally accepted view, especially when consideration is paid to the fact that adsorbed substances are usually removed from the adsorbent only by washing, with extreme difficulty. The alternative explanation that the figures in the final column refer to the gold (as aurocyanide solution) mechanically held in the charcoal by simple imbibition is strengthened by the fact that the so-called adsorption figures do not show the definite and regular variation that might well be expected in an instance of adsorption from solutions of graduated metal content.

Ralston[6] has summarized Feldtmann's conclusions that "a carbonyl aurocyanide is formed by the interaction of the adsorbed gold-bearing ions and the adsorbed carbon monoxide." Reference to Table II will show that adsorption was not considered the cause. In any case Mr. Ralston's interpretation seems to indicate an unnecessarily complicated conception of the phenomenon, although it is interesting to note that he favors the contention that adsorption plays an important part in whatever reactions occur.

The carbon monoxide theory is also supported by H. G. Walton[7], who affirms that the precipitation is due to this cause. This conclusion apparently arises from the favorable results at the Yuanmi mine, which have been interpreted as due, in large measure, to the fact that gas-producer charcoal is used, and that a considerable volume of the gas is drawn through the char on the hearth of the producer before the red-hot particles drop through to the water seal beneath to be quenched.

Yet another champion of the carbon-monoxide theory is found in H. R. Edmands,[8] whose recent contribution to the literature of the subject contains much interesting information. With regard to the formula suggested by Mr. Feldtmann as best representing the probable compound formed, Mr. Edmands shows that 65 parts of KCN would be abstracted from the solution for every 197 parts of gold precipitated. Experiments having shown that these proportions are not correct, the alternative formula—KCN, AuCN, CO—is suggested.

Edmands accepts the earlier work of Green and Feldtmann in support of the carbon-monoxide theory, but it is difficult to conceive how the practical results obtained in working operations can be used in this connection. Attention is called to the fact that water-quenched and wet-crushed charcoal is twenty times more efficient as a precipitant than the air-dried, dry-crushed material. It follows, therefore, that a preliminary treatment tending to eliminate a great proportion of occluded gas results in accelerating the precipitating action. There seems little evidence in this fact to add weight to the carbon-monoxide theory, but rather the reverse. If it can be considered that the precipitation of the gold is not a chemical action but a physical one, then it is easy to see why the removal of occluded gas must necessarily increase the surface activity of the charcoal.

As already stated, carbon monoxide is without effect on an ordinary aurocyanide solution if applied by any known method. It is possible to prepare a gold sol, however, by bubbling the gas through a dilute solution of gold chloride; but this is a distinct case of colloid formation, with no bearing on the present problem. When such a sol is prepared from gold chloride, the chlorine is freed and hydrochloric acid found in the resulting solution. With precipitation of gold by charcoal there is no likelihood of a gold sol being formed, and there is no evidence of the release of the quantity of cyanide that would necessarily accompany such a change. A silver sol can be obtained in the same way with carbon monoxide.

CRITICISM OF VARIOUS THEORIES

Concerning the carbon-monoxide theory, it is to be noted that recent work on a practical scale undoubtedly proves that wet crushing and fine grinding are two of the fundamental necessities for effective precipitation. It would certainly seem that wet crushing for the time specified as found necessary (18 hours) would tend to eliminate more occluded gas than if dry crushing was practiced. The success of the Moore-Edmands process might be ascribed to the fact that the quenching excludes the bulk of whatever gases have been held in the pores of the charcoal, and that wet grinding is a continuation of this action. A treatment that increases the surface area of the charcoal and eliminates occluded gas is one that insures maximum surface energy. The adsorption explanation is generally accepted as the most reasonable one to account for the extraordinary power of surface concentration possessed by charcoal in connection with the abstraction of gases and matter in solution; and a modified explanation would seem to be equally applicable in the case of the precipitation of a metallic compound from gold-bearing cyanide solution.

A few years ago, in commenting on the production of colloidal carbon by means of a modified Poulsen arc and a gelatinous carbon formed by chemical methods, I suggested[9] that there was a profitable field for research in determining the adsorptive nature of colloidal carbon when brought into contact with gold-bearing cyanide solution. Adsorption is by no means confined to colloids, and there seems no reason why the theory should not be more seriously considered to account for the precipitation of a gold compound on finely divided charcoal. The fact that precipitation efficiency is in direct ratio to fineness of division would tend to add weight to this, in opposition to the occluded gas theory; especially when consideration is paid to the fact that improved results are obtained by a method of preparation which facilitates gas expulsion, assists emulsion, and eliminates the floating effect caused by entangled gas.

---

[6] *Ibid.*

[7] Report of the Dept. of Mines of W. A., 1916.

[8] *Bull.* I. M. M., Mar., 1918.

[9] *Trans.* I. M. M., Vol. 25, p. 125.

PRECIPITATION BY OCCLUDED OXYGEN

The following formula has been suggested by H. K. Picard[10] to support the view that oxygen may be the cause of the precipitation:

$$NaAu\,(Cy)_2 + O = AuCy + NaCyO.$$

The products formed would be insoluble gold cyanide, together with cyanate of sodium.

This theory is perhaps more acceptable to many than the carbon-monoxide one, because the oxidizing value of the occluded gas is well known, and the reaction suggested is entirely feasible. The assumption that oxygen is the cause of the precipitation is, however, open to the same constructive criticism.

It has been suggested that the negative charge on the surface of the charcoal particles may neutralize the charge on the metallic ion in the solution, and result in an electro-deposition of metal. Morris Green states that the fine carbon deposit on the surface of charcoal has a graphitoid appearance, and suggests that the e.m.f. between this and the charcoal may account for a small fraction of the power of charcoal to precipitate gold from cyanide solution.

The electro-deposition theory is not convincing, and has been disproved by Edmands, whose titration tests show that there is no freeing of cyanide such as should occur after the abstracting of metallic gold by charcoal.

ADSORPTION OF AUROCYANIDE

Adsorption has been defined by Webster as "the adhesion of molecules of gases or dissolved substances to the surface of solid bodies, resulting in a relatively high concentration of the gas or solution at the place of contact." One of the most prominent characteristics of the phenomenon, as Philip states[11], is that the amount of the dissolved substance taken up by the solid increases much more slowly than the concentration of the solution, and that the removal of the substance is relatively most complete in dilute solutions. This is not a characteristic of any other reaction, but a further reference to Table II shows that charcoal precipitation obeys this law. If this argument is carried to a conclusion it will be found that the best proof is to plot the logs of the amount adsorbed, in proportion to weight of adsorbent, against the logs of the concentrations of the solution; then the curve obtained should approximate a straight line.

TABLE II. ADSORPTION AND PRECIPITATION OF GOLD BY CHARCOAL ACCORDING TO FELDTMANN.

Gold in 200 c.c. Solution, Mg.	Gold Precipitated, Mg.	Gold Adsorbed, Mg
2 16	2 08	0 08
5 4	4 28	0 02
10 8	7 4	0 20
16 2	9 75	0 45
21 6	11 29	0.9

The abstraction of gold from aurocyanide solution in the instance under review is apparently the only case where a chemical action is assumed, and where it is definitely known that the charcoal cannot play a part in the reaction. Similar actions are invariably referred to as adsorptions, and they can be easily shown to obey the above-mentioned law. In the case of an aqueous solution of acetic acid Schmidt gives the following figures:

Concentration of Solution	Weight Adsorbed
0 0365	0.93
0 084	1.15
0 135	1.248
0.206	1.43
0.350	1.62

From the logs of these figures it is possible to plot the curve as shown in Fig. 1, when it will be found that deposition obeys the adsorption law. By using the same argument in the case of gold precipitated from cyanide solution and by plotting the logs of the figures given by Feldtmann, and reproduced in Table II, in the same way it is possible to obtain a precisely similar curve (Fig. 2).

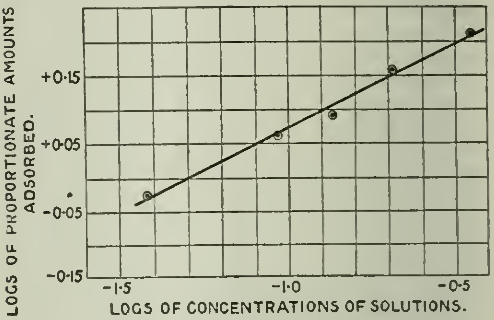


FIG. 1. ADSORPTION CURVE: ACETIC ACID AND CHARCOAL

ADSORPTION PROPORTIONATE TO SURFACE EXPOSED

Adsorption is a surface phenomenon, so much so that it has been suggested that surface area should be estimated by adsorptive effect. This effect is directly proportionate to surface exposure, but it would be impossible to estimate the area in the case of charcoal by calculation from screen analysis, as the larger sizes would possess a greater surface, due to porosity, than that indicated by the cube of the diameter of the average mesh measurement. If this fact is taken into consideration, the figures given in Table III, and quoted by Edmands, are interesting and significant. This datum could well be used in support of the adsorption theory as an explanation of the precipitation of gold, but it is difficult to see that it could be used in support of the contention that occluded carbon monoxide gas is the cause of the action.

TABLE III PARTICLE SIZE AND EFFICIENCY OF PRECIPITATION

Size of Charcoal. In.		Mesh.	Gold Precipitated, Mg
— ¼	+	20	0 806
— 20	+	60	0 806
— 60	+	100	1 211
— 100	+	150	1 617
— 150			3 229
— 150 reground			4 442

The chemical interpretation of the result of the action of charcoal on aurocyanide solution gains no weight from the fact that, according to Edmands, copper double cyanide is unaffected by charcoal, and silver is precipitated only to a small degree. If a chemical reaction takes place whereby a carbonyl aurocyanide or other analogous compound is formed when charcoal is brought into contact with aurocyanide solution, it is reasonable to suppose that some similar compound would be formed with cuprocyanide solution. If the adsorption theory is accepted, then the variation may be considered as attributable to differences in physical characteristics of the solution, caused by variations in surface tension when different metals form the basis of content.

---

[10] *Trans.* I. M. M., Vol. 24, p. 348.
[11] "Physical Chemistry," by J. C. Philip.

Solution from which potassium or sodium-gold cyanide has been adsorbed by charcoal should show a loss of cyanide in proportion to theoretical considerations. Edmands has proved this to be the case, although his figures were meant to support the contention that a compound of the composition KAu, $(CN)_2$, CO was formed. As the same amount of cyanide would be lost in each case, the results are equally applicable in support of the simple adsorption theory.

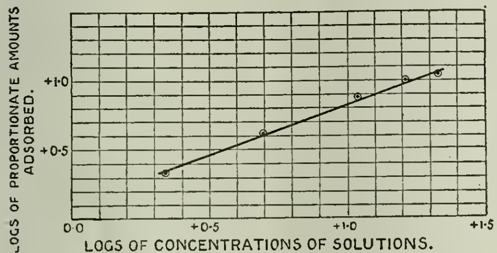


FIG. 2. ADSORPTION CURVE; AUROCYANIDE SOLUTION AND CHARCOAL

The effect of the addition of acid or alkali often furnishes evidence of the validity of certain reactions. Feldtmann claims that absence or presence of alkali is without appreciable effect on the precipitation of gold from aurocyanide solution by charcoal. S. B. Christy[12] shows that acidity in the solution results in a considerable increase in precipitating power. Edmands has since confirmed this in emphatic terms. Feldtmann's results are, however, not in opposition to this, as the tests did not include the addition of acid.

The data published in this connection afford further evidence in favor of the adsorption theory, and a parallel instance of the retarding effect of the addition of alkali and the accelerating effect of the addition of acid has been demonstrated by Lachs and Michaelis[13]. These investigators proved that the adsorption of potassium chloride in water by charcoal was diminished by the addition of KOH, and hastened by the addition of acid. This result was attributed to the obstructive effect of hydroxyl ions as compared with hydrogen ions.

A feature of adsorption phenomena is the difficulty experienced in removing the adsorbed substance by washing in excess of the solvent or water. This is particularly noticeable in the case of the removal by charcoal of a gold compound from an aurocyanide solution. Considerable attention was paid by Feldtmann to the fact that the gold precipitate on charcoal was soluble, to some extent, in alkaline sulphide solutions. Edmands has elaborated this phase of the question, and also shows that the addition of even a small quantity of soluble sulphides to the cyanide solution considerably reduces the precipitating power of the charcoal.

Addition of Sulphide May Cause Variation in Surface Tension

Adsorption is an equilibrium and closely dependent on surface-tension influences. By varying the surface tension by the addition of other reagents, the amounts adsorbed may also be varied, but an equilibrium is again reached, nevertheless. If a soluble sulphide is added to aurocyanide solution in a charcoal pulp, the equilibrium is disturbed and a new equilibrium established. It is not so much the question of the solubility of the gold in the sulphide solution as the alteration in the physical condition of the solution which causes a release of a part of the adsorbed compound. Conversely, the same effect is produced and the same equilibrium reached if the soluble sulphide is added to the cyanide solution before contact of the latter with charcoal. The results of the experiments of Feldtmann and Edmands are complementary. F. Wartenweiler[14] showed that strong reagents which do not dissolve the gold precipitate on charcoal do not inhibit the precipitating action when added to the solution. This is also in accord with the known laws of adsorption. Platinum adsorbs picric acid from aqueous solutions, and the adsorbed acid is insoluble in water. The addition of alcohol disturbs the adsorption equilibrium and releases the picric acid; but from this fact it would be unwise to infer that picric acid is insoluble in water and soluble in alcohol.

Rights of Surface Owners

By A. L. H. Street*

In the case of Cavanaugh *vs.* Corbin Copper Co. (*174 Pacific Reporter, 184*), the Montana Supreme Court recognizes the right of an owner of dwelling property in Butte to recover damages caused by mining operations carried on by defendant under such circumstances as to constitute a private nuisance interfering with the enjoyment of plaintiff's home.

Plaintiff's lot lies within an addition platted for residential purposes, covering the surface of a mining claim. Defendant opened a mine shaft on an adjoining lot, and constructed buildings and machinery thereon necessary to prosecute mining operations.

Finding that the work produced noises seriously affecting the comfortable enjoyment of plaintiff's home, and that the defendant had invaded a residential district in its operations, the court holds that plaintiff made out a plain case entitling him to damages.

The opinion recognizes the legal principle that where an owner of land sells the surface, unqualifiedly reserving mining rights, he will be entitled to employ such means and processes for the purpose of extracting the ores as may be reasonably necessary in the light of modern invention, regardless of annoyance to the surface occupants. But, as the deed under which plaintiff held the surface of his lot for residential purposes expressly provided that the surface should not be disturbed in the exercise of reserved mining rights, it is decided that he was not estopped to complain of defendant's operations.

---

[12] *Trans.* A. I. M. E., Vol. 24.
[13] *Zeit. f. Elektrochemie*, 1911.
[14] *Trans.* I. M. M., Vol. 24, pp. 360-3.
*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

A Study of Shoveling Applied to Mining[*] —II

BY G. TOWNSEND HARLEY[†]

One of the factors that influence shoveling is the horizontal distance between pile and objective. Four feet has been found to be about the proper distance. The shape of shovel used, and its length of handle, have a decided effect on the amount of shoveling done. The system of payment for work performed determines to a considerable degree the success of any scheme for increasing individual efficiency of miners or mine laborers.

FROM a series of tests during which the ore was thrown into a mine car 42 in. high, it was determined that a horizontal interspace of 4 ft. was the best distance to maintain between car and ore pile in order that a man might work to the best advantage. Owing to the height of the car, the capacity of a shoveler is decreased, as compared to his capacity in shovels per minute when loading into a wheelbarrow. This decrease in shoveling speed amounts to about 8% per foot of height. The best type of car for a shoveler to use holds about a ton of ore, is as low as is consistent with good design—certainly not over 45 in. in height—and is equipped with roller bearings, which should be kept in the best of condition. Cars much larger than this are too hard to tram and cars much smaller use up too much of the shoveler's time tramming back and forth.

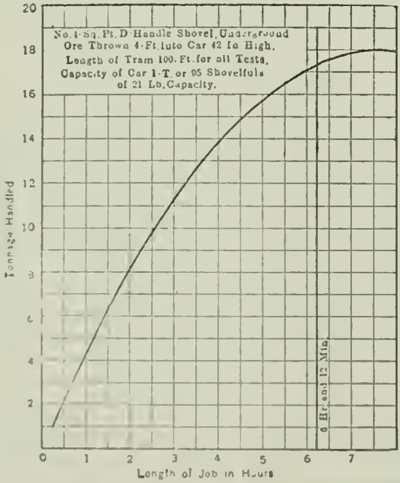


FIG. 19. SHOWING CAPACITY OF A SHOVELER USING A CAR FOR VARIOUS JOBS

Fig. 19 shows the tonnage to be expected of a man mucking into a car and tramming a constant distance, for various lengths of jobs. It will be noticed that the economic shoveling day is between 7 and 8 hours long, and that the maximum average results to be expected of a mine shoveler under the given conditions have probably been reached. The tonnage to be expected under average shoveling conditions during a uniform shoveling day of 6 hours and 12 minutes and for any distance that the ore must be thrown or trammed is shown in Fig. 20. The graph representing the tonnage to be expected of a man with a wheelbarrow may not be entirely correct, especially as the length of tram increases. On the other hand, the wheelbarrow is generally used where neither direct shoveling nor the use of a car, with its attendant track expense, is feasible; consequently, the wheelbarrow is always at work under adverse conditions in a stope, and no improvements over the results here tabulated are to be expected.

The calculation of tonnage to be expected when tramming either with a car or wheelbarrow, for any length of job and distance trammed, is expressed in the following formulas:

Let W = weight of load on shovel, in pounds;
N = number of shovels per minute;
P = % of time actually shoveling;
L = length of job, in minutes;
T = total tonnage shoveled;
a = time to load one car or wheelbarrow;
b = time to tram and dump one car or wheelbarrow, in minutes;
c = load on one car or wheelbarrow, in pounds;

$$\frac{c}{W \times N} = a \qquad \frac{\left(\frac{L}{a+b}\right) \times c \times P}{2000} = T$$

SHOVELS TESTED FOR DURABILITY

To determine the relative wearing qualities and the cost per ton for supplying the men underground with new shovels, different places in the mines were equipped with different makes and styles of shovels, and the results carefully noted. At frequent intervals these shovels were measured to detect the wear of the blade, and checked up to see that all were being used in the proper places underground; the tonnage coming from each place and the number of shovelers employed were also noted.

WORK WITH A SCOOP SLOWER THAN WITH A No. 4 SHOVEL

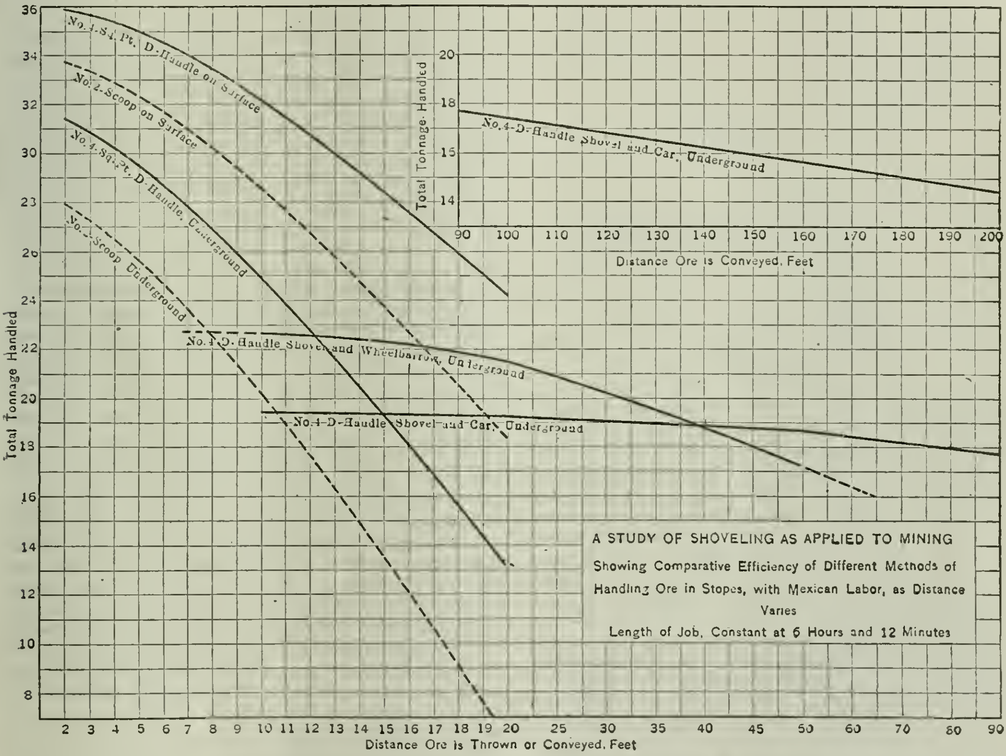
Tests were conducted with square- and round-point shovels varying in size from No. 2 to No. 6 and with standard No. 2 scoops, to determine what size of shovel was best adapted to the work. For short jobs of less than 4 hours' duration, the No. 2 scoop and the No. 5 and 6 shovel were slightly superior from the standpoint of tonnage handled; but for jobs requiring more than 4 hours for their completion, the No. 4 shovel was greatly superior. From the standpoint of "number of shovels per minute," work with a scoop is at all times slower than with a No. 4 shovel, and as the day progresses the percentage of time required for resting becomes greater with the scoop than with the shovel. The result is that although, for short work periods, the larger capacity of the scoop brings the total tonnage handled above that of a No. 4 shovel, for long periods the increased amount of rest required when handling the heavier load serves to put the No. 4 shovel considerably in the lead as a tonnage mover. In general it may be said that for shovels smaller than the 21-lb. load shovel, the tonnage handled per shift is approximately directly proportional to the shovel capacity; that is, if a man using a No. 4 shovel will handle 26 tons in an 8-hour shift, with a No. 3 shovel, which holds 91% of the load of a No. 4 shovel, he would be expected to shovel about 24 tons a shift. If the increased cost of shoveling with a smaller shovel, or one that has been worn, is balanced against the cost per ton of putting a new shovel underground and discarding the old one, it will indicate the economic limit of wear of the shovels in use.

---

[*] Concluding part of a paper presented at the New York meeting of the A. I. M. M. E., February, 1919. The first installment of this article appeared in *Eng. and Min. Journ.*, Mar. 15, 1919.

[†] Efficiency engineer, Phelps Dodge Corporation, Tyrone, New Mexico.

To obtain the highest shoveling efficiency underground, every man hired as a shoveler should be in a particular stope or working place that is directly in charge of a shoveling boss. This boss should have had considerable experience in shoveling, should know correct shoveling methods and be able to instruct men and gain their confidence. Each man should be taught: (1) The necessity of using the correct type of shovel for any given purpose; (2) the proper way to handle a shovel; (3) the range of usefulness of wheelbarrow and car, and (4) the advantage of using a platform from which to shovel. When each man has been thoroughly instructed in the methods of shoveling, he should be placed in general run-of-mine work among the more experienced shovelers, so that another new man may take his place for instruction.



A STUDY OF SHOVELING AS APPLIED TO MINING

Showing Comparative Efficiency of Different Methods of Handling Ore in Stopes, with Mexican Labor, as Distance Varies

Length of Job, Constant at 6 Hours and 12 Minutes

FIG. 20. COMPARATIVE EFFICIENCY OF DIFFERENT METHODS OF HANDLING ORE

The design of shovel which was considered as being the best adapted to mining work, conforming to conditions under which the tests under review were made, is shown in Fig. 21. The blade should hold 21 lb. of broken ore as an average load. Both the square- and the round-point blades should be of standard shape, of No. 15 gage at the point, and of such composition that the shovel will handle not less than 1100 tons of medium hard ore when shoveled off a wooden mat. All blades should be of the plain-back type without rivets, the back strap being welded to the blade. Only best-grade, second-growth, northern white ash should be used for the handle, which should be bent to the shape and dimensions shown. On short-handle shovels, the Dirigo, or split D, handle is preferred, as it is much stronger than the ordinary D handle.

The Phelps Dodge Corporation has not yet introduced a system of payment for shovel work other than the regular daily wage, and, in the case of development work, the contract system, in which the shovelers share by receiving a higher wage than the men in the stopes. The wage in force at present at Burro Mountain mines for Mexican shovelers is $3.40 a day. Assuming that this is a fair wage for this class of labor, to put the men in the proper frame of mind to take kindly to the bonus system the wage should be raised to $3.75 a day, an increase of 10.3%; this wage will be paid to them whether they make the required tonnage or not. If any man makes the tonnage required of him, his wage may be raised to $4 for that shift, an increase of 17.6%

above the \$3.40 rate. If he produces anything over the required amount, he should be paid a bonus per ton, depending on the original task allotted to him. To make an increase of 50% over his old \$3.40 rate, a shoveler will have to produce between 25 and 30% more than his allotment. Experience has shown that when a laborer receives an advance in wages of more than about 50 to 80% above a fair wage, he tends to become shiftless, and the increase usually does him more harm than good.

In 1917, in a stope with raises spaced 25 by 65 ft., from which was mined 145,000 tons, the shovelers average 8.5 tons per man, with wages at \$3.40 a day. This shoveling cost 33c. per ton, assuming that the men were on other work for 17.5% of the day. Charts show that under the new system these men should have averaged 22.9 tons per man, for which they would have received \$4 a day. This would be an average shoveling cost of 17½c. per ton, or a gross saving of \$22,475 for the year. Out of this gross saving would have to come the cost of, say, five special men, at an average salary of \$160 a month, or a total of \$9600 a year, to take care of this branch of the work. This sum deducted from \$22,475 leaves a saving of \$12,875, or a total shoveling cost of 23.9c. a ton.

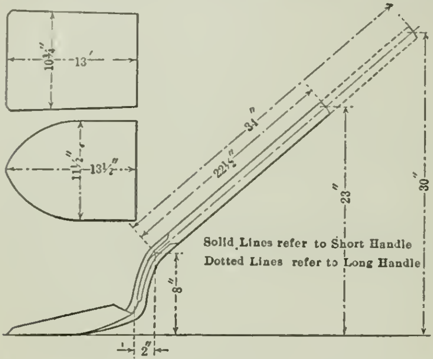

10½"
13"
11½"
13½"
34"
22½"
23"
30"
8"
2"
Solid Lines refer to Short Handle
Dotted Lines refer to Long Handle

FIG. 21. DESIGN OF SHOVEL BEST ADAPTED TO MINING WORK

Figures obtained at Tyrone indicate that the tonnage in at least one of the large stopes can be raised from 8.5 tons per man to 22.9 tons per man, an increase of 169%; the wages can be raised from \$3.40 a day to \$4 a day, and the cost to the company reduced from 33c. a ton to 24c. a ton, after taking care of all extra supervision needed. In addition to this actual saving in shoveling costs, the overhead and general mining costs will be reduced per ton by mining a greater tonnage per man; and the other classes of labor, such as machine miners and timber men, will be able to do more work, as they will not be hampered and delayed by the shovelers to such an extent as at present.

Effect of Air in Cyanidation

By N. S. Keith[*]

Since the general acceptance of Elsner's equation, ($2Au + 4KCy + O + H_2O = 2KAuCy_2 + 2KOH$), there has been little controversy opposed to that deduction. MacArthur, one of the inventors of the first successful cyanide process for treating gold and silver ores, denied the supposition as to the necessity for the presence of air, or, rather, oxygen. In analyzing the reactions one finds that gold in a cyanide solution has a higher affinity for cyanogen than has potassium, but it cannot exercise that affinity unless some element is present in the solution to combine with the potassium which would be freed by the gold. This desirable element is oxygen, which combines with the potassium to form its oxide, K_2O. To complete the reaction and fulfill the equation, the oxide combines with water, H_2O, to form 2KOH. The gold cyanide, insoluble in water alone, dissolves in the solution of 2KCy to form $2KAuCy_2$. Thus is evolved the complete term of the second part of the equation.

The foregoing synopsis is elementary, but basic to the consideration of the complicated conditions of actual practice in the treatment of auriferous ores which are crushed and pulverized to expose the maximum surficial area to the solution of KCy or NaCy. As tests are generally expressed in terms of KCy, and as NaCy is analogous in action with the former, this consideration and analysis will deal exclusively with the formula KCy.

Consideration will first be directed to the least-complex auriferous ores, consisting in the main of quartz containing, besides gold and silver, variable quantities (say 1% in the aggregate) of sulphides of iron, copper, and lead, which are pulverized in water or cyanide solution to which lime is added. In the grinding operation finely divided iron is introduced into the pulp. Much air is occluded in the solution during the grinding and subsequent agitation. Slimes are agitated in the cyanide solution by mechanical methods, such as stirring, or pumping from vat to vat. Agitation by compressed air is also extensively practiced, on account of the cheapness of that process, but mainly because the air provides the oxygen which is necessary for the reactions called for according to the Elsner equation.

Oxygen to promote solution of gold and silver has been supplied by the addition of oxidizing chemicals, such as permanganate, $KMnO_4$, ferricyanide of potassium, K_3FeCy_6, or MnO_2, BaO_2, or PbO_2. The use of these "cyanicides" in practical operations has been abandoned in most instances, because of cost, inefficiency, and destructive effects. Under ordinary temperatures and atmospheric pressure, quiescent cyanide solutions absorb air slowly and in insufficient quantity for speedy cyanidation of gold. But in motion under pressure the compressed air used in agitation insures a greater absorption of oxygen.

The foregoing statement of operative conditions calls for a much more complex formula, the first part of the equation being as follows:

$$2Au + 4KCy + O + H_2O + X[KCy + O + H_2O + Fe + FeS_2 + (Cu_2S, Fe_2S_3) + Ca(OH)_2].$$

The molecules named before the bracketed ones rearrange themselves as stated in the Elsner equation, unless trammeled by the presence of the others and their affinities one for another. Quantities and unsatisfied affinities are so indefinite that the final result of possible combinations cannot be predicated. By considering the molecules listed within the compass of the brackets the following reactions may be said to occur: KCy combines with indefinite amounts of Fe, FeS, and Cu_2S, Fe_2S_3, to form various and uncertain compounds. Oxygen oxidizes some iron and some iron and copper pyrites. These latter become oxides and sulphates and react with KCy, which is wasted, to form, according to various authorities, numerous complex substances, such as K_4FeCy_6, $KCyS$, $K_2S_2O_5$, K_2S, $K_2Cu_2Cy_4$, and others. These reactions have been studied by many metallurgists, but much more information is necessary for thorough understanding of the complications. The following equation is a necessary addition to the latter half of the Elsner equation:

---

[*] Mining and metallurgical engineer, 351 Bullitt Bldg., Philadelphia, Pennsylvania.

$2Au + 4KCy + O + H_2O + [X] = 2KAuCy_2 + 2KOH + [X]$.

The symbol X represents the molecules which take no further direct part in the dissolving of the gold, but have reactions in the process of its precipitation and recovery.

The precipitation of gold from a cyanide solution by means of zinc may be expressed by the following equation:

$2KAuCy + 2KOH + H_2O + 3Zn = 2Au + 2K_2ZnCy_4 + 2KOH + ZnO + 2H$.

The reactions are as follows: Two atoms of zinc displace and free two atoms of gold; one atom of zinc decomposes water in presence of potassium hydrate; its oxide is dissolved by the solution of potassium hydrate, and hydrogen is set free. Heretofore the equation expressing the reactions of gold-cyanide precipitation has been written as follows:

$KAuCy_2 + 2KCy + Zn + H_2O = Au + K_2ZnCy_4 + KOH + H$.

But this latter equation does not express all the reactions, such as are due to the presence of excess of zinc and of water. In this precipitation there is always present a large excess of both water and zinc, and oxidation by decomposition of water by the zinc will continue as long as free potassium hydrate is present to dissolve the zinc oxide formed on the surface of the zinc. The presence of oxygen in the occluded air increases the oxidation and solution and is largely responsible for the accompanying waste.

As soon as there is no more solvent for zinc oxide, the precipitation of gold on the zinc ceases, because the surface becomes coated by a film of zinc oxide which isolates the gold from the metallic zinc on which it was deposited. This isolator insulates the gold by reason of the loss of essential galvanic, or electric, contact with the zinc. When this last condition prevails, and occluded air is present, the gold precipitate is dissolved by the cyanide solution. Of course this is not a necessary condition, but it frequently happens through ignorance or neglect. If no free oxygen be present, gold will not be thus re-dissolved.

The complex assemblage of the various molecules represented by the symbol X in the foregoing equations interchange themselves, especially in the presence of air, to form various insolubles which are sometimes found in the precipitation boxes, in the form of "white precipitate." By the addition of more cyanide to the head of the precipitation box, this white precipitate would sometimes be dissolved, or disappear—and sometimes not. A considerable number of investigators have studied the question as to the composition of the white precipitate, and there is a wide divergence in opinion as to its origin and constitution. This divergence is probably due to the variety and composition of the ores being treated. The remedial addition of cyanide necessitates increased wastage of both cyanide and zinc.

A recently issued United States patent, which claims a monopoly for the practice of removing occluded air and gases from cyanide solutions before precipitation, draws attention to the fact that air has been removed from cyanide solutions as they pass to precipitation by various means, especially by pumps, including wet or dry vacuum, singly or in arrangement with vacuum chambers in various combinations, for many years, and at many times and places. This statement may be confirmed by examination of descriptions of cyanide plants published in books on the art, and in the transactions of technical societies devoted to mining and metallurgy. One citation is illustrative: *Trans.* A. I. M. E., Vol. 42, 1912, pp. 729-731.

The practice in the U. S. Patent Office which has prevailed during many years in the examination as to novelty of applications, has been to ignore the facts as to the prior state of the art involved, as shown in technical publications, other than patents previously issued by the United States, Great Britain, France and Germany. Therefore many patents have been granted which have not been sustained by the courts because of lack of novelty. This has caused much costly litigation which would have been avoided had the Patent Office functioned under a different system.

The practice of removing air from liquids is an old one and has been extensively adopted. The object has been effected by the use of such apparatus as wet or dry vacuum pumps, vacuum chambers, jets or sprays, in various arrangements or combinations, and barometric discharge pipes from vacuum chambers or tanks. During the empirical development of the art, much apparatus and many methods were tried in the search for improvement. These were frequently changed, intermixed, or abandoned, without always selecting the best for continued practice. An example of this is seen in the adoption of air lifts to convey solution from vats to precipitation boxes, without a realization of the deleterious action of excess of air at this stage of the process. It has been satisfactorily and practically demonstrated in many large cyanide mills that the removal of air from cyanide solutions, before precipitation, results in considerable savings of both cyanide and zinc.

I. O. U.

There may be no memorandum of it, or even a mental note, but every American who is sound of mind and body has an I. O. U. outstanding against him. It is in Uncle Sam's hands, and he will probably collect it, or will permit the delinquent to feel rather uncomfortable while it remains unpaid. He is not going to come around with a bill and present it in an offensive manner. Uncle Sam does not solicit in that way, but he will let the careless citizen know in a hundred and one ways, from day to day, if he has not paid his share or loaned the money with which to pay his share of the big account that is still on the country's books.

When the next Liberty Loan is called for, no one should assume that the war is over and ought to be forgotten. The man worthy of the country in which he lives will turn to his account book, the one that is kept in his conscience, and see if the two sides of the Liberty Loan account balance.

A Monazite Sand Analysis has been made by the Geological Survey of India which reports that samples from Mergui and Tavoy, in Tenasserin, Lower Burma, taken from 28 locations, show only 0.18% of thoria in the heavy concentrates, which is equivalent to 0.00216 lb. of ThO_2 per cu.yd. of the ground sampled, and adds: "Such a minute fraction is, of course, of no practical utility."

Re-treating Zinc Tailings in Wisconsin

By W. F. Boericke*

During the era of high prices for zinc ores several attempts were made to re-mill some of the old tailings dumps in the Wisconsin-Illinois field. In no case were operations undertaken on a large scale. Neither the size of the piles nor the zinc content of the tailings warranted large expenditures for equipment. The results, however, brought out numerous interesting points in milling practice.

THE re-treatment of old tailings dumps in the Wisconsin-Illinois field was recently undertaken by two or three practical men who were familiar with local practice, and who were able to construct the simple plants needed. Leases were obtained from the owners of the properties on which the tailings had been deposited, usually on a 5% basis. Some attempts were made to work the creek bottoms of the streams that carry the tailings away from operating mills, especially where these mills had been running through rich material, but in such cases it was necessary to handle so much gravel and detritus that the work was unprofitable.

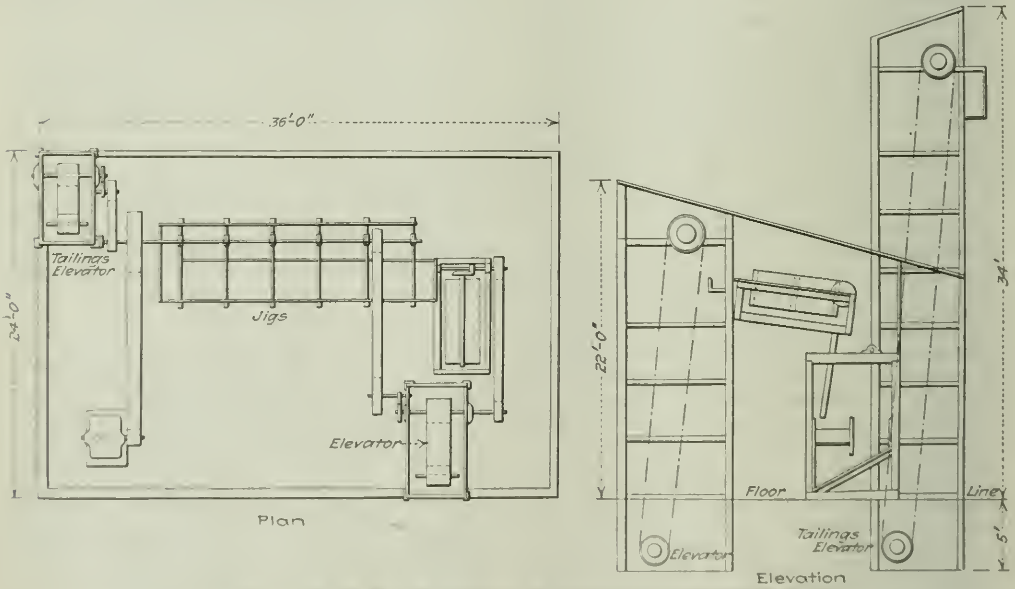


FIG. 1. PLAN AND ELEVATION OF TAILING RE-TREATMENT PLANT

Fig. 1 shows the layout of a typical tailing plant and Fig. 2, the detail of the jigs. Construction was of the simplest order, and the material used was often crude, the idea being to avoid spending any more on the plant than was absolutely necessary. This was good common sense, for in many cases a small pile could be cleaned up in a single summer's work, and permanent construction would have been wasteful. On account of the freezing of the pulp, no attempt was made to continue milling in winter; consequently most of the plants were open and exposed to the weather on all sides.

The plant is always built at the base of the tailing pile, with due regard for tailing disposal. At the outset, the tailing is shoveled into the boot of the belt-and-bucket elevator by hand; or, if water is plentiful, it may be sluiced in. As the pile recedes, a horse and scraper are used, or some kind of a cable drag operated by a hoist. A worm feed, sunk in a channel in the ground and parallel to the elevator, insures a steady feed to the jigs and prevents overcrowding and choking the elevator. The usual feed for a six-cell jig is from 75 to 100 tons in nine hours.

From the elevator the material goes to the trommel. This may be dispensed with in some cases, if there is only a small amount of oversize, or if recrushing in a set of rolls is not included in the treatment. It assists, however, in insuring a steady feed to the jigs. If a trommel is used without rolls, the undersize goes direct to the jigs, and the oversize, if it is of little or no value, is sent to the tailing elevator. But if the oversize forms a considerable proportion of the feed, and the preliminary tests have shown it to contain "chatty" ore, it usually pays to install a small set of rolls and crush it.

Jigs are usually run much the same as is a cleaner or sand jig in a zinc mill, but no set rules can be formulated for universal operation. Each ore creates a problem in itself, and the details must be worked out by test and experiment to obtain the best results. There are, of course, essential differences between the feed in a tailing mill, and in the ordinary concentrating mill. In the tailing mill, the feed is usually extremely thin, rarely over 2 or 3% Zn, and the recovery in jack and marcasite is from 2½ to 5%. The product is taken almost entirely from the hutch. The ore is mostly in the fines, often below 1 mm., of which a considerable proportion is "chatty"; and much of the jack is in the form of "floaters"—long, thin pieces of blende that are easily carried over in the top water.

---

*Mining engineer, Galena, Illinois.

The jig must therefore be run with a fast, light stroke, with as little top water as possible, and with the beds kept loose and thin to avoid matting the sieves. It is essentially a pulsation jig, with a light suction neutralized by considerable water from the plunger side. The line shaft is run at 185 to 215 r.p.m., with the higher speed favored. The drop between cells varies from 1½ in. to 2 in., and the grates should be tilted slightly toward the end of the jig, to keep the bed of uniform depth. Unless the tailing is rich, and with much coarse ore, it will not form a satisfactory bed, but will mat and cause trouble from choking the sieves. For this reason a bottom layer of coarse concentrate is usually provided, and this is left undisturbed when the beds are skimmed. Six-inch beds are generally adopted. As stated, the product is almost entirely hutch, and little is skimmed off above the sieve. Therefore, gate-and-dam discharges are not needed.

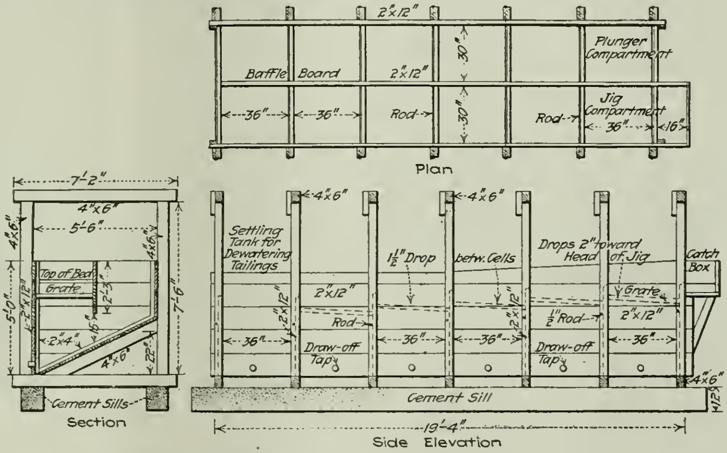


FIG. 2. DETAILS OF 5-CELL JIG WITH SETTLING TANK

The usual sizes of sieves are ⅛ and 3/32 in. on the first four cells, and 3/16 in. on the last cell. This last cell is generally run wide open, all the hutch being returned to the elevator and run back over the jig. No attempt is ever made to clean ore on the first cell; this also goes back to the elevator. The middle cells give a clean hutch product. From the last cell the overflow goes either to a settling box, where the water and slimes are decanted off to the pond, or runs direct to the elevator.

It has already been noted that the construction of these little plants is of the simplest character, and they can be erected by a couple of carpenters in a few weeks. The entire body of the jig consists of 2 x 12 in. lumber, on edge. Oakum or candle wicking is placed between the boards to make them water-tight. A frame of 4 x 6 in. timbers is spaced every 3 ft. for the length of the jig. The posts, strengthened by a ¾-in. round-iron rod, passing crosswise through the jig, serve as buckstays, whereas the caps support the line shafting. This type of construction is more favored than the more elaborate jigs used in the big mills, all the walls and partitions of which are built entirely of 2 x 4-in. lumber. Although the 2 x 12-in. material looks flimsy, it proves satisfactory, and effects a large saving in the lumber bill. The jigs, of course, are intended for not more than a couple of seasons' work.

The lumber requirements for the 5-cell jig shown in Fig. 2 will amount to 250 ft. of 4 x 6 in., and 520 ft. of 2 x 12 in., or about 1600 board feet. This does not include an estimate for the elevators, rollframe, launders, and other equipment. The cost of a complete plant such as shown in Fig. 1, exclusive of the motor, will amount to between $1000 and $1500.

Power is usually provided by a 25-hp. induction motor. This gives enough for the jigs and elevators, and, if necessary, sufficient to run a centrifugal pump for the mill from the line shaft. The great merits of the electric drive are reliability and steadiness of power. It is absolutely necessary for successful work that the mill be run at a uniform speed, regardless of the load; and it goes without saying that interruptions of the power are fatal to good milling work. A five-minute shutdown often means the loss of an hour's running time before the mill is working smoothly again. In one ill-fated mill, an attempt was made to run with a 50 hp. gasoline engine. The saving in the power charge was offset a dozen times over by the erratic speed of the jig, on account of the varying load, and the consequent inability to hold the beds.

The amount of water needed for a 5-cell jig will be from 150 to 200 gal. per min. It is fed into the elevator, and above the plunger of the jig. The amount is adjusted by the millman to secure the best results. If the supply is limited, the water is sent to a pond from the settling tank and re-used.

It is my opinion that most of the failures in retreating tailings result from a careless preliminary sampling of the original piles. This work, which should be done conscientiously, is too often carried out in a haphazard, hit-or-miss manner. A grab sample is taken from several places, sometimes supplemented with a few "gun" samples. If these are found to contain sufficient mineral content, say 3% Zn or better, and conditions for operation may be assumed to be favorable, the lessees go ahead.

Under such circumstances it was not surprising that there were disappointments because the tailings failed to come up to expectations. The proper sampling of a pile cannot be done in a hurry. Anyone familiar with tailings knows that a surface valuation is misleading. On account of weathering and natural concentration due to rain or snow, the top of the pile invariably looks richer than the main body really is. This is especially true if the sample is taken from where the launder formerly discharged on the pile. Sometimes a cross-section of the pile can be taken without much trouble if teams have been digging into it. Otherwise, gun samples can be taken liberally from all over the pile, and these quartered down. These samples should be assayed, and examined carefully under a glass as well, to determine whether the jack is free or "chatty." One might get a fair assay return for the sample, but find on examination that practically every piece of jack was firmly attached to a piece of lime, a condition which would necessitate regrinding, and possibly a different scheme of milling, and certainly increase the cost considerably. An instance occurred where three different lessees tried to re-mill an attractive pile that assayed over 2.5% zinc, in each case failing to make a profitable extraction, before it was realized that the dust was too "chatty" to jig effectively.

PRELIMINARY EXPERIMENTATION DESIRABLE

If the assay return for the general sample is satisfactory, the next problem is to determine whether the zinc is in the fine, middling, or coarse material. If the original ore ever passed through a ⅜-in. trommel, it is, of course, unnecessary to look for anything above this. A ¼-in. screen might be used to start. The material which does not pass should be weighed, examined, and assayed. It is unlikely that much coarse jack will be found; if there is any zinc it will probably be "chatty," and regrinding will be necessary to free it from the gangue. The undersize may be passed over a ⅛- and a $\frac{3}{32}$-in. screen, the latter the smallest size used in the re-treatment plant, and the process repeated. The undersize should then be put through fine screens to determine the proportion of fines to the total weight, and to ascertain the zinc contents. If a large proportion of the zinc is found in the fine sizes, it is doubtful if it can be extracted by jigging. To illustrate concretely the foregoing, the following table was constructed from tests made on material obtained from a large tailing pile near Galena. The original ore was passed through a $\frac{5}{16}$-in. trommel; the sample was quartered to 24 lb., and assayed 2.3% Zn:

Material	Per Cent Total Weight	Per Cent Assay Zn	Per Cent Total Zn
+¼ in	17	0.8	5.7
+ $\frac{3}{32}$ in	29	1.9	23.9
− $\frac{3}{32}$ in	54	3.0	70.3
Total	100		99.9

A 1-lb. sample of the minus $\frac{3}{32}$-in. material was then put through a nest of fine screens, and the following results were obtained:

Material	Per Cent. Total Weight	Per Cent. Assay Zn	Per Cent. Total Zn
+20 mesh	15.6	3.5	21.2
+ 40	25.0	2.1	20.5
+ 60	25.0	1.5	14.6
+ 80	15.6	2.8	17.0
+ 100	9.4	3.4	12.4
− 100	9.4	3.9	14.3
	100.0	...	100.0

From these results the following conclusions were drawn:

1. The coarse material, on ¼ in., containing less than 6% of the total zinc, shows, on microscopic examination, a large proportion of chats, and a minimum of free jack. Little can be recovered without recrushing.

2. Through ¼ in., on $\frac{3}{32}$ in.: Free ore, few chats. Can be saved on jig.

3. Through 8, on 40 mesh: Contains 41% of zinc in the 1-lb. sample, or 28.7% of zinc in the entire sample. Normal mill recovery on jig.

4. Through 40 mesh: Contains 59% of zinc in 1-lb. sample, or 41% of zinc in entire sample. Not much chance to save this by jigging.

PROBABLE EXTRACTION IN FORM OF CONCENTRATE

The total amount, therefore, available for treatment comprises only 52% of the zinc, or heads equivalent to 1.2% Zn. Unless the concentrate was sure to be high grade, this clearly could not be profitably treated, as it would be subject to a further milling loss. In most concentrating mills the extraction is from 65 to 70% of the zinc in the heads, and 50% of the iron; that is, if the heads run 4% Zn and 3% Fe. There is, on making the proper reduction to sulphides, 5.9% ZnS, and 6.4% FeS_2, or 12.3% total sulphides present. Taking the recovery factors given, one should get, in the mill, 3.8 tons ZnS and 3.2 FeS_2 or 7 tons of concentrate per 100 tons of mill feed. This concentrate should assay $\frac{4}{12.3} = 32\%$ Zn.

With a tailings mill, however, the extraction factors are considerably lower. About 50% of the zinc and from 25 to 30% of the iron are usual. This is probably due to the large relative proportion of fines that is carried over the jigs, and the amount of jack lost in the chats. The surprisingly low recovery of the iron as concentrate is undoubtedly due to its being seldom in the form of free particles, but nearly always attached to lime, thus altering its specific gravity. Much of the lime rock in Wisconsin is termed "sulphuric rock" by the miners. This means a lime fairly impregnated with minute particles of marcasite, with widely varying specific gravity. A poor recovery of concentrate is made from such an ore.

GRADE OF CONCENTRATE OBTAINABLE

The grade of the resulting concentrate will therefore approximate that of the original concentrate, but should be slightly higher in zinc, and lower in iron. The lime is usually high, so high, indeed, as to be penalized in some cases. It is generally so with low-grade ore, where the "sulphuric rock" referred to carried the lime down with the marcasite. With the higher-grade concentrate, the lime, if the ore is not "chatty," can be kept below 3% with no more trouble than in milling the original mine-run material.

Tests were made on the work being done at a tailing plant operating on the Northwestern tailing pile near Galena. The following assays were received:

Heads, Zn 2.8%, Fe 7.1%.

Tailings, Zn 1.4%, Fe 5.1%.

Concentrate, Zn 20.8%, Fe 24.8%, CaO 4.1%.

These figures show an extraction of 50% of the zinc and 28% of the iron. The grade of the concentrate is what reasonably might be expected from the assays of heads and tailings.

Concentration of Manganese Ores*

It is axiomatic that small deposits or mines of uncertain period of life, as determined by tonnage and markets, do not warrant elaborate plants or the adoption of intricate beneficiation processes. A general classification of methods applicable to the manganese industry is given herewith. The processes mentioned are all preliminary to the greater and final concentration of the desirable elements in the blast furnace from which the ferroalloy is produced.

1. SIMPLE METHODS OF CONCENTRATION

A. Selective mining.
B. Hand picking.
C. Jigging.
D. Screening.
E. Log washing.
F. Water classification.
G. Roughing-table treatment.
H. Slime-table or vanner treatment.
I. Pneumatic separation.
J. Combination of two or more of the above.

2. COMPLEX METHODS

A. Magnetic separation:
    1. Without preliminary thermal treatment.
    2. With preliminary thermal treatment.
B. Electrostatic separation.
C. Hydrometallurgical processes:
    1. Leaching with various acids. Precipitation by chemical substances.
    2. Leaching with various acids. Precipitation by electrolysis.
    3. Leaching with various acids. Evaporation of solution and heat treatment in rotary kiln.
D. Preliminary thermal processes:
    1. Drying, to remove hygroscopic moisture.
    2. Calcining, to remove carbon dioxide or combined water.
    3. Agglomerating fine concentrates, to make them desirable for blast-furnace use.
    4. Volatilizing manganese at high temperatures in the presence of certain constituents which form readily volatile compounds.
    5. Direct reduction of oxides by carbon, under temperature control.
E. Miscellaneous processes:
    1. Flotation.
    2. Use of heavy solutions.

There are many standard machines for the concentration of ores based on certain principles or combinations of principles, but it is unwise and usually unsatisfactory to assume that a certain machine will accomplish the necessary result on manganese-bearing materials. As the character of the manganese materials varies greatly in different districts, it is important first to determine the detailed physical, as well as the chemical, characteristics of the material. When such preliminary study has shown the nature of the impurity, and its relation to the manganese mineral, it is easier to outline the general methods of treatment that might reasonably be expected to accomplish the desired result. The flow sheet, however, must be determined by experimentation.

If the technical possibilities of beneficiating a particular ore have been favorably determined, it is then necessary to ascertain whether such an operation could be conducted on a commercial scale, and a reasonable profit made. The cost of the plant and its installation must be justified either by the available ore in the deposit, or upon the length of time during which the profit could be made by such an operation. The amortization of capital and interest on the investment must be included in the estimation of cost.

The effect of concentrating an ore is not always clearly understood. Concentration implies that an improvement of metallic content is made by the intentional elimination of barren material, but by so doing there is always a loss of the valuable mineral itself. When the grade of material is increased, the weight is decreased. In other words, in some cases 2 to 25 tons of crude manganese-bearing material may be necessary to produce 1 ton of high-grade concentrate. The income results from the sale of the smaller quantity of concentrate, but chargeable against this, will be the mining cost of the several tons of crude ore necessary to make that concentrate, the actual cost of treating the ore, the freight to market, and overhead charges. Concentration may, however, be necessary to make the material marketable at all.

New System of Thawing Ground*

What is known as the Miles system for thawing frozen ground, the conception of it having originated with J. H. Miles, general manager of the Alaskan Mines Corporation, has been put to the test in the Candle section, Alaska, and has proved of great value. Those who watched it in operation say that it has come to stay and will replace the old system of steam-thawing frozen ground. It is employed on the Pierce dredge, owned by Pierce, Johnson & Sundquist, the two former having been brought out by Sundquist on Candle Creek, and has been an unqualified success. The operators of the dredge are thawing ground and dredging the frozen dirt, the thawing having been carried out at less expense than 5c. a foot. They have discarded the old method, stripping, for which they used a 50-hp. gas engine, and, instead, use the Miles system wholly. The method is to secure the water from a high-line ditch, but the pressure should not exceed that secured from a 20 ft. fall. This is led with a 2-in. canvas hose to a 1-in. pipe, the latter leading the water into the muck in a hole previously picked through grass and tundra. The pipe then automatically thaws and drops down in the muck and gravel, the water being somewhere around the temperature of 52°. The less pressure the slower the circulation and the more heat surrendered from the water. In this manhole the water from the pipe thaws a hole 12 ft. deep and 8 ft. wide in 24 hours.

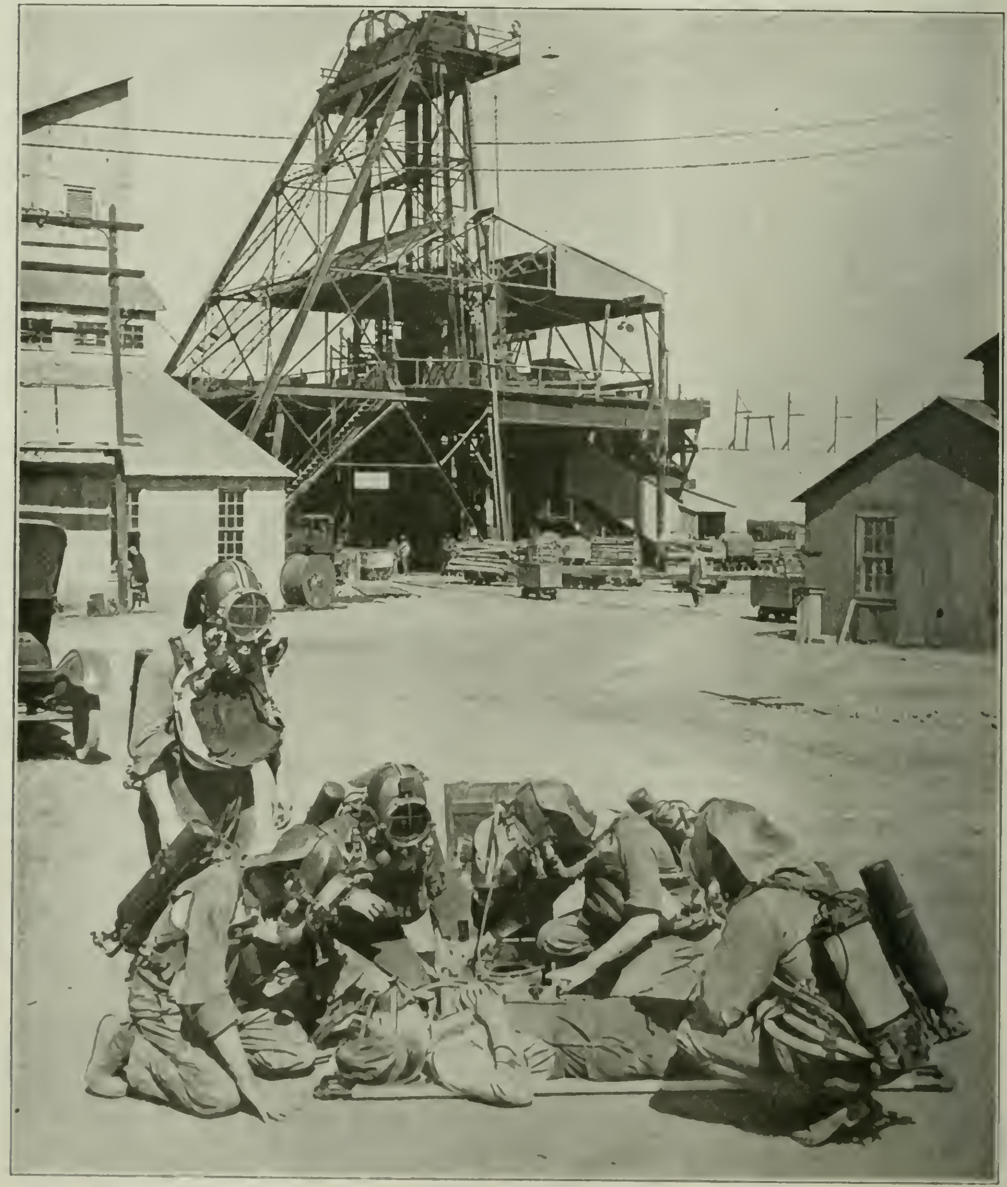
A Commission of Spanish Engineers has been appointed by royal order, says Consul General C. B. Hurst, of Barcelona, to study the actual state and probable development of the metallurgical industries in the republics of South America. The commission is to make an investigation of the possibilities of Spanish commercial expansion, the markets for Spanish metallurgical products, and the procuring of needed raw materials. The creation of this commission is regarded in Spain as necessary to domestic economy in preparation for the time when peace shall put commerce on a normal footing.

---

*Abstracted from *Bull. 9*, U. S. Bureau of Mines, War-Minerals Investigation Series, by Edmund Newton.

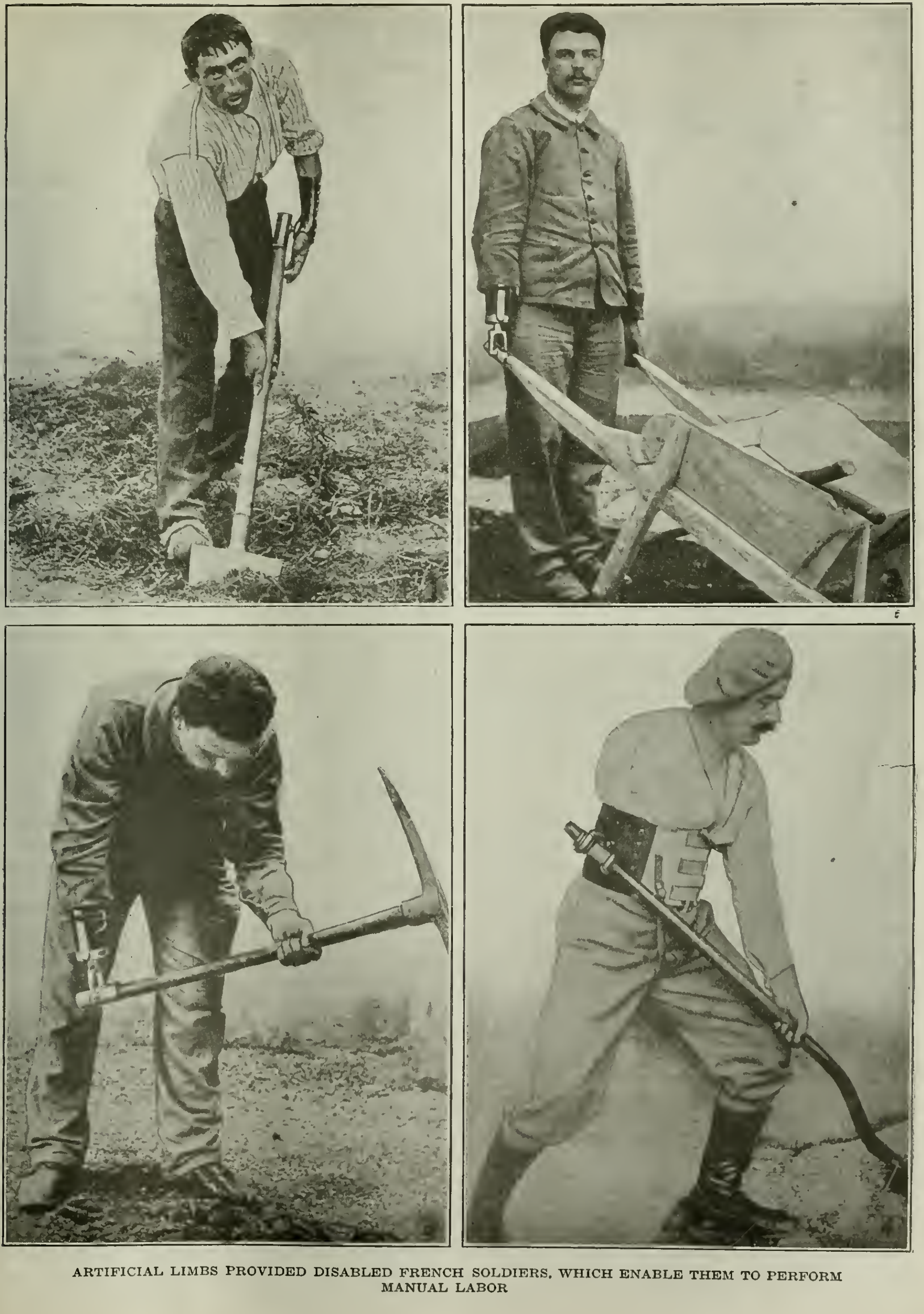
*Abstracted from the *Salt Lake Mining Review*, Jan. 15, p. 34.

Photographs from the Field



MINE RESCUE CREW, PROVIDED WITH OXYGEN HELMETS, MAKING USE OF RESUSCITATION DEVICE

(Copyright by Underwood & Underwood, New York)



ARTIFICIAL LIMBS PROVIDED DISABLED FRENCH SOLDIERS, WHICH ENABLE THEM TO PERFORM MANUAL LABOR

Mexico From Within

BY AN AMERICAN ENGINEER

IN FEBRUARY, 1917, Mexico adopted a new constitution, which is being tried out now. Clause 5 of Art. 27 reads:

> 1. Only Mexicans by birth or naturalization have the right to acquire ownership in lands, waters and their appurtenances, or to obtain concessions to develop mines, waters or mineral fuels in the Republic of Mexico. The nation may grant the same right to foreigners, provided that they agree before the Department of Foreign Affairs to be considered Mexicans in respect to such property, and accordingly not to invoke the protection of their governments in respect to the same, under penalty, in case of breach, of forfeiture to the nation of property so acquired. Within a zone of 100 kilometers from the frontiers, and of 50 kilometers from the seacoast, no foreigner shall under any conditions acquire direct ownership of lands and waters—From the "Mexican Review," March, 1917.

The question naturally arises: How far does compliance with this law affect the rights of citizens or subjects of foreign countries to protection from their own governments under international law? Do they lose any rights by making the renouncement required by the Mexican government? If so, to what degree?

The State Department at Washington, being consulted, replied:

> The department acknowledges receipt of your letter of Jan. 17, 1819, in which you ask to be advised respecting the department's opinion as to the effect upon the rights of American citizens in Mexico of compliance by them with the requirements of the Mexican constitution, that ownership of lands by foreigners can only be acquired in connection with the renunciation by them of their rights as nationals concerning the property in question. In reply, you are informed that the department has advised the Mexican government that it could not regard the constitutional requirement in question as annulling the relations existing between the Government of the United States and American citizens who might acquire property in Mexico by compliance with such requirement, or as affecting its obligation to protect such citizens in the enjoyment of those rights to which they might appear to be entitled under the generally accepted rules and principles of international law. Having assumed this attitude, the department must leave it to interested American citizens to determine for themselves whether they shall comply with the constitutional requirements in question.

It stands to reason that Mexico, like every other country, wants to keep the sovereignty of its territory intact and free from foreign interference, but Art. 27 gives the impression to a foreigner that the required renouncement involves more than the simple title rights of a special piece of property; for instance, that the owner could not present a claim of any kind, old or new, against the Mexican government through the friendly help of diplomatic channels, and that, should he do so, this might be considered treason and involve the loss of his property. In case such claims have already been presented, how will they be affected by the required renouncement of foreign citizenship, and how will the rights of ownership be affected by such claims? It will be hard to reach a general conclusion.

Lately the press of this country has given many reports on the conditions in Mexico and the stability of the present government there, but the information is so conflicting that the average foreigner, either in or out of Mexico, can form no precise opinion of the present general conditions and outlook. The reports are almost invariably biased by the point of view. It may therefore be of interest to hear what an experienced Mexican engineer and prominent miner says on the subject. Many may hold different views, but if there be a desire to get a true estimate one should take more than a grab sample of evidence, and, at least, sample all over the pile. The writer of the letter from which the following extract has been translated has been an engineer and miner in Mexico for almost half a century, and has operated in many parts of the republic. He has been through the various revolutions and has personally suffered from them for years. His point of view and his opinion therefore cover much more than a single location or district and are worth consideration. The name is not given, because the letter was not intended for publication and because such publicity might now be inadvisable:

"February 16, 1919.

"In November, 1916, trying to start up work again, through treason and intrigue we fell into the hands of the insurgents, who plagued us for 11 months, tormenting us in every way, in order to make me pay them money. At last Providence saved us, when we were on the point of being put against the wall.

"On this occasion I had a chance to become thoroughly acquainted with the soul of what you call 'Indianism,' and perhaps we were the first to put in practice the true remedy to counteract this. Numerous times the bandits placed over us a number of ragamuffins, fully armed, and prohibited me from talking to anyone; but as I happened to have medicines, and functioned as physician, I was frequently consulted by the sick, and especially by the women, when at last, by the grace of God, we were going to have peace.

"As long as the pacifists do not arm themselves or furnish themselves the necessary guarantees to guard against any armed forces, be these insurrectionists or professing to help the government, the real government will not help them, and they will have to suffer.

"Last September it became suddenly known in the State of Guerrero that in all the pueblos, and even in the most distant barrancas, the pacifists had taken up arms and had put a stop to the insurgents, most of whom gave up their arms. A few died, and some of the criminals fled from the state, as there was no longer a corner in which to hide. The same happened in the states of Mexico, Morelos, and elsewhere. Morelos was occupied by government troops almost without a shot. The 'Social Defence' is now substituting almost everywhere the forces of the government, which are now being used to persecute the insurgent bands which here and there make an appearance.

"The result therefore is that the so-called new revolution is losing the help of 'Indianism,' which at first dreamed of ownership of land and water, but soon got tired of working it, and changed its banner, carrying a rifle on the shoulder at the expense of the pacifists, until the latter, tired of being tyrannized by a few bandits, stopped them and drove them from the last corner of their ground.

"Now in that region there is not a pacifist who is not on the roll of the Social Defence, which is controlled and assisted by the government. The authorities at present try to get the people to go to work, but as everything has been left in ruins and without resources, it will take time for business to pick up; in many cases because the enemies of the government make use of the paralysis as a means of opposition, in order to break it down. Now that they see that the pacifists do not favor their plans, they will understand that it is better for owners to resume work, before others do so, on their properties.

"There is still many a nucleus of revolutionary politicians who will not submit or reconcile themselves to the new order. Some are being animated and paid by the refugees of the Porfirist party and by certain foreigners who are still working and trying to stir the American people, so that it may show the same interest that they have, to force President Carranza to grant the privileges which Don Porfirio Diaz gave them. They appeal to the Peace Conference and to the League of Nations to have Carranza put out and some one of their choice put in, but as this will not happen, and as the pacifists are depriving them of the help which they got from 'Indianism,' public opinion will finally reestablish order everywhere.

"As the enemies of the government capitulate, the government will be able to return to them the properties which have been confiscated, and ultimately a general amnesty will be granted as soon as the government sees that it will not be betrayed.

"President Carranza wishes in good faith to consolidate the foreign debt, to pay the damage caused by the revolution, and to give back to each one what belongs to him, but it is a condition that the treason of the exiles shall stop, that foreigners shall agree to respect the Mexican nationality and shall enjoy the same rights and guarantees which the government concedes to Mexican citizens.

"President Carranza under these circumstances will welcome the further investment of foreign capital. He is far from wishing to suppress this. As the national resources are unlimited, he wants to see them developed, so as to give work to the people and to derive from the products obtained the highest taxes allowed by law, so that the government may, as soon as possible, be able to pay the nation's debts and the budget.

"Carranza is not the fool some people think him to be. He has no wish to kill the goose that lays the golden eggs, though he may increase taxes up to the limit permitted by economic science, but never so that an enterprise cannot be carried out because the taxes are prohibitory or confiscatory.

"Take, as an example, petroleum. Great underground wealth in this commodity exists in Mexico. Why, because a foreign capitalist drills a hole and makes the oil spring up for an indefinite time, and in indefinite quantity, should he have the privilege to enjoy this wealth forever, without giving a part to the nation? What would the miners say, who constantly have to go to heavy expense for each pound of copper or ounce of silver which they get out, and who, further, have to pay constantly a heavy tax to the government? What equity would there be in this? I notice that the oil people keep on exporting, and would export still more if there were more tank boats, a sign that, notwithstanding the heavy taxes, they make a good profit—more than miners make.

"On the other hand, the intrigues of foreign capitalists have fomented the civil war and are to blame that the government has to spend so much to defend itself. Notwithstanding this, it is obliged to pay the interest on its foreign debt, which by day and by night is growing without pity.

"If the government did not collect these taxes and presented all the wealth of the soil to the foreigner, because the latter wants it and tries to scare us with his money, what would become of the national credit? Are we to be his slaves?

"These large foreign interests are only being suppressed because they try to blind and annihilate us. The law of supply and demand, and competition, will surely draw capital to Mexico. Soon it may come trampling over, when it sees that Europeans, less timid and with better knowledge of our situation, are running ahead of it, selecting the best enterprises and then quietly acquiring them.

"These same considerations are applicable to mining. Eight years of Zapatism and Bolshevism have tested us, more than any other nation, and we are now coming out of the slough. Soon things will resume their just value and price, and competition will do the rest.

"In general, I believe that the Carranza government is getting more and more solidified; that the United States will not intervene, and, still less, Europe; that there soon will be enough elasticity to allow some changes to be made in the constitution, which will make the public tension less, as the enemy is giving way; and that, within the year, interchange throughout the country will be as easy as it was in the time of General Porfirio Diaz.

"The impulse to business in Mexico is going to be stupendous and without precedent in the history of the country, because every one will have a safe basis for his business operations. Mexican investments will be in fashion and will offer better security than those of Europe, and, maybe, than those of the United States. Mexico has passed already through the fiery test of Bolshevism. Europe and the United States still have to go through this. If to this is added the climate and the geographic location, we may hope with confidence for a happy future for Mexico."

California Gems*

Accounting for the production of gems in California is unsatisfactory, owing to the number of widely scattered places where stones are gathered and marketed in a small way. The production for 1917 includes diamonds, beach pebbles, garnet, opal, californite, quartz crystals, chalcedony, kunzite, and tourmaline.

California tourmalines are decidedly distinctive in coloring and fire as compared to foreign stones of this classification. The colors range from deep ruby to pink, and various shades of green have been noted; also more recently a blue tourmaline has been found. Two California gem stones, kunzite and benitoite, are not found elsewhere in the world, and these have each been found in but a single locality, the former in the Pala Chief mine, in San Diego County, and the latter in the Dallas mine, in San Benito County.

Some rhodonite has been mined in Siskiyou County, and used for decorative purposes. Diamonds have been found in a number of places in California; but in every case they have been obtained in stream gravels while working them for gold. Some chrysoprase was mined in 1917, in Tulare County, but not sold until later. The total value of the gems produced in California during 1917 amounted to $3049.

---

*Abstracted from *Bull.* 83, "California Mineral Production for 1917," California State Mining Bureau.

The German Metal Interests

THE Alien Property Custodian has made a report, in the third chapter of which, under the caption "The Metal Situation," the cases of the American Metal Co., L. Vogelstein & Co., and Beer, Sondheimer & Co. (American branch), are reviewed. The essential part of the report follows:

After the passage of the Trading With the Enemy Act, in October, 1917, the Alien Property Custodian, then appointed, caused investigations to be made of the American Metal Co., Vogelstein & Co., and Beer, Sondheimer & Co., as a result of which he took over the entire business of Vogelstein & Co. and of Beer, Sondheimer & Co. and 49% of the stock of the American Metal Co. The investigations disclosed the following facts:

Beer, Sondheimer & Co.—In August, 1915, Benno Elkan and Otto Frohnknecht, who were simply the agents of the Frankfort firm of Beer, Sondheimer & Co. and were conducting in the United States a branch of the business of the Frankfort firm under the name of Beer, Sondheimer & Co., American Branch, without the knowledge or consent and against the express wish of the Frankfort firm, formed a corporation under the laws of the State of New York called Beer, Sondheimer & Co., Inc., capitalized at $1,000,000, and transferred to that corporation all the assets of the Frankfort firm in consideration of the issue to that firm of all the capital stock of the new corporation. Correspondence passing between the Frankfort firm and the American attorneys who advised Elkan and Frohnknecht in this situation, and did the legal work in organizing the corporation, clearly shows that the corporation was organized and the assets were transferred to it for the express and only purpose of making it impossible for the United States Government, in case of a war between the United States and Germany, to exercise its belligerent rights and take control of enemy property in the United States.

The assets thus transferred to the corporation amounted to about $3,250,000, which did not include the profits made by the business in 1915, amounting to about $1,200,000, and the profits of 1916, amounting to $2,000,000. Between September, 1915, and Feb. 3, 1917, Beer, Sondheimer & Co., of New York, transferred to Beer, Sondheimer & Co., of Frankfort, $2,047,000. The last remittance of $700,000 was made on Feb. 3, 1917, the very day on which Count Von Bernstorff received his passports and was sent out of the country. When this happened, and it became clear the United States and Germany were on the brink of war, Elkan and Frohnknecht, to further make it impossible for the Government to seize the German property in their possession, caused to be transferred to the corporation 7000 out of the 10,000 shares of stock of the corporation which had been issued to the Frankfort firm as consideration for the transfer of the assets to the corporation; and, to effect this transfer, they did not hesitate to cause the name of the Frankfort firm to be indorsed upon the back of the stock certificate without any apparent authority. The other 3000 shares of stock they claimed to have bought from the Germans in 1916 at the rate of $80 a share, when the book value thereof was in excess of $300 a share, and in the face of a profit of $2,000,000 made by the business in that one year. Thus the two individuals claimed to become the owners of all the business and assets formerly belonging to their German principals, less the portion of profits sent to Germany as above stated.

Though they have been in this country since 1906, Elkan and Frohnknecht did not become citizens till 1917. One of them became a citizen after von Bernstorff got his passports, and the other was admitted to citizenship in May, 1917, after we were at war with Germany. There is evidence to indicate that their sudden desire to embrace our citizenship was only a "war measure," and that they asked for and obtained the approval of the Frankfort firm to their action.

The foregoing is but a bare outline of what the investigation disclosed, but it is sufficient to indicate that the transfers were void as against public policy, and in consequence the Alien Property Custodian demanded and took over the entire business and assets of Beer, Sondheimer & Co., as German property.

L. Vogelstein & Co.—It had been the custom for years for Vogelstein to make annual settlements with Aron Hirsch & Sohn and to send and receive annual accounts upon the basis of which respective shares in the profits were determined as between Aron Hirsch & Sohn and L. Vogelstein & Co. The last accounting was had as of the end of 1914. Owing to the war it has been impossible for accountings to be had since that time. At the end of 1916, Vogelstein bought out the interests in the firm of L. Vogelstein & Co. owned by Ernest G. Hothorn, and he then formed a corporation under the laws of the State of New York under the name of L. Vogelstein & Co., Inc., capitalized at $5,000,000, and transferred to the corporation all of the assets of the firm of L. Vogelstein & Co. in consideration of the issue of the entire capital stock. At that time the books of L. Vogelstein & Co. showed that the firm was indebted to Aron Hirsch & Sohn for its share of the profits of the American business and balances due in the sum of about $3,900,000. But inasmuch as there was no way of determining what profits, if any, Vogelstein was entitled to receive from the European business of Aron Hirsch & Sohn, no accounts having been stated between the parties since the end of 1914, there was no way of determining what amount was really due to Aron Hirsch & Sohn. Under these circumstances Vogelstein placed the entire 50,000 shares of stock in escrow with his attorneys, setting aside 39,000 shares thereof to be held to await a final accounting between the two firms. The Alien Property Custodian made a demand upon the attorneys who held the stock in escrow for the surrender to him of the interest of Aron Hirsch & Sohn in said stock. The entire 50,000 shares of stock, being the total capitalization of the company, were turned over to the Custodian, and he took control of the business.

American Metal Co.—In 1917, on the last increase of the capital stock of the American Metal Co., the Metallgesellschaft and the other German interests allied with it (not including Henry R. Merton & Co.) who appeared as stockholders of the American Metal Co., held 34,644 shares of the 70,000 shares of stock outstanding; Henry R. Merton & Co. and the interests allied with it held 16,736 shares, and the balance of 18,620 shares was held by Americans. The Americans were at this time in control of the board of directors of the company and all the officers were American. The Alien Property Custodian demanded and received all of said 34,644 shares of stock owned by Germans, and appointed five of the fifteen directors of the company to represent him in the conduct of the affairs of the corporation.

In dealing with the German interests in the American Metal Co., L. Vogelstein & Co., and Beer, Sondheimer & Co., the Alien Property Custodian sought, not only to take possession of all such alien property, but also to eliminate as far as possible for all time German interests and German influences which existed and had been exercised in this country through the control of these three companies; and it is believed that the disposition made by the Custodian has been such as to effectually eliminate all present and, it is hoped, future German control in the metal market and the metal industry of this country.

The business of Beer, Sondheimer & Co. is in process of liquidation. This includes not only the corporation Beer, Sondheimer & Co., Inc., but also its subsidiaries, the National Zinc Co., the Norfolk Smelting Co., and the Cuba Copper Leasing Company.

When the Custodian took over the business of Beer, Sondheimer & Co. he placed it in control of a board of directors designated by him. Elkan and Frohnknecht, maintaining that they owned all the stock of the corporation, filed a claim therefor, and thereafter brought suits to recover the same. These suits, however, have been withdrawn, and the Custodian, through said board of directors, is proceeding to liquidate the company, and as soon as the business has been liquidated the corporation itself will be dissolved, and Beer, Sondheimer & Co. will entirely have disappeared as a factor in the zinc and copper situation, both in the purchase and sale of ores and in the control of mines and smelteries. As pointed out above, the Frankfort firm of Beer, Sondheimer & Co. was a stockholder in the Minerals Separation companies. In 1913 the Frankfort firm transferred to its American branch its interest in this stock, and when the American Minerals Separation was formed in 1916, under the name of Minerals Separation North American Corporation, the stockholders of the predecessor, the British Minerals Separation Co., became entitled to exchange their shares for the stock of the new company upon the basis of one share of the old stock for two of the new. Thus Beer, Sondheimer & Co. became entitled to receive 65,230 shares of the stock of Minerals Separation North American Corporation. In addition to this amount of stock, Beer, Sondheimer & Co. had received from Minerals Separation North American Corporation 35,000 shares of stock as a consideration for the cancellation of the exclusive agency of Beer, Sondheimer & Co. theretofore granted by the British Minerals Separation Co., thus giving to Beer, Sondheimer & Co. a total of over 100,000 shares of the stock of Minerals Separation North American Corporation out of a total issue of 500,000 shares. The Custodian took over all of said 100,000 shares (in form of voting-trust certificates) as property of Beer, Sondheimer & Co., of Frankfort. This stock will likewise by disposed of by the Custodian and will go into American hands. Beer, Sondheimer & Co.'s control over the important flotation process has been destroyed.

As in the case of Beer, Sondheimer & Co., when the Custodian took over the business of L. Vogelstein & Co., Inc., he placed in control thereof a board of directors designated by him. Subsequent investigation by the Custodian disclosed that Vogelstein, who was a naturalized American citizen, had a preponderating interest in the assets of the corporation; and inasmuch as it has as yet been impossible to obtain from Aron Hirsch & Sohn an accounting so as to determine that concern's exact interest in the assets of L. Vogelstein & Co., Inc., an arrangement has been perfected between the Custodian and Vogelstein whereby all of the stock of the corporation has been put into a voting trust for a period of five years, the Custodian naming two of the three voting trustees. Thus the control of the corporation for the next five years will be in the hands of the trustees appointed by the Alien Property Custodian. Vogelstein has agreed not to resume his relations with the Germans during this period of five years and to conduct the business of the corporation as a purely American concern. The voting-trust certificates have been made assignable only to Americans. Vogelstein has agreed to pay to the Custodian $1,668,671.49, being the amount of the apparent indebtedness from him to the Hirsches as of Apr. 30, 1916, and has agreed to pay to the Custodian all additional moneys that may be found to be due to the Hirsches upon a final accounting, which is to be had within six months after the declaration of peace. Thus circumscribed and guarded, the control of the business has been turned back to Vogelstein, the Custodian retaining two out of the five places on the board of directors as long as the Custodian may have any interest in the business.

Soon after the Trading With the Enemy Act became a law, the Americans in control of the American Metal Co. not only promptly filed the report required by the act and disclosed therein the German ownership of about 49% of the stock of the company, but offered to coöperate with the Custodian in any direction looking to the elimination of the German interests. An investigation of the affairs of the company was courted, and, at the instance of the War Trade Board, such an investigation was made, and subsequently the Alien Property Custodian likewise made an investigation of his own. The officers of the company heartily coöperated with the Alien Property Custodian, which resulted in the first instance in the transfer to the Custodian of the stock belonging to the Germans. The Custodian was satisfied with the good faith of the management of the corporation and, therefore, designated only five of the fifteen directors of the company.

By agreement between the Alien Property Custodian and the American stockholders, together controlling 53,264 shares (out of 70,000 shares outstanding), all of said stock has been placed in a voting trust for a period of five years. The Alien Property Custodian is entitled to receive voting-trust certificates representing the 34,644 shares of stock formerly held by enemy aliens. It is his purpose to offer these certificates for sale to the American public at public auction.

The voting-trust agreement provides that the Alien Property Custodian shall appoint all five of the voting trustees. He has already appointed three trustees, who are now in actual control of the management and policy of the company. The trustees are Joseph F. Guffey, Henry Morgenthau, and Berthold Hochschild. Mr. Hochschild is one of the founders of the company and has been chairman of the board of directors for several years. The Alien Property Custodian will appoint the other two trustees after he shall have sold the voting-trust certificates held by him.

The policy of the Alien Property Custodian to sell only to Americans will be strictly adhered to in this instance, and none of the voting-trust certificates will be permitted to go into any but American ownership. The immediate result is that 76% of the stock of the company will be owned by American citizens. The Alien Property Custodian is in correspondence with the British authorities with a view to the deposit, under the voting-trust agreement, of the 16,736 shares held by Henry R. Merton & Co. and its allied interests. It is hoped that such action will be taken in the near future. When this has been done, the Alien Property Custodian believes that all German ownership and influence will be effectually eliminated from the company.

Lessons of the War

By an Army Officer

Mining men from all parts of the world have served in the Allied forces during the war. Much that was common knowledge to pioneers was discovered by the authorities and by various ranks in the Army. It will be most interesting to see whether the knowledge which has been gained by the millions who have served, and also to some extent by the nations concerned, will be to any appreciable extent utilized; or whether there will be an almost complete reversion to the old order of things.

Millions of letters were written and addressed in pencil. They presumably got home and answered their purpose. When traveling one generally has a pencil, and post office and hotel pens are well known. Before the war many men had never slept in blankets without sheets, but any one who has been accustomed to his own blankets would never want sheets, and probably, also, would never have rheumatism. Those who are accustomed to the open air will have to do without ventilation or fresh air when they travel in crowded railway carriages, for the majority of the passengers want all windows closed and all ventilation cut off. No wonder so many people can get colds at any time of the year and that influenza is prevalent. The Army authorities realize the advantage of ample ventilation, which is fortunate.

Compare the shape of a boot or shoe, as purchased ready made, with the shape of the human foot, which has to bear the weight of the body. The infantrymen know all there is to be known about footwear from a wearer's point of view. Ordinary ornamental boots or shoes are useless for marching, or even for wearing any length of time at a stretch. An Army "foot inspection" shows the irreparable harm often done, and reveals the scandalous absurdity of the design of the ordinary shoe. No wonder so many people have to get on a street car to travel for only a block or two.

There is a great difference between what one wants and what one cannot do without. Mining men who have done pioneer work know exactly how to cut their essential requirements to a minimum, especially as they sometimes have to carry their packs themselves. It is only in war time that the majority of people begin to realize that there are such things as non-essentials; and, under peace conditions, it may be a considerable time before many non-essentials reappear. A crop of substitutes arose during the war, some of which, such as imitation tobacco, whiskey, and beer, it is to be hoped, will disappear soon, and not return.

An army without discipline and organization is merely a mob; and the same argument applies to nations and to the subdivisions of a nation such as its industrial concerns. To the degree that the human part of any business or undertaking may lack discipline, and just so far as the various human elements that make up the whole enterprise do not correctly harmonize mutually—to that extent the enterprise works unsoundly and on lines the reverse to economical. Executives must look after subordinates if they want reciprocal consideration. Many an officer has, to his advantage, discovered that fact at the front; and many have failed dismally because their men were not accorded the proper consideration. This is probably not without its lesson in civil life.

A large number of women have done work which was hitherto always done by men; and there can be no two opinions in regard to their capability, even at semiheavy labor and at many skilled trades. Uniformed policewomen are actually essential in places where large numbers of women are employed, but they must be properly trained and drilled, or they cannot maintain authority.

Idaho Mining Association

The Idaho Mining Association held its sixth annual convention at Boise, Idaho, on Feb. 11 and 12, 1919. Jerome J. Day, of Moscow, Idaho, was elected president for the year 1919, J. B. Eldridge, of Boise, Idaho, vice-president, and Ravenel Macbeth, of Mackay, Idaho, secretary-treasurer. I. E. Rockwell, of Bellevue; James F. McCarthy, of Wallace; and Frank E. Johnesse and W. N. Sweet, of Boise, were elected members of the executive board. The delegates-at-large elected were: Stanly A. Easton, Kellogg; J. H. Richards, Boise; A. A. Klockmann, Klockmann; Homer V. Jenkins, Mackay; C. L. Herrick, Mullan; A. E. Carlson, Pocatello; Edward Schwerd, Boise; D. H. Ferry, Murray; F. C. Howe, Bellevue; W. C. Ames, Sandpoint; John J. St. Clair, Silver City; Leroy Hillman, Driggs; E. E. Carter, Quartzburg; Francis A. Thomson, Moscow; Robert N. Bell, Boise; F. A. Losekamp, Elk River; C. B. Faraday, Mountain Home; Edward M. Griffith, Grangeville; H. H. Broomhead, Paris; Alex Houlihan, Heath; D. L. Nichols, Gilmore; C. C. Stimson, Pearl; P. T. Sweeney, St. Maries; and Harry L. Day, of Wallace, all of Idaho.

The program of the first day opened with an address of welcome by Governor Davis of Idaho, following which the members were presented with the freedom of the city by Mayor Hays of Boise. Addresses were made by Francis A. Thomson, dean of the Idaho School of Mines, who had for his subject "The School of Mines and the State," and by Robert N. Bell, state mine inspector, who talked on "Mine Inspection in Idaho."

In the evening two illustrated lectures were given, one on the "Physiography of Idaho," by Douglas C. Livingston, professor of geology at the University of Idaho, and the other on the "Mining Industry of the Coeur d'Alenes," by W. C. Clark, of Kellogg.

On Feb. 12, President E. H. Lindley of the University of Idaho spoke on "Human Engineering," emphasizing the fact that the human factor must be considered in all lines of business.

President Lindley's address was followed by a first-aid demonstration by the Hecla first-aid crew, of the Hecla Mining Co., of Wallace, and champion first-aid crew of the Coeur d'Alenes, in the course of which four first-aid problems were solved and the use of the pulmotor and oxygen mask was demonstrated. The State Legislature, which was in session, adjourned to attend this demonstration.

The report of the secretary showed that the association had 924 members actively engaged in mining, and that its affairs were in a flourishing condition. It was stated that the association maintained its representative, Ravenel Macbeth, in Washington from Dec. 12, 1917, to Jan. 26, 1919, for the purpose of keeping in touch with Federal legislation, and that it is the only Western mining organization that did so continuously during this period.

A resolution was adopted by the association asking Congress to enact a law exempting owners of mining claims from performing assessment work for 1919, on account of the cost of labor and supplies. A bill was also endorsed that is now before the State Legislature, providing for the creation of a state bureau of mines and geology, to coöperate with the University of Idaho and with the U. S. Bureau of Mines and the U. S. Geological Survey.

The association, through another resolution, invited the attention of Van. H. Manning, director of the U. S. Bureau of Mines, to the fact that there are to be established several of the mine experiment stations authorized by the act of Congress of Mar. 1, 1915, and asked him to recommend that the next station be established at the University of Idaho.

The members of the association extended to Jerome J. Day their congratulations for his having established four scholarships at the Idaho School of Mines. A committee was appointed to formulate a plan of obtaining additional scholarships for the school.

Spokane Engineering Society

The Spokane Engineering and Technical Association was organized more than three years ago, by the local members of national engineering societies, for the purpose of providing closer coöperation between engineers in the district and to stimulate to a greater degree participation in public affairs.

Three national engineering societies influence to a large degree the affairs of the association and alternate in featuring the monthly meeting. Another feature of this organization is the arranging of noon luncheons by specified committees. There are 15 of these committees, the membership of which varies from three to thirteen, each having a luncheon arranged one day a month. When questions of unusual interest are under consideration, prominent speakers are invited to place the subject properly before the members and the attendance of non-members is welcomed.

The 15 committees are as follows: executive, Americanization, educational, emergency, highways, legislative, manufacture and industry, municipal, national and state, patents and inventions, program, reclamation, research, resources, safety and rehabilitation. The chairmanship and memberships of the committees are so distributed as to secure representation of each society.

Facts About Mosquitoes*

Mosquitoes are annoying pests, and certain kinds are dangerous, because they spread diseases. Malaria is spread from one person to another by the bite of a mosquito. Mosquitoes should be destroyed before they have an opportunity to breed, and this can best be accomplished by destroying all breeding places. Mosquitoes lay eggs in water. These develop into "wiggle tails," then into full-grown mosquitoes. The female mosquito lays her eggs in stagnant water, along the banks in slow-running streams; also in tin cans or other places where water may stand.

Destroy the breeding places and banish the mosquito. No mining camp should tolerate mosquitoes. Drain the stagnant water, allow no rubbish, cans, or pools about the camp. Pour kerosene oil on the pools or ponds that cannot be drained. Fish in pools or ponds aid by eating the wigglers and young mosquitoes.

Mosquitoes that carry malaria bite at night. They seemingly prefer dark objects, as dark articles of clothing. The female mosquito does the biting, as the male rarely leaves the breeding place. When a mosquito bites a person with malaria it draws up into its stomach the malaria germs which are in the blood of the sick person. Later, when it bites someone else, it transfers these malaria germs.

The Victory Liberty Loan

Secretary of the Treasury Glass has made official announcement that the next Liberty Loan campaign will begin on Monday, Apr. 21, and close on Saturday, May 10. The official announcement follows:

> After studying financial conditions in all parts of the country, I have determined that the interests of the United States will best be served at this time by the issuance of short-term notes rather than of longer-term bonds which would have to bear the limited rate of interest of 4¼ per cent.
>
> The Victory Liberty Loan, therefore, will take the form of notes of the United States maturing in not over five years from the date of issue. These notes will be, as were the Liberty Loan bonds, the direct promise to pay of the United States, will be issued both in registered and coupon form, and the coupon notes will be in final form and will have attached the interest coupons covering the entire life of the notes. I am hopeful that the notes in final engraved form will be ready for delivery by the opening of the campaign on April 21.
>
> I am led to adopt the plan of issuing short-term notes rather than long-term bonds largely because of the fact that I believe that a short-term issue will maintain a price at about par after the campaign is concluded far more readily than would a longer-term issue.
>
> I have not yet reached a conclusion as to the rate of interest and exemptions from taxation which those notes will bear, because this decision must be based on existing conditions immediately prior to the opening of the campaign.
>
> I take this opportunity to repeat what I have already stated, that it is the intention of the Treasury Department to carry on the same kind of intensive campaign for distribution as heretofore. It would be a most unfortunate occurrence if the people of the United States failed to take these notes, thus placing the burden of subscriptions on the banks. The business of the country looks to the banking system for credit wherewith to carry on its operations, and, if its credit is absorbed to a large extent by the purchase of Government securities, there will be many limitations placed upon the supply of credit for business purposes.
>
> Our merchants and manufacturers need ample credit for setting the wheels of industry in motion for peace-time production and distribution, and the wage earner is directly interested in seeing that these wheels are kept moving at a normal rate, in order that full employment at good wages may continue, and, where readjustment conditions have necessitated a slowing down of industry, it is vitally important that activity be resumed and labor reëmployed at the earliest possible moment.
>
> I therefore ask the American people once again to give their support to their Government in order that this great loan may be made an overwhelming success by the widest possible distribution.

Uncle Sam Calls for a hundred million volunteers to enlist in his Army of Thrift. We must—

War on Waste.

Conduct a Campaign of Economy.

Drive Extravagance Out of Its Trenches.

Go Over the Top in a Great Thrift Offensive.

Buy W. S. S.

---

*Abstracted from the "Miners' Safety and Health Almanac for 1919," Bureau of Mines, Department of the Interior. Miners' Circular No. 24.

Correspondence and Discussion

The Mexican Situation

I agree that it is time to interest the American public in conditions in Mexico, which, so far as the mining industry is concerned, are as bad today as they were three or four years ago. With the exception of a few of the large properties on the railway lines, nearly every mine and prospect is as much closed down as it was during the height of the revolution.

Some people here seem to believe that we are in the reconstruction period, but most of us believe it is the destruction period. The destruction of property—mining, agricultural, and manufacturing—is incredible, and little known to the outside world. We do not advertise it, as we think Mexico has a pretty bad black eye now, and do not want to make it worse.

Bandits infest every part of the country except along the lines of the principal railways, and even these are frequently cut. Hardly a day passes but we hear of trains blown up and passengers killed or hurt. This happens on every line of railway operating in this part of the republic. No train leaves Mexico City in any direction without a military escort, sometimes large, sometimes small, but it is always escorted.

No one attempts to leave the railways for interior towns or villages, except, perhaps, the poor peon, who has nothing to lose. The country is in a state of devastation. The many large haciendas or ranches over this part of the republic are abandoned. Some are in ruins, some are being worked by the bandits, and some have been totally destroyed. The owners of these ranches are invariably poor. Some are financially ruined and ready to sell their properties for what they can get for them. In many cases the government troops are worse than the bandits, as their wages are not paid regularly, and, as they must eat, they rob.

In the cities, mining camps, and such places where labor is required. the situation is bad. Strikes are of daily occurrence, both in the manufacturing and mining districts, and have been the cause of closing many industries and many mines. Labor costs much more today than before the trouble, and is less efficient. The cost of living and the cost of operating have more than doubled in the last 10 years, and both are still going up.

There are practically no mines in operation at any distance from the railways. It is quite true that the mines in El Oro and Pachuca have been working nearly all through the troublous times, but they have been able to do so on account of their proximity to the railways connected with the port of Vera Cruz. This line of communication has been kept open practically all the time by the various factions in power, because the revenue derived was a great benefit to them. Both the principal companies in El Oro and Pachuca have their own trains, operated apart from the regular lines, and in this way have been able to keep going, although at a comparatively large outlay.

The State of Mexico, one of the richly mineralized states of the republic, has a large number of well-known and prosperous mining properties; but outside the El Oro district all are closed down and abandoned. A few were able to operate during the first years of the revolutionary trouble, but in 1917 all were closed and have remained so to date. Some of these mines have filled with water, and it will involve large sums to unwater them and place them on a producing basis again. Practically all the large properties here are owned by foreigners.

The State of Morelos, although not so important, on account of its small size, has several rich mines, which were operating and paying dividends before the trouble. These closed down, and are still abandoned by the owners. Some have been forfeited because of failure to pay the taxes. The state is a center for the Zapatista element, and, although the government has made several efforts to obtain control, it is still far from pacifying this section of the country.

The State of Guerrero, one of the large states of the southern part, is in bad condition and entirely abandoned. The Zapatistas have complete control aside from a few towns on the Pacific Coast. Guerrero is a highly mineralized state, and, though development has been held back for want of transportation, the mines are numerous and rich.

Michoacan is also another large and important state. Before the trouble many properties were shipping ore to the smelteries, and the mining industry was expanding rapidly. Today hardly one mine is working. The state is important from an agricultural standpoint, and a considerable trade was formerly done in lumber. Today the large haciendas are lying idle or being worked by the bandits, and the lumber mills are silent. Trains are blown up here about as fast as they are being dispatched in an effort to try to keep traffic open. Probably one or two trains a week is the toll. Many are killed and wounded with each blow-up.

Queretaro is another state which is rich in mineral wealth. It is in about the same position as the others. Mexican opals, antimony, lead, silver, and gold are the principal products. The mines here are all at some distance from the railways, but a few of them can be operated on a small scale because their owners pay the bandits to leave them alone.

The State of Jalisco, north of Michoacan, and on the west side of the country, is of importance both in mining and agriculture. It has several large mining properties that have shipped a considerable amount of bullion, and some old *antiguas* well known to mining men. Aside from two or three properties, the state is paralyzed. Everything at a distance from the railways is abandoned. The conditions are bad, and there is no outlook for any betterment. This state has a big future when peace comes.

The State of Nayarit, or Territory of Tepic, as it was called before the revolution, is a small state on the Pacific side, and is probably worse off than any of the others are. It was at one time prosperous both in mining and farming. Today it is in ruins and completely overrun by bandits. The mines are all shut down and left to the mercy of the hordes, as are the haciendas.

The State of Guanajuato is a well-known mining district. A few mines in the city of Guanajuato are working on a reduced scale. Most of them are away from the railroads and have been practically abandoned. Zacatecas is practically in the same position as the others. A few mines are shipping ore to the smelters in the northern part of the state, but in the south nothing is being done.

Aguascalientes has some good mines. A few of these along the railways are operating and shipping to the smelting plant of the American Smelting and Refining Co. This company has its own mines, which are the main producers for the smeltery. It has been compelled to close down some of its properties at times, owing to the difficulties encountered in dealing with the new government.

Most of the mines in the various states are closed, on account of inability to get supplies, or to market their ores or bullion. Until these conditions are changed, and a guarantee as to the future delivery of supplies and fuel can be given, they must remain closed. The small investor or mine holder will be the last to be able to open, because it is more difficult for him to get small supplies.

In spite of difficulties encountered and the inability to work many of the mines here, the time is opportune for mining as well as other investments. Mining properties, land, and haciendas can be bought now at ridiculously low figures compared to what they would have fetched 10 years ago. Mines that could not be purchased at that time can now be bought for a nominal sum.

Mexico, D. F., Jan. 9, 1919. ENGINEER.

Capital for Small Operators

Many small operators come to New York in search of financial aid for their prospects or mines; and as the experience of one who has failed will doubtless save others from a useless expenditure of time and money, I am submitting these notes for publication.

About two years ago a prospector in British Columbia uncovered a quartz vein carrying pyrite, galena, and gold, in several places of good width. The gold content attracted my attention, and in due course I arranged to prospect the vein for an interest and for what appeared to me to be a satisfactory option on the property. This option called for cash payments after three years, to be concluded at the end of the fifth year.

I trenched across the vein at a number of points, establishing its continuity for 1500 ft., and sunk six pits, each from 10 to 30 ft. in depth. I took samples from the vein wherever opened, panned the samples, and had them assayed, and convinced myself that I was working on something of value. For two years I carried out this work with little help, and then considered that I was ready to interest capital in my venture. Having no friends who were strong enough to take over my option and go on with the business, I came to New York to look for help, but I have been disillusioned as to the ease with which funds may be secured here. I have had no trouble in meeting engineers, and, through them, responsible parties who invest in mining properties. Many of the engineers were interested, but were frank in telling me that no money could be raised on the terms suggested.

My payments fall due before the property can be proved to be a mine. I found no one ready to buy a prospect—no one willing to advance money on account of purchase extending over several years. Although lack of interest is largely due to the terms of the contract, it was encouraged by the fact that I had no engineer's report. My panning tests and assays did not represent intelligently the merits such as I believe the property possesses. I find that there is little money available for outright purchase, even though considerable ore is developed, but that money can be secured for equipment if development has gone so far as to render the necessary expenditure reasonably safe. I think also that I could have secured money for development purposes had I held a contract that would have permitted the purchase price to come out of the property, and had I brought with me an engineer's report telling exactly what had been exposed by my work. If I had invested in a report rather than spent the money on a trip, and then conducted my negotiations by correspondence, I should have done better, and, in any case, would have been no worse off.

The only optimists I found were the mining brokers, but as their methods of financing did not appeal to me, I made no serious attempt to interest them. The advantages of my trip are that I have met some real mining men, and know how they feel toward the prospect or the young mine. They do not want all of it, but they are unwilling to take unnecessary risks. They are open to conviction, and ask only that the facts, as nearly as possible, be accurately and fairly presented.

My advice to an operator coming to New York for the same reasons that I did would be to see that his affairs are first in such a condition that he can say: (1) "All money asked for will be spent upon the property"; (2) "All money that you spend will be returned to you out of the mine before I get any"; (3) "Here is a report by a competent engineer, whose statements are substantially correct."

I am leaving for home, but when I return to New York I am going to secure the money needed for the development of my property, unless I am very much mistaken. J. M. C.

New York, Mar. 16, 1919.

Mineral Enterprise in China

Our attention has just been called to your review of Collins' "Mineral Enterprise in China," an excellent notice, by the way, which we are glad you cared to publish. You give the name of the publisher as William Heinemann, of London, although the book is handled in this country by ourselves. We would appreciate it if you would make a note of that fact in your next issue of the *Journal.*

The book is of limited appeal, anyway, and we are anxious to have all who would like to possess it know that it can be obtained in this country. The American price is $6. THE MACMILLAN COMPANY,

New York, Mar. 4, 1919. Editorial Department,
H. S. Latham.

Details of Practical Mining

Many different designs for semaphore systems in underground haulage have been produced, and each scheme has been planned to meet the requirements of some particular condition. The devices used have, in general, depended on the extent of the haulage system, so that, at mines where the installation has justified the expenditure, elaborate and intricate devices have been adopted. The article "Underground Semaphore System" describes a simple and inexpensive installation that may be used to advantage at any mine.

The use of timber in bulkheads, packs, or pigsties has long been a practice in the support of underground workings, but the increasing cost of timber has forced the adoption of various substitutes. The suggestion embodied in "Pigsties or Bulkheads on the Rand" offers a saving in timber, by reducing the amount used, and affords a means of using the spare ends of timber, otherwise wasted.

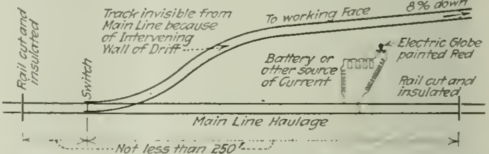
The mine surveyor who usually must painstakingly plot and figure the curves for each individual problem in the mine trackage system will appreciate the short-cuts that are offered in the article "Adapting Railway Curves to Mines." Laying out mine curves requires the use of short measurements and small angles, and the accompanying table, calculated in chords of suitable length, will be found most convenient.

Among the annoyances to which the field engineer is subject are those caused by broken tapes, and the convenient repairing frame described in a following article suggests a valuable addition to the surveyor's outfit. The device not only provides a method for holding the broken ends while the mend is being made, but also assures accuracy in the repair of the tape.

Underground Semaphore System

At a mine in southeast Missouri it was necessary for a train of ore cars to approach the main haulage line underground at a high rate of speed, on account of an adverse grade at the approach. The train on the main line also ran at high speed, was given the right of way, and had no set schedule, so that it was necessary for the motorman on the switch to choose a time when the main line was empty in order to get his cars out.

Following an accident, which, fortunately, was not serious, a semaphore system, consisting of an electric globe of high candlepower, painted red, and suitably protected from the mine moisture and falling pieces of rock, was installed at one side of the switch track about 75 ft. from the switch and connected to the main line, as shown in an accompanying sketch. When the motor on the main line approached within 250 ft. of the switch, on either side, the lamp immediately indicated its approach, and the motorman on the other line either slowed down or stopped. The approaching motor on the main line, after crossing into the "insulated" zone, completed the electrical circuit and caused the lamp to burn until the main line train passed out on the other end of the block.


Rail cut and insulated
Switch
Track invisible from Main Line because of Intervening Wall of Drift
To working Face
8% down
Electric Globe painted Red
Battery or other source of Current
Rail cut and insulated
Main Line Haulage
Not less than 250'

SIMPLE SEMAPHORE INSTALLATION FOR MINE USE

Pigsties or Bulkheads on the Rand

By E. M. Weston

The research engineers of the Rand Mines, Ltd., have been conducting experiments to secure the most efficient methods of supporting the roofs of stopes. Roof support on the deepest levels of the workings of the reef costs upward of 35s. per fathom in normal cases. Pigsties, or bulkheads, 6 to 10 ft. square are being placed from 6 to 10 ft. apart in workings between 4000 and 5000 ft. in vertical depth. Fig. 1 shows the ordinary type of pigsty constructed of squared timber, and Fig. 2 illustrates an improved type which has been tried by the Village Main Reef Gold Mines Co. It is

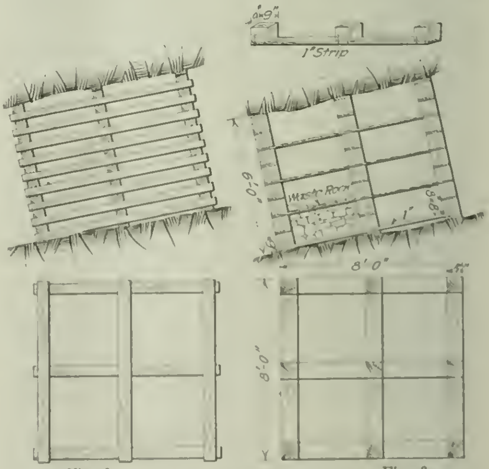


Fig. 1 Fig. 2

TYPES OF PIGSTIES OR BULKHEADS

obvious that the cost of this latter type could be further reduced by the use of unsquared sections cut from the end of stulls, thus utilizing much timber that is now being wasted. A shortage of suitable mining timber in South Africa is threatened, and mining companies are securing all the available supply.

Adapting Railway Curves to Mines

By Frederick Mac Coy*

United States standard railway curves are calculated on a basis of 100-ft. chords, and therefore are not suitable for use in mine work where the radius of curve usually lies between 20 ft. and 200 ft. The usual method of laying out a curve of short radius is to assume an arbitrary radius of an exact number of feet (usually some multiple of five) and then calculate deflections for various chords by the following formula:

$$\frac{\frac{1}{2}\text{ chord}}{\text{radius}} = \text{sin. } \tfrac{1}{2}\text{ deflection angle.}$$

For a curve the radius and chords of which are in exact feet, the deflection angle is usually expressed in fractional minutes, which it is not convenient to lay off with the transit. Also, sub-chords require separate calculations. To obviate this difficulty, it is better to assume a curve of an approximate radius, with deflection angles for a standard chord in even degrees and minutes; and a table of standard railway curves such as are found in Searles, Trautwine, or Nagle, and also in some field notebooks, is used as follows:

The degree of curve is the angle at the center subtended by the unit chord. Hence, for two curves of the same central angle, one laid out with 100-ft. chords subtending any angle (say 6°) and the other laid out with 10-ft. chords subtending the same angle at center, all lineal measurements will be in the ratio 10: 1. For comparison:

Chord	Degree of Curve	Radius	Middle Ordinate	Tangential Offset
100 ft.	6	955.37 ft.	1.31 ft.	5.234 ft.
10 ft.	6	95.54 ft.	.13 ft.	.52 ft.
20 ft.	6	191.07 ft.	.26 ft.	1.05 ft.
20 m.	6	191.07 m.	.26 m.	1.05 m.

A 20-ft. chord makes a convenient length for mine work, and the accompanying table was calculated with such work in mind. Should any other length be thought more suitable, it is possible to adjust standard railway curve tables to fit the case in the following manner: For example, consider a central angle of 5° per chord of 16 ft. (such as might occur when three drift sets would make up that distance). According to standard tables a 5° curve has a radius of 1146.3 ft., which may be regarded as a radius of 11.463 stations. In like manner the middle ordinate and tangential offset will be 0.01091 to 0.04362 stations, respectively. Then by multiplying by the length of station there is ascertained, in feet, the radius, middle ordinate, tangential offset, and other measurements.

A similar adaptation of tables of switch curves may be made to fit any gage of track by use of the following: For the same gage, radii of turnout are to each other as the square of number of frog; for the same frog with different gages, radii and frog distances are to each other as the width of gage. For a standard unit, a No. 1 frog requires a turnout radius of 2 ft., on a 1-ft. gage. Hence a No. 1 frog on a 3-ft. gage requires a turnout radius of 6 ft.; No. 6 on 1-ft. gage, turnout radius of 72 ft.; No. 6 on 3-ft. gage, turnout radius of 216 ft., and a No. 6 frog on a 1-m. gage requires a turnout radius of 72 meters.

STANDARD CURVES FOR MINES

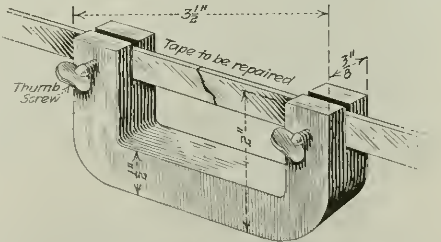
(For Chords of 20 Feet)

Degree of Curve	Nominal Radius	Actual Radius	Log. Radius	Defl. in Minutes Per Foot
58° 00′	20 ft.	19.97 ft.	1.300370	87
46 00	25	25.08	399315	69
38 24	30	29.98	476855	57.60
32 52	35	34.99	543887	49.30
28 44	40	39.99	601905	43.10
25 32	45	44.97	652944	38.30
22 56	50	50.05	1.699410	34 40
19 08	60	59.96	777867	28.70
16 22	70	70.07	845562	24.55
15 18	75	74.95	874784	22.95
14 20	80	80.00	903089	21.50
12 44	90	90.04	954434	19.10
11 28	100	100.10	2.000440	17.20
10 26	110	109.98	041330	15.65
9 34	120	119.92	078897	14.35
9 10	125	125.14	097404	13.75
8 50	130	129.85	113458	13.25
8 12	140	139.87	145709	12.30
7 38	150	150.23	2.176760	11.45
7 10	160	160.00	204119	10 75
6 44	170	170.28	231172	10.10
6 32	175	175.49	244253	9.80
6 22	180	180.08	255464	9.55
6 02	190	190.02	278796	9.05
5 44	200	199.95	2.300927	8.60
5 28	210	209.70	321595	8.20
5 12	220	220.44	343298	7.80
5 06	225	224.76	351726	7.65
5 00	230	229.26	360320	7.50
4 46	240	240.47	381063	7.15
4 36	250	249.18	2.396511	6.90
4 24	260	260.50	415807	6.60
4 14	270	270.75	432569	6.35
4 06	280	279.55	446461	6.15
3 56	290	291.39	464477	5.90
3 48	300	301.61	479449	5.70

Note: Curves of less than 100-ft. radius should be laid out by half chords.

Repairing Frame for Steel Tapes

Breaks in steel tapes are unfortunate but inevitable, and it is therefore important that a surveyor be able to repair tapes accurately. The accompanying illustration shows a contrivance which may be used to hold the two ends of a broken tape while a sleeve is being soldered on the break. The device is rectangular in shape, and is made of ⅜ x ½-in. iron. Longitudinally across each end a hack-saw cut is made ½ in. deep, and near each end a $\frac{3}{16}$-in. hole is drilled one-half way through the frame, and tapped to receive a thumbscrew. The two ends of the broken tape are passed through the saw cuts in the ends of the frame, the ends being brought exactly together, and then the thumbscrews are set down tight. The surveyor can then proceed to clamp and solder on a sleeve. The frame illustrated was made by E. B. Mills, surveyor for the Mason Valley Mines Co., Mason, Nevada.



REPAIRING FRAME FOR STEEL TAPES

---

*Mining engineer, Jerome, Arizona.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Peace Conference Gets Mineral Data

Extensive and carefully checked data on foreign mineral resources, compiled by the U. S. Geological Survey, are being taken to the Peace Conference by Dr. J. B. Umpleby, the geologist in charge of the section of foreign mineral deposits of the Survey. The data are being sent at the request of the American delegation to the conference.

The part played by minerals in the war, and the fact that many important mining districts and regions of mining potentialities lie in areas to be affected by the peace treaty, have made it important to have all available data on these subjects directly before the conference. The problem has been complicated further by the exceptional hold that Germany had upon the mining industries of other countries.

Prior to the war, no important effort had been made by the United States Government to keep closely abreast with the mining industry in other countries, especially those whose products were not shipped extensively to the United States. In 1917, however, the entry of this country into the war made necessary the immediate collection of available data on foreign mineral deposits. This was undertaken by the Geological Survey. With the coöperation of American mining and exploration companies which previously had been interested in foreign mineral deposits, it has been possible to amass a large amount of information.

The results of the investigation have been shown graphically on specially prepared indexed maps, so that it is possible to grasp at a glance the outstanding facts as to the mineral resources of various countries. The maps are supported by digests and references to original sources of information. The atlas on reserves in Europe contains 96 pages and the one on Latin America 57 pages. Africa, Oceania, Siberia, and Asia Minor are covered by preliminary sheets.

One set of this extensive exhibit is retained in Washington and is available for personal study by American engineers and geologists. A comparatively small portion of the information is not to be available to the public, as it would disclose material collected by private enterprise, which was furnished with the understanding that it would be held confidential.

Metal Situation Reviewed

In the course of its monthly review of its minerals investigation, the U. S. Bureau of Mines expresses the opinion that lead production now has been curtailed to approximately the demand to be expected during the coming year. The iron and steel situation is regarded as promising, with every indication pointing to greatly increased foreign as well as domestic sales. The quantity of tin in the hands of consumers, at the beginning of February, is estimated at 20,000 tons, with consumption rated at 2500 tons per month. The prediction is, however, for a material increase in consumption during the next few months. Advices received by the Bureau as to prospecting in the Irish Creek mines of Virginia are that the disclosures thus far are disappointing.

The average curtailment in domestic copper production is figured at 26%, based on returns from 10 representative mines. October, 1918, and January, 1919, are the months used in making the deduction. Uncertainty as to the stocks of tungsten concentrates on hand is held to show the desirability of having accurate information available, such as could be furnished if reports of stocks were made to the Government. These reports would be confidential, with the exception that certain general deductions would be made public for the benefit of all interested.

Ferroalloy Questionnaire Sent Out

In an effort to eliminate the uncertainty surrounding the situation in the minor ferroalloys, the U. S. Bureau of Mines is sending out a questionnaire to manufacturers, consumers, and dealers asking that they make returns on their stocks. It is believed to be to the advantage of all concerned to have a timely and accurate estimate of the quantities on hand of each of the nine materials covered. They are chromium, cobalt, molybdenum, nickel, tungsten, titanium, uranium, vanadium, and zirconium. If the industry will cooperate to a sufficient extent to afford reliable deductions, the Bureau promises to furnish, before the end of each month, such compilations and totals as do not violate the confidential nature of the individual reports.

Investigating War-Mineral Claims

With the appointment of Philip N. Moore, of St. Louis, as the third member of the War-Minerals Relief Commission, that organization is now prepared to consider the claims of those whose losses come within the range of the recently enacted law. In an effort to secure all the facts pertaining to each claim, a 10-page questionnaire has been drawn up. Each claimant is required to fill out and swear to the questionnaire. The 34 questions asked are designed to bring out the full history of the enterprise on which the claim is based. A perusal of the questionnaire is expected to be sufficient to indicate to many considering the making of claims that their cases do not come within the provisions of the act. An itemized account of all expenditures, receipts, and assets must be returned with the questionnaire.

The war-time regulations requiring licenses for the purchase, possession, and use of explosives for reclaiming land, stump blasting, ditching, and other agricultural purposes were revoked on Mar. 15 by the Interior Department. The only qualification is that this revocation does not allow enemy aliens or subjects of a country allied with an enemy of the United States to manufacture, purchase, or sell, use, or possess explosives.

Monthly Copper Production for 1919

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE-COPPER PRODUCTION, 1919

	January	February
Alaska shipments	5,618,504	5,176,033
Arizona:		
Arizona Copper	3,600,000	3,360,000
Calumet & Arizona	4,786,000	6,612,000
Cons. Ariz. Smelting	1,070,000	1,000,000
Inspiration	6,500,000	6,600,000
Magma	900,000	
Miami	5,273,260	4,462,578
New Cornelia (*a*)	2,848,000	2,014,000
Old Dominion	2,812,000	2,360,000
Phelps Dodge	9,425,733	7,410,000
Ray	4,470,000	4,150,000
Shattuck Arizona	627,226	376,166
United Verde	5,350,000	2,850,000
United Verde Extension	4,040,338	1,239,120
California:		
Mammoth	1,670,000	1,506,000
Michigan:		
Calumet & Hecla	11,758,500	9,263,868
Other Lake Superior (*b*)	6,500,000	
Montana:		
Anaconda	15,900,000	12,400,000
East Butte	2,291,950	633,560
Nevada:		
Mason Valley	1,111,000	
Nevada Cons	4,400,000	4,150,000
New Mexico:		
Chino	4,241,000	3,552,676
Utah:		
Utah Copper	10,500,000	10,335,000
Eastern smelters (*b*)	1,400,000	..
Total reported	117,093,511	
Others, estimated	18,640,000	
Total United States	135,733,511	
Imports: Ore and concentrates, etc	9,926,390	
Imports in blister, etc	5,065,683	
Grand total	150,725,584	
British Columbia:		
Granby Cons	3,156,486	
Mexico:		
Boleo	1,654,240	
Cananea	3,000,000	3,000,000
Phelps Dodge, Mexican properties	2,453,000	1,775,000
Other foreign:		
Cerro de Pasco	5,836,000	4,586,000
Chile	6,800,000	5,376,000
Katanga	3,306,900	
Backus & Johnston	1,897,642	

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery. (*b*) Estimated

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce, and includes Kennecott production from its Alaskan mines.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco, and Chile. As a matter of record, however, the individual figures are given after the total. We also report the copper output of the Boleo and Katanga companies, which does not come to the United States.

Recent Events in the Mexican Situation

A brief summary, taken from press accounts, of the important events that have developed during the month and some of which represent activities on the part of the Mexican government through its agents and on the part of American interests that are coöperating to make clear the status of the Mexican situation, as well as to stimulate action toward the settlement of the present difficulties, is given in the following:

Feb. 13—In an interview President Carranza said that the people of Mexico are cordial to the people of the United States, but that the policy of foreign interests had created a sentiment of distrust; that Mexico would, in all probability, soon begin paying, in part, the interest upon her foreign indebtedness; that Mexico's revenues are now on such a scale that the necessarily big budget is soon to be met, and the prospects are for a surplus; that he was going to devote the remainder of his administration to the conversion of Mexico's foreign financial obligations; that the occasional outbreaks of lawlessness are due to the pernicious activity of interests seeking intervention; that outside interference in Mexico's political affairs would be resented.

At a meeting of the Council of Foreign Relations, of New York, composed of business men and citizens, the opinion was expressed that the time has come when the United States must intervene in Mexico, either by financial aid, with the practical control that such a course implies, or, if Mexico refuses that, then by overwhelming force of arms.

Feb. 18—The view was expressed that New York bankers are now more open to proposals to aid Mexico financially than at any time since the Carranza government came into being.

Feb. 19—Employees of the American Smelting and Refining Co. and other large American concerns operating in Chihuahua have been ordered to prepare to leave for the United States, owing to persistent rumors of bandit raids and rebel threats to destroy property.

Feb. 25—Rafael Nieto, Sub-secretary of the Republic of Mexico and acting Secretary of Finance, expressed in behalf of President Carranza a desire to coöperate fully with a group of American, British, and French bankers just formed, with J. P. Morgan as chairman, to protect foreign investments in Mexico. He declared that Mexico will soon be able to reëstablish its financial credit on a firm basis, and expressed the belief that the bankers' committee, in conference with representatives of the Mexican government, can arrive at a plan of coöperation in regard to their investments and interests which will result to the mutual advantage of Mexico and investors in Mexican securities.

Mar. 2—Dr. William R. Shepard, of Columbia University, who is a member of the Mexican Committee of the Council on Foreign Relations, declared that there is need of a commission to visit Mexico and investigate conditions in the republic.

Tampico oil men submit to the State Department a chronological list of bandit outrages in the Tampico oil field beginning with Aug. 15, 1917. In all, 115 raids, attacks, hold-ups, and battles are listed in the record, which includes depredations perpetrated upon the properties and employees of 14 different oil companies.

Mar. 4—The Mexican government went on record as favoring payment of all just damages resulting from the revolution, liquidation of all foreign debts, and amendments of the confiscatory oil law.

Mar. 6—Prominent Mexican mining men have started a movement for the calling of a general mining congress in Mexico City in the near future to consider all questions dealing with the mining industry. A committee has been appointed consisting of the leading mining men of San Luis Potosi, Nuevo Leon, Coahuila, and Durango. The chief trouble is the securing of necessary explosives. An official statement of the Department of Industry, Commerce and Labor says that every aid will be given to the smelting industry.

Mar. 9—Rafael Nieto made further announcement of his belief that the conferences with the new International Bankers' Committee on Mexico would serve to lay the basis for an adjustment of Mexico's financial affairs. He further announced that the Mexican government has requested Henry Bruere to serve as financial counsel in conducting the negotiations, in association with Lindley M. Garrison. All information on Mexican financial and economic conditions will be placed at the disposal of the committee.

Mar. 10—Mexico reëstablishes relations with Cuba by appointing Gen. Heriberto Jara, Mexican minister to Cuba.

A Washington dispatch states that nothing can be done at present to alter the confiscatory oil decrees.

Mar. 11—Carranza declines to send representatives to a New York conference called by the Council of Foreign Relations to discuss affairs of mutual interest to both Mexico and the United States.

The Council of Foreign Relations initiates a series of meetings by prominent Americans with a view to making known the facts about Mexico.

Mar. 12—Although President Carranza had agreed with the United States authorities to take no further action affecting foreign oil interests in Mexico until the Mexican Congress could act on the new oil law introduced some weeks ago, a decree has been issued at Mexico City directing that "royalty taxes" on oil produced in January and February be paid immediately.

At the monthly dinner of the Council of Foreign Relations, opponents of the Carranzista government maintained that armed intervention on the part of the United States in Mexico would be futile and disastrous.

England and France oppose the immediate admission of Mexico into the League of Nations, because of Mexico's failure to meet certain foreign obligations and maintain order.

Mar. 13—According to advices from Mexico City, the Carranzista government has ordered the purchase in the United States of 200 passenger cars for the National Railways of Mexico.

Between 1,000,000 and 2,000,000 rounds of ammunition were shipped into Mexico in the last two months.

Mar. 14—A formal request has been made by the Mexican authorities for a permit from the State Department for 2000 American-made rifles. It is stated that the rifles are to be used to guard American and other foreign-owned mines and mills in Mexico.

An extra session of the Mexican Congress has been called by Presidential decree for May 1. The petroleum legislation is to be reviewed.

Mar. 17—The State of Morelos is said to have been rid of Zapatistas; railroad traffic has been resumed.

Mar. 18—Washington dispatches are to the effect that the State Department has sent a communication to President Carranza, demanding protection for certain American missionaries.

Dr. A. R. Ledoux

Our attention has been drawn to an error which we hasten to correct, and which occurred in the issue of Mar. 15, wherein it was stated that Dr. Albert R. Ledoux retired in 1885. On the contrary, he is today the president of Ledoux & Co., a post which he has held since the inception of the corporation. After the partnership with the late Dr. P. de P. Ricketts was dissolved, Dr. Ledoux continued to carry out professional work in the same office, the name of the firm being changed from Ledoux & Ricketts to A. R. Ledoux & Co. A further correction that we take this opportunity to make is that Augustus D. Ledoux is not connected with A. R. Ledoux & Co. in any professional capacity.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for January, 1919, and the figures for January, 1918, as finally revised, are as follows:

IMPORTS, JANUARY, 1918 AND 1919

(In pounds, unless otherwise stated)

Metal and Ore	Jan., 1918	Jan., 1919
Antimony ore, contents	267,932	205,474
Antimony matte, regulus or metal	918,429	2,402,000
Copper:		
Ore, contents	6,421,103	2,919,767
Concentrates, contents	2,787,500	2,505,000
Matte, regulus, etc., contents	79,550	4,501,623
Imported from (in part):		
Canada	1,736,979	1,834,314
Mexico	3,163,371	6,510,910
Cuba	950,384	1,580,320
Chile	3,133,249	..
Peru	27,584	846
Venezuela	197,036	
Unrefined, black, blister, etc	34,513,165	5,065,683
Refined, in bars, plates, etc.	...	4,019,469
Old, etc., for remanufacture	161,704	1,676,525
Composition metal, copper chief value	28,010	3,141
Lead:		
Ore, contents	2,194,898	753,435
Bullion, contents	15,576,688	9,678,891
Imported from (in part):		
Canada	852,545	113,618
Mexico	16,913,955	10,318,708
Pigs, bars and old	5,215,476	......
Pyrites, long tons	43,155	6,422
Imported from:		
Spain, long tons	40,596	4,662
Canada, long tons	2,559	1,760
Tin ore, long tons	130	2,741
Tin bars, blocks, pigs, etc	12,572,727	8,461,444
Imported from (in part):		
Straits Settlements	3,976,381	7,341,240
Dutch East Indies	3,675,224	....
United Kingdom	3,140,709	168,108
Australia	978,478	880,416
Hong Kong	280,597	..
Zinc:		
Ore, contents	4,712,100	1,929,071
Imported from:		
Canada	1,038,666	894,752
Mexico	3,673,434	1,034,319
Blocks or pigs, and old	32,654	
Manganese ore, long tons	42,947	47,504
Imported from (in part):		
Cuba, long tons	3,081	14,051
Brazil, long tons	35,800	32,352
Br. India, long tons	3,000	
Tungsten ore, long tons	745	873

EXPORTS OF COPPER, LEAD, AND ZINC

(In pounds)

	Jan., 1918	Jan., 1919
Copper:		
Ore, contents	312,822	318,946
Concentrates, contents	48,000	....
Unrefined, black, blister, etc	4,434,271	
Refined, in ingots, bars, etc	81,098,209	72,757,340
Exported to (in part)		
France	46,696 676	10,264,342
Italy	11,302,669	33,793,557
United Kingdom	20,537,541	18,401,808
Canada	1,317,603	1,072,465
Composition metal, copper chief value	3,303	8,882
Old and scrap	5,790	25,040
Pipes and tubes	574,188	356,340
Plates and sheets	4,808,921	3,130,974
Wire, except insulated	478,278	3,289,411
Lead:		
Pigs, bars, etc., produced from domestic ore	9,012,126	4,658,427
Pigs, bars, etc., produced from foreign ore	6,210,713	12,875,887
Exported to (in part):		
Denmark		1,320,671
Canada	1,224,606	518,278
United Kingdom	11,220,945	12,873,376
Argentina	528,120	562,000
Japan		336,000
France	1,141,754	
Brazil	457,816	696,604
Zinc:		
Dross	2,027,136	4,084,155
Spelter:		
Produced from domestic ore	19,098,929	10,680,934
Produced from foreign ore	8,331,747	4,073,515
Exported to (in part)		
France	11,479,058	3,427,980
Italy	835,081	1,459,653
United Kingdom	13,365,163	7,585,622
Canada	1,503,070	726,435
Mexico	162,400	....
Japan		664,015
In sheets, strips, etc	1,771,755	3,408,051

Ferromanganese contracted for prior to Apr. 6, 1918, may now be imported from all countries, the War Trade Board has announced.

Welcoming the 27th Engineers

As we go to press, the 27th Engineers is almost home. The latest word is that the S. S. "Dakotan," on which the mining regiment sailed, will arrive in New York Harbor about midnight on Mar. 19. Representatives of the *Journal* will go down the harbor on the boat of the Mayor's Committee of Welcome to take a word of greeting to the returning men. All rejoice at their safe home-coming and vie in congratulating them for what they have accomplished.

The men of the regiment will soon be absorbed into the industry which they left at the call to the colors. They will find no difficulty in recovering their old employments, it is anticipated, for it is certain that all will join to help them in this respect.

Incidentally, the Comfort Fund has reached its goal of $20,000.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including interest	$19,745.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
W. L. Strauss	10.00
Employees Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5.00
Carl J. Trauerman (second contribution)	5.00
Carl Tombo	6.00
Charles Le Vasseur (monthly)	5.00
February interest	16.44
D. W. Hall	10.00
Editorial staff	3.10
Total	$20,000.00

Engineers Wanted by Bureau of Mines

Congress has passed a War-Mineral Relief Bill providing for adjustment of war claims, made by producers of manganese, chrome, pyrites, and tungsten, at the discretion and judgment of the Secretary of the Interior. It will doubtless be necessary to do much mine-examination work in investigating these claims. Therefore the Bureau would like to receive at once applications from mining engineers who have the requisite standing, judgment, and experience. Salaries will range from $300 to $400 a month, and it is probable that the work will occupy a number of months. The Bureau would also like to receive applications from assistant engineers to assist in these examinations at salaries ranging from $150 to $250 a month, depending upon the individual. The applications of men who have had experience in manganese, chromite, pyrites, and tungsten are especially desired.

Italian Iron Ore

The needs of the metallurgical industry in Italy cannot be indefinitely satisfied by the limited local supplies of iron, therefore recourse must be had to foreign sources for the necessary raw and semi-manufactured materials, according to *Commerce Reports*, which quotes the Italian Metallurgical Association.

Prior to the war the iron mined in Italy came principally from the island of Elba, and from there was taken to the blast furnaces at Portoferraio, Piombino, and Bagnoli. Thus, for example, in 1914, of the total iron ore produced in the kingdom, amounting to 706,246 tons, Elba yielded at least 649,561 tons. The mines of Valdaspra, in the Province of Grosseto (central Italy), yielded 36,000 tons, and the remainder was derived from the mines of Iglesiente (Sardinia) and Bergamasco (Province of Bergamo). Between 1909 and 1914, approximately 2,500,000 tons of ore was mined in Elba, and the production during the war has considerably increased.

The war has stimulated research for other ore deposits in Italy. Although in 1909 there was known to be high-grade iron ore in the Val di Cogne (near the French frontier), estimated at 6,000,000 tons, its exploitation was only recently begun by the well-known Ansaldo firm, which has installed electric blast furnaces modeled after Swedish types. Moreover, in the Nurra district of Sardinia the surveys made during the war have revealed the existence of about 6,000,000 tons.

The following figures give the present estimated deposits of iron ore in Italy: Traverselle, 1,000,000 tons; Cogne, 5,000,000; Central Italy, 2,000,000; Sardinia, 6,000,000, and Val Brembana, 20,000 tons; total, 14,020,000 tons.

Crude Petroleum Movement in January

A comparative summary of the crude petroleum movement in the United States in January, 1919, issued by the U. S. Geological Survey and based upon the reports of about 200 pipe-line, marketing and refining companies, shows an increase in marketed production of 1,798,000 bbl., or 6%, compared with December, 1918, and of 2,625,000, or about 9%, compared with January, 1918. The following table includes 98% of the total quantity of petroleum brought to the surface, the remaining 2% being oil produced and run directly to the field storage tanks of producers.

MARKETED PRODUCTION OF CRUDE PETROLEUM IN JANUARY, 1918 AND 1919

(Barrels of 42 Gal. Each)

Field	January, 1919	Daily Average	January, 1918	Daily Average
Appalachian	2,420,000	78,065	1,731,000	55,839
Lima-Indiana	271,000	8,742	168,000	5,419
Illinois	1,094,000	35,290	1,004,000	32,387
Mid-Continent	15,027,000	484,742	13,402,000	432,323
Gulf Coast	1,630,000	52,581	1,652,000	53,290
Rocky Mountain	1,085,000	35,000	843,000	27,194
California	8,342,000	269,097	8,444,000	272,387
Totals	29,869,000	963,517	27,244,000	878,839

It is estimated that 28,622,000 bbl. of domestic crude petroleum was delivered in January, 1919, to refineries and other consumers, a decrease of 2,432,000 bbl., or about 8%, compared with December, 1918, and greater by 1,849,000 bbl., or 7%, compared with January, 1918. The following table includes 99% of the total quantity consumed.

CONSUMPTION OF CRUDE PETROLEUM IN JANUARY, 1918 AND 1919

(Barrels of 42 Gal. Each)

Class of Oil	January, 1919	Daily Average	January, 1918	Daily Average
Appalachian	2,347,000	75,710	1,914,000	61,742
Lima-Indiana	246,000	7,935	155,000	5,000
Illinois	790,000	25,484	1,300,000	41,935
Mid-Continent	14,822,000	478,129	12,297,000	396,677
Gulf Coast	1,340,000	43,226	1,111,000	35,839
Rocky Mountain	992,000	32,000	842,000	27,161
California	8,085,000	260,806	9,154,000	295,290
Totals	28,622,000	923,290	26,773,000	863,644

The American Zinc Institute, in its campaign to increase the uses of zinc, is advocating spelter for rail-bonding purposes. One of the largest street railway companies recently made a considerable purchase of spelter for use in the manufacture of Nichols joints. Engineers in charge of bonding operations report that, in consideration of its price and adaptability, spelter is unexcelled for such work.

Editorials

Walter Renton Ingalls, who has been editor of the *Engineering and Mining Journal* for nearly 14 years, has retired from that position and will reënter professional practice as consulting engineer. Under Mr. Ingalls the *Journal* has grown to proportions exceeding anything in its previous history. Although Mr. Ingalls will open an office of his own, we are glad to say that he will not sever his connection with the *Journal*, but will continue to act as consulting editor and will remain in full charge of recording the weekly metal markets and making the quotations, as heretofore. H. C. Parmelee becomes acting editor of the *Journal*, without relinquishing the editorship of *Chemical and Metallurgical Engineering*.

Keep Up Development

"IN TIME of peace prepare for war" was the advice given to the American people by their first President, and that advice is as sound today as when it was given. Not only literally to the business of war, but to industry in general and to the mining industry in particular, does this admonition apply. Using more appropriate terms, it might be said: When the metal business is slack, prepare for the time when it will be active. Easier said than done? Quite true, but, nevertheless, the proper plan to follow if at all possible.

In the days immediately preceding our entry into the war, and, later, when miners were straining every force to make a maximum production, development work was allowed to lag, and tonnage was not developed as rapidly as ore was mined. An examination of mining-company reports for 1918 shows a notable decrease in ore reserves, compared with the year 1917, which, in many instances, showed less ore developed than in 1916. This was not due to carelessness or lack of forethought, but to the necessities of the times. Supplies were costing from 50 to 200% above normal, and labor was being paid from 50 to 100% more than it had been paid only a short time previously. If the customary amount of prospecting and development had been done, the additional consumption of supplies and labor would have caused these percentages to be still higher.

The great demand for metals and the high cost of exploration and development compelled operators to curtail the latter. With the fall in the price of metals, a new condition has confronted the mining industry, and already many of the stronger operators have cut down their output, without discharging miners, by placing a large number of their men on development work. It has been easy for some companies to do this, as in such cases profits had not all been distributed when they were received, but were assigned to the reserve for the emergency which was sure to follow the cessation of the war. Other companies have borrowed funds for development work, giving as the security the metal already refined and now in storage.

Every pound of the base metals taken from the ground today and passed through the refinery adds to the congestion of a metal market already overstocked; every pound of new metal is a further menace to the restoration of normal buying and consumption, which still waits for the bottom prices. The labor which operators are doing their best to keep from idleness, the labor which is engaged in this production, is daily adding to the strength of that force which will compel still lower wages or cessation of production.

With an empty treasury from which to meet the payroll, it is not an easy task for the mine manager to cease mining ore and put his men upon development work, even though he recognizes the advisability of doing so. The payroll must come from some source, either from the sale of metal at a reduced price or from such loans as may be obtained upon the stored metal.

It is not to the mine manager but rather to his financial backer that the appeal for mine development should be most strongly made. The former realizes the necessity; the latter may not be so fully alive to it. From the banker's point of view, refined metal is very good security for advances; it is something that may quickly be converted into liquid funds, if an emergency arises; and many a banker would feel justified in loaning on metal who would not think of making advances for development purposes. The banker's point of view will not be easily changed, and yet it may be pointed out that he is not taking an extraordinary risk in furnishing money for development, and that he is not supporting the industry as it should be supported at this time when loaning only on refined metal. By confining his loans to metal at this time he is increasing the supply and lowering the value of each pound of his security.

Take, for example, the case of copper. It is not certain when an improvement in the copper market will take place or for what figure the metal will sell, but it is a safe prediction that some day there will be a tremendous demand for copper. It may be that metal now in the ground is a more valuable security for loans than that which has already passed through the refinery and is now ready for shipment.

It is a far cry from undeveloped ore to refined metal, and no such advances can be made on the former as upon the latter, but, on the other hand, the development of a pound of copper in a substantial operating property costs but a small fraction of the total required to place it on the market. When it costs 10c. to produce a pound of copper, that amount of money will develop and prepare for mining many pounds of the metal. The value of the security developed is many times that of the investment. The ratio is far greater than that which exists between the value of the refined metal and the amount which may safely be loaned upon it.

What has been said of copper is equally true of other metals. If a mine really possesses undeveloped resources, it is today good business for the mine operator and his financial backer to push development; it is better business for both than the storing up of further supplies of the refined metal for which there is no visible market.

The Mexican Situation

THE Mexican situation is softening. It is like the faint beginnings of a thaw after a long, hard winter. Whether there will be additional storms or another freeze-up, remains to be seen. We hope that recent events are substantial indications of a rational and speedy settlement of a problem that has vexed a considerable portion not only of our own population but also of Great Britain and France. There have been large personal and financial losses; there have been robbery, violence and murder; there has been apparent indifference on the part of the authorities at Washington to the just claims of American citizens who have suffered at the hands of the conflicting parties in Mexico.

The situation is and has been involved. The Great War has undoubtedly contributed in a large measure to prevent a settlement of difficulties. The facts, or at least a sufficient number on which to form an adequate conception of the internal situation, have not been obtainable. We are, however, justified in our conclusion that affairs have been in a chaotic state and are probably so to a considerable degree at present.

We are glad to publish two articles in another place, one of which is an engineer's account that tells of the conditions that make mining in Mexico an especially hazardous proceeding, the other affording an insight into the Mexican's point of view. The latter is especially interesting, as it shows that the sentiment of distrust that prevails may be in part due to racial misunderstanding and in a measure to unscrupulous exploitation that has unfortunately occurred to some extent at least. How much of the distrust represents the by-product of enemy activities, is a question that naturally arises. It does not take much stretch of the imagination to reach the conclusion that the susceptible nature of the Mexican must have been greatly influenced by the malignant activities of the German agent. That the misunderstanding is probably due in a large measure to this cause is a reasonably safe conclusion.

Economic pressure is slowly but surely forcing the Mexican government authorities to make a substantial move to restore order. In this issue we publish a summary of recent events that show how the Mexican government is seeking to reëstablish itself in the good graces of other governments. This is, however, only an initial step. Mexico must restore order and must assume the heavy obligations that are the result of years of turmoil. She must reimburse, as far as it is practicable to do so, the miners, mining companies, and other foreign interests that have suffered spoliation. Justice is the supreme quality that measures the fitness of a nation. Not until justice has been established will the Mexican government regain the confidence of other nations. It is plainly incumbent upon the Mexican authorities to adopt a course leading to this desirable objective.

The Application of Mine Shoveling

IN THIS ISSUE we present the last installment of an abstract from the paper of G. Townsend Harley, "A Study of Shoveling Applied to Mining," which was read at the February meeting of the A. I. M. M. E. The various considerations that are emphasized show the value of careful thought and planning, and the demonstration of what can be done in increasing the mine output by such means is indicative of other lines of application wherein operations may be standardized.

Experimental work in mine shoveling represents the initiation of a standard in this field. The methods followed in attaining the results are similar to those used in other industrial pursuits, and the conformity that exists in the shoveling conditions encountered in mines would suggest this work of the Phelps Dodge Corporation as being one of great interest to the industry as a whole.

Industry's intellect is constantly at work striving to attain perfection in machinery. The development of power devices is creative and expansive. In view of the fact that mechanical considerations are of such importance, is it not pertinent that some thought be given to the development of the human machine? Immediately the cry of "labor's exploitation" is raised, and perhaps not without some justification. But does the fact that certain abuses arise from the adoption of a so-called "efficiency" system condemn the entire practice? We would venture to suggest that the difficulty comes from an unbalanced consideration of all the principles involved, and that, with the proper understanding existing between the operator and his labor, and an equitable adjustment of wage, based on actual performance, the practice of time-saving and labor-saving systems can be of infinite benefit to employer and to labor alike.

The Mine Physician

THE work of the mine physician is no longer that of the family physician, or, rather, it is the work of the family physician plus that of the surgeon, the director of the board of health, and numerous other officers. He is a handy man and a specialist.

The aim at a 100% healthfulness in the working force is not only desirable from a sociological viewpoint but it is also one of economic importance, and of such importance that nearly all industries are interested in securing capable men for administering this department of their works. The Division of Labor Administration, U. S. Department of Labor, has had many calls for men especially trained in the work, and in consequence has established a register of industrial physicians, with the object of placing mining and industrial companies in contact with those especially fitted for the service. The Division of Industrial Hygiene will be glad to coöperate with mining companies in assisting them to organize and equip their medical departments.

German Iron Production

THE first real index of industrial conditions in Germany during the war is afforded by the statistics of iron and steel production that have recently been disclosed and reach us through the British papers. In 1914 the monthly production of pig iron was about 1,550,000 metric tons up to August. In July it was 1,564,345 tons. In August it fell abruptly to 586,661 tons, and was the lowest, with 580,087 tons, in September. With October began a rise that continued steadily until July, 1915, when 1,047,503 tons was recorded. From then until October, 1918, there was a fairly constant production of 1,000,000 to 1,100,000 tons per month, except during December—February, 1917-18, when it fell as low as 893,000 tons.

The statistics cease with October, 1918, when 1,050,000 tons was produced. However, the decline during the last two months of 1918 is said to have been very heavy. Under the terms of the armistice 144 of the 469 German blast furnaces passed into the control of the Allies.

We make no attempt to draw any deductions from these figures. At first sight the most striking thing is the steadiness of the production from July, 1915, to October, 1918, but it was at only 60% of the pre-war rate.

The foreign papers give us some idea of the difficulties in resuscitating industry in France and Belgium. Many important works were crippled, but those that were unharmed find many impediments to the resumption and continuance of operations. Taking the cases of the iron and steel works, some that are operating are unable to ship their products, owing to railway difficuties, and consequently are piling up stocks. Other works are short of coal, lime, manganese ore, and other supplies and therefore find it difficult to produce. The French ports are congested with hardware and other material waiting to be moved inland. In Belgium the great Cockerill works at Seraing were so damaged that Léon Greiner, the managing director, estimates that it will take three years and $10,000,000 to repair the damage.

BY THE WAY

Mining speculation was rampant in England in 1824 and 1825, as a result of the opening of Mexico to British intercourse, according to Townsend's "Manual of Dates." It is within the possibilities that Mexico will be reopened in time for a centennial celebration.

"The North values highly its men of creative genius, that is to say, its optimists," writes J. A. McRae in the *Canadian Mining Journal*. "Had it not been for such men, there would perhaps have been no Cobalt, no Porcupine, no Kirkland Lake, and no Boston Creek. The prospector is an optimist. It should also be pointed out that there is another optimist—the man with money and with sufficient courage to apply it efficiently in the development of promising mining areas."

One of the speakers at the recent convention of the Canadian Mining Institute, in discussing the question of raising the professional status of mining engineers, related the following incident as illustrating the low estimation in which technical men were and to some extent still are held by the politicians: Many years ago, during the Premiership of the late Sir John Macdonald, when the estimates were being considered in committee, a member moved to strike out the very modest appropriation for the Geological Survey as being a useless waste of money. "Oh, let it stand—let it stand," said Sir John in a tone of good-natured tolerance. "There are quite a lot of damned fools who believe in that sort of thing."

The following story is told of a young doctor who was sent to one of the mining towns in Michigan in the early days when most of the miners were from Cornwall. One of the men was laid up with a sore throat, and sent his young son for the head doctor, who was unable to make the visit, and so sent his new assistant. "Well, my good man," said the assistant, when he reached the home of the Cornishman, "What can I do for you?" "Oh, m'son, ussel sore, cussen suffer t' clunket." "What's that?" said the doctor. So the patient repeated his complaint. The young physician was at his wits' end, and after several attempts to make out this jargon (as he thought), returned to the hospital and stated that the man was suffering from "something or other" and he thought that his superior should go to see him. So the old doctor set out, and, upon his arrival at the house, he discovered that Jan was suffering from a sore throat. "Say, Doctor," said Jan, "This 'ere feller w'ot thee sent up 'ere, 'e's naw bloody good, is un?" "Why, yes, Jan, of course. What's the matter with him?" replied the doctor. "Well, Doctor, can't say I lay much stock longside o' 'e. W'y, dam-me, 'e can't talk English language."

In the spring of the year 1837 a reporter for the *Detroit Spectator* observed a rough fellow, dressed in frayed linseywoolsey, cowhide boots, and slouch hat, sidling up to a well-dressed and prosperous-looking business man. "Hello, mister ——," he said. The other, somewhat astonished, replied, "I do not know you. What do you want of me?" "Well, hain't yo' got an 80-acre lot in Wisconsin, in —— County? Yo' hev, hey? Well, I kinder thought so. Perhaps yo'd like to sell that there land." The business man, who had bought the tract in question at Government price, replied that he was not particularly anxious to sell, but might consider an offer of $2000. "Tew thousand dollars! Gosh, mister, that's a lot of money. I bet yo'd be mighty glad to git about $1900. Wouldn't yo' take $1900?" As that price would represent a handsome profit on a tract of land the speculator had never seen, he admitted that if a spot cash buyer came along he would make a trade at that figure. Out came a grimy shot bag, and the roughneck began to count out the money in gold pieces as he remarked, "I'm yo' buyer, mister, and this here gent is a witness. Git yo' deed and make the transfer." When the business was concluded, the seller said, "You seem pleased with your bargain." "Yes, might as well be pleased." "Have you seen the lot?" "Well, guess I have." "Is it good?" "It'll do." "What is it worth?" The buyer shoved back his tattered slouch hat to scratch his head as he drawled, "Well, mister, can't say as I know exactly whut that piece of land is wuth. All I knows is that I've dug about $10,000 wuth of lead ore out on it a'ready, and can't say just whut it is wuth now."

Blue-sky legislation is without doubt needed to control the operations of those who located the claim mentioned in the following notice, which our correspondent avers is posted on a claim somewhere in Oregon:

We the undersigned men of worth,
Just to show that we're on the turf,
Do hereby locate for ourselves alone,
Fifteen hundred feet radius around this stone;
Together with mineral and water rights;
All placer lands and townsites,
All veins and ledges within our line
Of brass or gold and other mines.
We claim all coal and all oil as well
From the top of the sagebush down to hell;
All the air and sunshine too
Up to where the sky shines blue.
The name of the claim is Wilson and Green,
No. 400 and Group 16.

Personal

W. R. Ingalls has taken an office at 115 Broadway, New York.

Mark R. Lamb has opened an office in Paris at 21 rue Henri Martin.

Bennett R. Bates is now in Sinaloa, Mexico, on examination work.

Hennen Jennings is in California, where he expects to remain several months.

Kirby Thomas is making an examination of chrome properties at Black Lake, Quebec.

Victor Brandt has returned to California after a trip to Washington in the interests of potash producers.

D. C. Jackling was in Salt Lake City recently, and remained five days before returning to New York.

E. E. Barker has been transferred to Morococha as superintendent of the Cerro de Pasco Copper Corporation.

John Saam, formerly employed at the Seneca mine, has resigned to become salesman for the Delany Oil Company.

A. Scott Thompson, chairman of the committee of revenue legislation of the American Mining Congress, has returned to Miami, Oklahoma.

Pope Yeatman and his partner, **Edwin S. Berry**, have removed their engineering offices from 60 Broadway to Room 708, 111 Broadway, New York.

Herbert C. Enos has just completed a mine examination in the State of Zacatecas, and is now making examinations in the State of San Luis Potosi, Mexico.

Olaf P. Jenkins, geologist, Arizona Bureau of Mines, is preparing a classified bibliography on Arizona geology, which will probably be completed before next autumn.

D. H. McDougall has been appointed to the Canadian Engineering Standards Committee as one of the representatives of the Canadian Mining Institute, suceeding **F. H. Crockard**.

George E. Hawes has been appointed historian of the U. S. Fuel Administration. He has been a member of Dr. Garfield's personal staff, acting as assistant executive secretary.

J. C. Haas has been elected chairman of the Columbia section of the American Institute of Mining and Metallurgical Engineers. **L. K. Armstrong** was reëlected secretary-treasurer.

G. A. Joslin, managing engineer of the Aetna Mining and Investment Co., Felt Bldg., Salt Lake City, returned to that city on Mar. 15 after a business trip in New York lasting one month.

John H. Adams has opened offices in the American Trust Bldg., Birmingham, Ala., as consulting mining engineer. He was formerly general manager of the Birmingham Trussville Iron Company.

Edward C. Uren, civil and mining engineer of Nevada City, Calif., is at Bingham Canyon, Utah, in a professional capacity at the Utah-Apex mine, preparing data for use in litigation.

Seely B. Patterson, Jr., formerly assistant general manager of the Bethlehem Steel Co.'s Cuban interests, has been relieved from duty in the Engineering Corps and is now in Allentown, Penn.

Lewis D. McClaren, recently metallurgist and chief of steel production and inspection, Chicago district, in the U. S. Navy, is connected with the Chicago office of Rogers Brown & Co. as sales representative.

A. C. Bedford, chairman of the National Petroleum War-Service Committee, was formally invested with the title of Chevalier of the Legion of Honor, conferred upon him by the French government in recognition of his services during the war.

William Cardwell, of the Primos Mining and Milling Co., Lakewood Colo., announces that, owing to the cessation of tungsten mining in this district, he has removed to No. 727 Ninth St., Douglas, Arizona.

L. H. Hartman, chief of the surplus property division, which was created after the signing of the armistice, has severed his connection with the War Department and returned to his business interests in Chicago.

M. R. Hall, designing engineer for the Nevada Consolidated Copper Co., returned to McGill, Nev., on Mar. 1, after a business trip lasting four weeks, during which he inspected metallurgical plants in the southwestern states.

W. G. Flint, who was held a prisoner in Germany for four years, has been released and has returned to Canada. The Canadian Mining Institute endeavored to secure his release early in the war, on the grounds of physical disability, but was unsuccessful.

George C. Mackenzie, formerly chief of the division of ore dressing and metallurgy, Department of Mines, Canada, has resigned his position and assumed the general management of the Electric Steel and Engineering Limited, with headquarters at Welland, Ontario.

C. W. Whitney, formerly of the Yuba Manufacturing Co., has opened an office as exporter and manufacturers' agent in the Insurance Bldg., San Francisco, to represent the Bucyrus Co., of South Milwaukee, Wis., for foreign and domestic business in connection with gold dredges.

E. A. Holbrook, superintendent of the Urbana station, in Illinois, of the Bureau of Mines, has been called to Washington to act as chief mining engineer of the Bureau during the absence of **George S. Rice**, who is in Europe studying mine rehabilitation.

Mahlon M. Garland, formerly vice-president of the American Federation of Labor and president of the Amalgamated Association of Iron, Steel and Tin Workers, and at present the ranking Republican member of the Committee of Mines and Mining of the House of Representatives, has been selected as chairman of the committee.

Edward W. Berry, professor of paleontology, and **Joseph T. Singewald, Jr.**, professor of economic geology at Johns Hopkins University, will leave in April for South America, under the auspices of the George Huntington Williams Memorial Fund. They expect to spend about seven months investigating the mineral resources and geology of the Andes in Peru, Bolivia, and Chile.

Obituary

J. B. Jardine, pioneer machinery manufacturer of San Francisco, died of heart failure on Mar. 5 in San Francisco. He came to California 50 years ago from Scotland, and founded the original Atlas Iron Works, and later became president of the Jardine Machinery Co. He was 72 years old, and is survived by his widow and five children.

W. R. Burt, pioneer prospector and Mesabi range mine owner, died at Saginaw, Mich., on Mar. 2. He was one of the large timber operators of Northern Minnesota in the early days, and through his timber holdings became the owner of several valuable iron properties on the Mesabi, among them the Burt pit, in Hibbing, named after him.

William H. Steinman, superintendent of blast furnaces for several years at the plant of the New Jersey Zinc Co., at Palmerton, Penn., died recently. Prior to his connection with the New Jersey Zinc Co.. Mr. Steinman was general foreman for the Pennsylvania Steel Co. at Steelton, Penn., and superintendent of the plant of the Dominion Iron and Steel Co., Sydney, Nova Scotia.

Lawrence M. Lambe, of the Canadian Geological Survey, died at Ottawa, Ontario, on Mar. 12, in his 56th year. He received his appointment in 1885, and his work had since consisted mainly of contributions on new species of extinct vertebrates found as fossils in the cretaceous rocks of Alberta. His services to science were recognized by his election in 1901 as a fellow of the Royal Society of Canada. He is survived by his widow, son and three daughters.

Charles W. Aby, vice-president of the New Guadalupe Mining Co., died at San Jose, Calif., Feb. 19, of Bright's disease. He went to California in 1888 with "Lucky" Baldwin, having charge of the racing stables at Santa Anita ranch and later had charge of Lily Langtry's ranch in Lake County. About 17 years ago he became interested in the quicksilver mining industry in Santa Clara County, and he had been connected with the Guadalupe property since.

Phillip Maitland Macgregor, a well known mining man, died on Mar. 4 in Salt Lake City, following a stroke of paralysis. He was a former officer of the British Army, and later was graduated from the Colorado School of Mines, after which he became interested in mining and railroad activities in the West. Mr. Macgregor was recently in charge of the license and regulations division of the local food administration. He was 47 years old, and is survived by his widow and two daughters.

J. K. Batchelder, superintendent of refineries for the Consolidated Mining and Smelting Co., at Trail, B. C., died recently of influenza followed by pneumonia. He was born at Wilton, N. H., on Mar. 27, 1890, and was graduated from the Massachusetts Institute of Technology, Boston, in June, 1913, in electro-chemistry. He came to Trail in August, 1913, and was in the smeltery assay office from 1913 to 1915, in the zinc plant from 1915 to 1917, and was made superintendent of refineries in February, 1917.

Societies

American Welding Society will hold its first meeting on Mar. 28 at the Engineering Societies Bldg., 33 West 39th St., New York, at 10:30 a.m.

The Franklin Institute held a meeting on Feb. 19, when a paper was presented on "Oil Shales" by Dean E. Winchester, of the U. S. Geological Survey.

Engineers' Society of Western Pennsylvania held the regular monthly meeting on Mar. 18. A paper was presented by Maj. F. F. McIntosh on "The Manufacture of Steel for Ordnance Materials in England and France."

The Engineers' Club of Northern Minnesota held its annual banquet at the Oliver Club rooms, in Hibbing, on Feb. 22. Prof. Richard McCaffery, of the University of Wisconsin, delivered the principal address and emphasized the advantages to be obtained by closer coöperation between the graduate engineer and the university.

The Institute of Metals, London, England, will hold the annual general meeting on Mar. 25 and 26 in the Burlington House, Picadilly, W. I. Among a number of technical papers to be read are the following: "The Properties of Some Copper Alloys," by W. Rosenhain, and D. Hanson; "Metallurgical Information Required by Engineers," by Lieut.-Col. C. F. Jenkin; "Effect of Work on Metals and Alloys," by Owen W. Ellis, and "The Influence of Cold Rolling Upon the Mechanical Properties of Oxygen-Free Copper," by F. Johnson.

American Chemical Society will hold the spring meeting with the Western New York Section in Buffalo, Apr. 7 to 11, inclusive. Registration, beginning at 3 p.m. on Apr. 7, will take place at the Hotel Statler, where the information bureau will be situated. The general program includes papers on problems in reconstruction, the utilization of war-time products and secret information of chemical warfare. Excursions will be made to industrial plants in the vicinity, and a banquet will be held on the evening of Apr. 10.

Metallurgical Society of America held a meeting in the Fort Pitt Hotel, Pittsburgh, Penn., on Feb. 13, when the following officers were elected: D. L. Mathias, president; O. B. McMillen, first vice-president; C. I. Neidringhaus, second vice-president; W. Arthur Hall, secretary and treasurer; H. R. Connell and W. H. Seaman, directors. Plans were discussed and formulated whereby most of the coöperative research results in the metallurgical field during the war may be presented to the public, and thus preserve that which otherwise might have been lost.

The Tungsten Committee of the War Industries Board held a meeting in New York on Mar. 12 and adopted the following resolution: "That the chairman appoint a committee of three to present to James T. McCleary, secretary of the American Iron and Steel Institute, a resolution known as 'Resolution No. 1' in person and to explain to Mr. Cleary the personnel of the committee of nine, the method of election and our right to represent the industry, and that we also ask of the American Iron and Steel Institute that our committee of nine, known as the Tungsten Committee, receive consideration in the appointment of a chairman to represent the tungsten industry in presenting our case to the Redfield Peek Commission through their assistance."

Industrial News

L. M. Van Moppes Co., 665-671 Broad St., Newark, importers of bortz and diamonds, announce the sailing of George L. Van Moppes for England on Mar. 19 to act as the London representative of the firm.

The Aluminum Ore Co., subsidiary of the Aluminum Co. of America, according to reports, is planning the completion of a large plant at Sollers Point, Md., the construction of which was stopped on account of the war.

The U. S. Copper Products Co. is constructing a new plant in Cleveland, which will have a brass-melting furnace of the muffled-arc type, of 2200 lb. per hour capacity. The furnace will be installed by the General Electric Company.

Laclede-Christy Clay Products Co., Railway Exchange Bldg., St. Louis, announces that the company has begun the manufacture of melting pots, made from a new refractory material for use in glass manufacture. This material is also sold in the form of a prepared mixture.

Electric Furnace Co., Alliance, Ohio, announces that 10 Baily electric brass furnaces are now under construction at the Salem plant, to complete a Mexican contract and other foreign and domestic requirements. G. Amsinck & Co., of New York, has also just closed a contract with the company for a complete furnace equipment for melting brass to be shipped to Mexico. The furnaces are of the tilting type, rated at 105 kw., 1500 lb. hearth capacity and a melting rate of 600 lb. per hour.

Westinghouse Electric and Manufacturing Co. announces the appointment of C. W. Johnson to the position of assistant manager of works. Mr. Johnson was formerly in the employ of the Steel Motor Co., of Johnstown, Penn., and the Bullock Electric Co., Cincinnati, Ohio, and was superintendent of the Allis-Chalmers Bullock, Ltd., Montreal. He was chief inspector of works of the Westinghouse Electric and Manufacturing Co., in 1907, and later was promoted to the general superintendency, serving in this capacity until his recent appointment.

Adjustable Anchorage Co., 1502 Ford Bldg., Detroit, is manufacturing an adjustable anchorage to support and align motors from 50 hp. up, and particularly for use with those equipped with magnetic clutches, which require accurate alignment. The device can also be used on motor driving belts. It is claimed that changes in motor position, when required, may be made on the new anchorage in a fraction of the time necessary when motors are dowel pinned, as the latter method involves the destroying of the concrete to make changes in position, whereas with the new device it is merely a matter of adjusting bolts.

The Sullivan Machinery Co., Chicago, announces the establishment of a branch sales office and warehouse, for the convenience of its customers in Mexico, at Edifico Oliver No. 3, Mexico City, Mexico, in charge of Joseph F Bennett, formerly sales engineer of the company in Mexico, associated with the El Paso branch. This new office will serve customers and clients in central and southern Mexico and in that part of the states of Sinaloa, Durango, Coahuila, and Tamaulipas, lying south of the 26th parallel of latitude. The company also announces the appointment of Chester Mott as manager of its branch office at Denver, No. 837 Equitable Bldg., who succeeds Wallace T Roberts, recently resigned.

Chicago Pneumatic Tool Co. announces the removal of the Detroit office from 236 Hancock Ave. to 502 Farwell Bldg. To supply the demand for its products this company has opened offices and warehouses at Tulsa, Okla., at No. 313 Richards Bldg., and at El Dorado, Kan., where stocks of repair parts and other products will be maintained. The Boston offices have been removed to 182 High St., and F S. Eggleston is the district manager of sales. The company also announces the appointment of J. I. Edwards as manager of the rock-drill sales division, succeeding E. Eklund, who has been appointed special foreign representative and who will leave soon for Europe. Fred H. Waldron, formerly Minneapolis representative, has been appointed manager, pneumatic-tool sales division, succeeding J. G. Osgood, retired. Nelson H. Gatch will act as the Minneapolis representative, with offices at 301 Metropolitan Bank Bldg. J. K. Haigh has been appointed assistant district sales manager of the San Francisco office at 175 First Street.

Trade Catalogs

Small Power Chain Drives. Morse Chain Co., Ithaca, N. Y. Bulletin No. 16; 6 x 9; pp. 25; illustrated. Descriptive of silent chain drives from 5 to 200 horsepower.

Fuses. A. F. Daum, 1157 Hodgkiss St., Pittsburgh, Penn. Pp. 4; 7½ x 3½; illustrated. A folder giving a list of the Daum fuses.

Hoists. Rodney Hunt Machine Co., Orange, Mass. Folder descriptive of various worm-wheel and spur-gear hoists. Catalog sent on request.

Shingles and Roofings. The Flintkote Co., 88 Pearl St., Boston. Folder containing a new price list on asphalt shingles and prepared roofings.

Steel Products. Walter A. Zelnicker Supply Co., St. Louis. Two folders, Nos. 260 and 261, giving a stock list of special rails, pipe, steel girders, sheet-steel piling, tank cars, trucks and other steel products.

Lamp Guards. Flexible Steel Lacing Co., 522 South Clinton St., Chicago. Folder descriptive of various types of guards made of expanded steel for the protection of electric-light bulbs of standard voltages.

Gasoline Locomotives. McFarlane Eggers Machinery Co. 2757-2763 Blake St., Denver; 9 x 6; 8 pp.; illustrated. Descriptive of gasoline locomotives for track gages from 18 to 36 in., including specifications.

Steam Engine. Ingersoll-Rand Co., 11 Broadway, New York. 6 x 9; 11 pp.; illustrated. Descriptive of high-speed, piston-valve steam engines, of the horizontal center-crank type, using automatic splash lubrication.

Belt Fasteners. Crescent Belt Fastener Co., 381 Fourth Ave., New York. Bulletin covering "The Crescent Principle of Belt Joining" and ready service chart, by means of which it is possible to determine the correct type of belt fastener to use for any condition of work.

Roller Bearings. American Roller Bearing Co., Pittsburgh. Bulletin No. 1004; 6¾ x 10; pp. 8; illustrated. Descriptive of roller bearings intended for use under medium loads at medium speeds, and includes list prices. Bulletin covering heavy-duty bearings furnished upon request.

Tie Tamping Outfits. Ingersoll-Rand Co., 11 Broadway, New York. 6 x 9; 26 pp.; illustrated. Descriptive of "Imperial" pneumatic, tie-tamping outfits, for use on steam and electric railroads. Also describes gasoline-engine and electric motor-driven compressor cars, with complete equipment.

Flotation Machines. Southwestern Engineering Co., Hollingsworth Bldg., Los Angeles, Calif. Catalogue B; 7½ x 10½; illustrated; pp. 32. Descriptive of the K & K flotation machines, giving sizes and types, parts list and data on local and export shipments and mule-back transportation.

"Long Life for Wood at Low Cost." The Barrett Co., New York; 6 x 9, pp. 16; illustrated. The booklet gives a brief description of the uses and application of Carbosota Grade-One Liquid Creosote Oil. Methods of applying preservative treatment by the open tank and brush are explained in a general way.

Coal and Ash Handling. Jeffrey Manufacturing Co., Columbus, Ohio. Catalog. No. 210; 6 x 9; pp. 96; illustrated. Descriptive of the latest type of pivoted bucket conveyor for handling coal, ashes and clinkers. Exteriors and interiors of large power plant equipments are illustrated, and blueprints for various sizes of carrier equipment are reproduced.

Oil Combustion. The Denver Fire Clay Co., Denver. Bulletin No. 300; 7 x 10; 16 pp.; illustrated. Descriptive of high and low-pressure and combination burners for oil fuel to obtain maximum efficiency. A discussion of the general principles involved in burning oil, with tables of heat values of various oils and commercial gas and theoretical flame temperatures, is included, as is a price list for burners and motor blowers.

Screening Machinery. Kennedy-Van Saun Manufacturing and Engineering Corporation, 120 Broadway, New York; Bulletin No. 4; 6 x 9; 19 pp. illustrated. Descriptive of screening machinery for rock, ore and pulp, and mechanical feeders, of the roll, plunger and pendulum types. The Maxton tubular screen designed for a maximum tonnage is described and tables on capacities and dimensions of pulsating and revolving screens are given.

Water Filter and Grease Extractor. The Griscom-Russell Co., 90 West St., New York. Bulletin 609; 6 x 9; 8 pp.; illustrated. A description of the Reilly multiscreen filter and grease extractor for the removal of oil, grease, and other foreign matter in suspension in condensed steam, from engine cylinders, heating systems, etc., used for boiler feed. The bulletin further describes the use of the filter for the removal of mud or sand from lake or river water when used as a boiler feed. Tables giving capacities, dimensions, working pressures and fittings are included.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Blast Furnaces, Charging Apparatus for. Julian Kennedy, Pittsburgh, Penn. (U. S. No. 1,291,019, Jan. 14, 1919.)

Lining for Tube-Mills. Alexander V Jensen, Devil's Slide, Utah, assignor to American Manganese Steel Company, Augusta, Me. (U. S. No. 1,291,008, Jan. 14, 1919.)

Magnesium. Process of Making Magnesium Carbonitrid in Blast Furnaces. Edward W. Haslup, Bronxville, N. Y., assignor to Gilchrist, Haslup & Peacock, Inc., New York, N. Y. (U. S. No. 1,291,498, Jan. 14, 1919.)

Manganese Steel, Method of Making. Wesley Groff Nichols, Chicago, Ill., assignor to American Manganese Steel Company, Chicago, Ill. (U. S. No. 1,291,655, Jan. 14, 1919.)

Nitrogen and Carbon Dioxide, Apparatus for Making. Cyril Douglas McCourt, London, England, and Carleton Ellis, Montclair, N. J., assignors, by mesne assignments, to Surface Combustion, Inc., Wilmington, Del (U. S. No. 1,289,496; Dec. 31, 1918.)

Ore-Reducing Apparatus and Process. John M. Longyear and John T. Jones, Marquette, Mich., assignors to New Metals-Process Co., Chicago, Ill. (U. S. No. 1,289,835; Dec. 31, 1918.)

Ore Separator, Pneumatic. Marion S MacCarthy, Denver, Colo., and Charles F. MacCarthy, Carthage, N. M., assignors, by mesne assignments, to said Marion S. MacCarthy. (U. S. No. 1,289,845-6; Dec 31, 1918.)

Ore-Washing Machine. John H. Schott, Boulder, Colo. (U. S. No. 1,289,931; Dec. 31, 1918.)

Potash—Potassium-Compound-Recovering Apparatus. Hugh Meridith Hiner, Fort Smith, Ark (U. S. No. 1,290,194; Jan. 7, 1919.)

Potash—Process for Recovering Potassium from Potassium-Bearing Silicates. Allan Grauel, Kitchener, Ontario, Canada (U. S. No. 1,289,736; Dec. 31, 1918.)

Pump, Rotary. William H. Leiman and George W. Leiman, Newark, N. J. (U. S No. 1,290,25[illegible]; Jan. 7, 1919.)

Refractory of Graphite, Alumina and Binder. Frank J Tone, Niagara Falls, N. Y., assignor to Carborundum Company, Niagara Falls, N. Y. (U. S. No. 1,289,578; Dec. 31, 1918.)

Refractory of Graphite, Zirconia, and Binder. Frank J Tone, Niagara Falls, N. Y., assignor to Carborundum Company, Niagara Falls, N Y. (U. S. No. 1,289,966; Dec. 31, 1918.)

Rock Drills, Cutter Head for. Jacob J Trakimas, Watertown, N. Y (U. S. No. 1,290,412; Jan. 7, 1919)

Rock Drills, Sprayer Attachment for. Alfred Hoffman and Lem Henry Hileman, Leadville, Colo. (U. S. No. 1,290,196; Jan. 7, 1919.)

Shovel, Coal-Loading. Walter Ferris, Milwaukee, and Svante R. W M Bager and Mitchel L. Fykse, South Milwaukee, Wis., assignors to Bucyrus Company, South Milwaukee, Wis. (U. S. No. 1,289,426; Dec. 31, 1918.)

Sulphur Burner. Hubert C. Ellis, Chicago, Ill., assignor to Ellis Drier and Elevator Co., Chicago, Ill (U. S. No 1,289,417; Dec. 31, 1918.)

Sulphur Burning, Process of. George F Hurt, Atlanta, Ga., assignor to Pratt Engineering and Machine Co., Atlanta, Ga (U. S. No. 1,289,783; Dec. 31, 1918.)

Well Drilling—Rotary Drilling Tool for Use with Casings. John William Pippin, Oklahoma, Okla. (U. S. No. 1,290,340; Jan. 7, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Mar. 11.

The Production of Petroleum in California in January was 8,598,253 bbl., or an average daily production of 277,263 bbl. Total field shipments were 8,341,574. Crude-oil stocks on Jan. 31 were 32,299.589 bbl. This is an increase in production, shipments, and field stocks over December, but the increases are not large enough to indicate marked advancement in the industry. Fifty-two new wells were completed in January, with an initial daily production of 17,375 bbl. New rigs numbered 44, and 323 wells were being drilled. Only two wells were abandoned. This shows an increase over December of 11 wells completed, but a decrease of 2 new rigs and 8 wells being drilled. The total number of wells producing in January was 8617, an increase of 11 over December. The above figures are from the compilation of the Standard Oil Co. Regarding field activity, the State Mining Bureau reports that between Jan. 1 and Feb. 15, drilling either had been completed or made ready for on 80 new wells, as compared to 112 for the same period in 1918 and 144 in the same period in 1917, indicating a steady decline in drilling activity and suggesting that such condition continued for any appreciable time must result in a marked decline in production. The recent large initial production in the Montebello and Casmalia fields has been maintained to a degree that has hidden to some extent the approach of a certain decline in production. This condition is due chiefly to the unsettled status of legislation and litigation respecting the oil industry. Other causes are the rapid decline in gas pressure and improper drilling, especially in decreasing the initial production of new fields.

RENO, NEV.—Mar. 13

Companies in the Divide District of Nevada that are reported as operating or preparing to operate include the following, the shaft development of each being given: Tonopah Divide, shaft 520 ft., shipping to Tonopah; Brougher Divide, shaft 500 ft., cut Divide vein on 177 and 500 levels; Gold Zone Divide, shaft 500 ft., cut Divide vein on 295 and 500 levels; East Divide, shaft 320 ft.; Divide Extension, shaft 170 ft.; Tonopah Hasbrouck, shaft 400 ft. and tunnel 900 ft.; Divide Consolidated, started shaft; Tonopah Dividend, shaft 300 ft., cut two veins; Alto Divide, started shaft; Sutherland Divide, inclined shaft 400 ft., and two shallower shafts; will sink 200 ft. deeper; High Divide; Gold Wedge Divide, started shaft; Rosetta Divide, started shaft; Silver King Divide, started shaft; North Divide, sinking shaft. The following companies are said to be about to start sinking: Divide Annex, Allied Divide, Florence Divide, Mohawk Divide, Divide City, Goldsmith Divide, and Gold Reef Divide. The capitalization of all the foregoing companies ranges from $1,000,000 to $2,000,000. Tonopah Divide, Brougher Divide, and Tonopah Hasbrouck have par value $1, all others being 10c. per share.

KINGMAN, ARIZ.—Mar. 13

A Suit for Extralateral Rights has been filed in the Superior Court at Kingman, Ariz., by the Tom Reed Gold Mining Co. against the United Eastern Mining Co. The case does not affect the main ground of the latter, but concerns the Big Jim claims, that lie beside the Grey Eagle and Bald Eagle claims of the plaintiff company. It is alleged that the plaintiff has the right to explore ground within the Big Jim claims, it being understood to refer particularly to ore found in a vein on the 400 level. Big Jim was bought by United Eastern for a consideration of 187,000 shares of the latter's stock.

JEROME, ARIZ.—Mar. 14

Work Has Been Resumed at Jerome on a number of development properties, and the United Verde Extension is working about 50% of its normal force, despite the recent labor trouble and general layoff. The Extension tunnel will be cut through soon. Recently only a drift heading has been driven, owing to heavy ground and water. Later, this will be enlarged and concreted where necessary, but it is believed best at present to drive through, so that drainage be the earlier secured. At the smeltery at Verde the furnaces are being relined and other work started that will take about three months. United Verde also has a repair and enlargement program outlined at Clarkdale that will take a half a year to complete. It is therefore unlikely that copper production will be resumed at this camp for several months.

SALT LAKE CITY, UTAH—Mar. 13

The Utah Power and Light Co. is seeking added power to the amount of 2250 hp. and has applied to the State Engineer for the use of 125 sec.-ft. of water from the Logan River. It is planned to build a large timber dam of the weir type and to lay an iron pipe 10,032 ft. long to connect with the company's power plant.

Skirmishing Over the Mine-Taxation Bill continues in the State Legislature, the House seeking to have the words "not to exceed three times the net proceeds," as passed by the Senate, expunged, and to have taxation fixed at "three times the net proceeds," with no leeway. It is not probable that the Senate will yield in the matter.

Workmen at the Garfield Smeltery, who struck recently because of the wage reduction of 75c. a day, capitulated Mar. 8 and accepted the new wage scale. The company has announced that as many men as possible will be taken back, preference being given first to married men and then to returned soldiers, single men coming last. The strike was not general at the plant.

A Railroad Into the East Tintic District, primarily to serve the Tintic Standard, the chief producer there, and the Iron King mine, under development by the Loose interests, should be operating within the next few months. The road will start from a siding on the Denver & Rio Grande, two miles west of Alberta, completing the distance of seven miles to the Tintic Standard and connecting with the Iron King by means of a two-mile spur branching off four miles from the starting point. The line, which will be known as the Goshen Valley R.R., is capitalized at $50,000, divided into 500 shares of a value of $100 each. Officers are: E. J. Raddatz, of the Tintic Standard, president; C. E. Loose, vice-president, and W. I. Snyder. Properties within easy hauling distance of the new railroad include the Eureka Lilly, Eureka Bullion, Eureka Standard, South Standard, and Apex Standard.

WALLACE, IDAHO—Mar. 14

A Reduction of Wages of $1 per day has been announced in notices posted at the various mines of the Coeur d'Alene district. This action had been expected for the last few weeks, and therefore occasioned no surprise. The surprise is that it had been delayed so long, as reduction of wages had long been made in other mining districts of the West similarly situated. The sliding scale under which wages are fixed in the Coeur d'Alene district provides for a maximum wage of $4.75 per day when lead is above 7½c. per lb. During the war, when the price of lead went above 8c. per lb., wages were advanced 50c. per day voluntarily, making the rate $5.25, and that has been the prevailing rate since the armistice was signed. The basic wage is $3.50 per day, so that the bonus being paid amounted to $1.75 per day. When the reduced pay goes into effect, on Mar. 16, the bonus will be 75c. per day, which is 50c. in excess of that required by the sliding scale based upon the average price of lead for the preceding month. There is absolutely no indication that the cut will be resisted by employees. To reject it would unquestionably mean a suspension of operations. This is made clear in the notices posted. After announcing the reduction, the notice posted by the Bunker Hill & Sullivan Co. says: "The state of the industry and of the lead market makes it impossible to pay the present bonus and makes the above reduction imperative." The notice from the Federal Mining and Smelting Co., operating the Morning mine, says: "Owing to the fall in the price of lead, the Morning mine is being operated at a loss. It is impossible for the company to continue to absorb the loss. Either the operating cost must be reduced or the mine must be shut down." All the notices contain a statement substantially the same as the following, which is from the notice posted by the Hecla Mining Co.: "Realizing that the cost of living still remains high, and that to reduce the amount paid to employees would be hardship to them, the companies have not enforced the bonus scale, and have hesitated to make any reduction at all. They cannot, however, carry the loss indefinitely, and they are therefore reluctantly compelled to ask the employees to share the burden." Hope is expressed that "employees will acquiesce in the plan, so that the mines may continue in operation." Fortunately the district is comparatively free from the radical type, and it is believed that employees regard themselves fortunate in retaining employment even at reduced wages. Already four large mines are idle, namely, the Hercules, Tamarack & Custer, the Interstate-Callahan and the Success, the suspension being forced by the high cost of mining and low prices of lead and zinc. New work is practically at a standstill throughout the district, and the large producers still running are approaching the point where a reduction of mining costs must be accomplished or operation suspended. The four big producers operating are the Bunker Hill & Sullivan, Hecla, Morning, and Gold Hunter. The Bunker Hill and the Hecla are in the best position. The former has its own smeltery, which also handles the lead product of the Hecla. The Bunker Hill is in a strong position and can let its lead accumulate at the smeltery until more favorable market conditions exist; at the same time its product of refined silver obtained from its own, Hecla, and Caledonia ores yields a quick profit. The Bunker Hill now has about 5000 tons of lead on hand, and the amount is steadily increasing. Hecla also produces considerable zinc, having a leased mill for the treatment of lead-zinc ore.

BATESVILLE, ARK.—Mar. 17

Investments in the Batesville Manganese Field made during 1918 in the purchase of property and equipment will approximate $1,000,000 in the aggregate, it is estimated. Claims for reimbursement under the Dent bill, which passed Congress last month, are being made out now and filed.

YELLVILLE, ARK.—Mar. 17

Zinc Operators in the North Arkansas field are loath to put their production on the market at present. The owners of producing properties will hold their output for a better price. Considerable development work is in progress in the field, those engaged anticipating a better market later in the spring after peace is signed.

CLEVELAND, OHIO—Mar. 11

Additional Curtailment of Operations in the Lake Superior underground mines is being placed in effect because of the probability of a poor ore season, says "Iron Age," of Mar. 13, and one interest is planning to entirely shut down some of its properties. Many of the mines are not being operated at above about 50% of maximum capacity. Shipments of ore from Lake Erie docks to the furnaces during February amounted to 910,948 gross tons, as compared with 555,852 tons during the corresponding month last year. If shipments are kept up at the same proportion to May 1, there will be less than 300,000 tons more ore on docks on that date than at the same time a year ago. The open weather that has prevailed is doubtless largely responsible for the heavy shipments during February. On May 1, 1918, the ore on docks amounted to 5,622,019 tons.

BOSTON, MASS.—Mar. 13

The American Oil Co., of Boston, which has been drilling on Connanicutt Island, opposite Newport, has discontinued drilling for oil and is planning to develop and equip the graphite deposits on the property, which were proved by drill holes to be extensive. Two oil wells were drilled, the first to 1300 ft., in 1916, and the other to 2000 ft., in 1918. These cut several beds of graphitic material, with which were associated deposits of high-grade amorphous graphite. The drill holes cut sandstone beds in depth, but no absolute evidence of oil was found, according to report. The graphite is being developed by a shaft 90 ft. deep near the eastern shore of the island. The selected material is pulverized in a special mill, and sorted into two grades for shipment. The present plans include more extensive development of the graphite-bearing shale beds, which in places are several feet thick, and which appear to occur at different horizons. Arrangements are being made for the testing of the ore for concentration, preliminary to making plans for a mill to operate on an extensive scale. The company produced 150 tons in 1917 from preliminary operations. It has a capital of $2,000,000. William W. Clark is president, Benitt J. Orkin, vice-president, and Wesley Alfred Gove is secretary and treasurer, all of Boston. The stock is traded on the Boston curb.

NEW YORK—Mar. 17

The Texas Gulf Sulphur Co.'s new 1000-ton plant is nearing completion, and will soon be producing sulphur. Property covers larger portion of "Big Hill," about six miles northeast of Matagorda and 20 miles south of Bay City, the county seat of Matagorda County. It contains one of the largest sulphur deposits in the United States. Extensive drilling to prove this field has been done, and further development is still under way. Some wells have been completely equipped for production. Plant consists of 10,000-hp. steam-boiler installation, "booster" pumps, superheaters, compressors, and electric generators. In connection with plant is also a complete machine shop and warehouse. Railroad connection from Gulf, Colorado & Santa Fe has been built and deep water wells drilled and canals are being dug. New town of Gulf, for accommodation of employees, has been finished.

West Texas Sulphur Co. elected a new management as follows at the recent annual meeting: John K. Zinc, of Baltimore, president; Blair Ferguson, A. W. Pussey, P. T. Sharples, all of Philadelphia, directors. Company has complete plant for treating sulphur-bearing material, including specially designed retorts for liquating by means of superheated steam. Technical difficulties have developed in operating, and change of method is considered. Property is situated about 12 miles from Orla station, Santa Fe R.R., Pecos River division. One other treatment plant has been erected in the district, on the Michigan property, about three miles southwest from West Texas, and not now in operation. The Standard Sulphur Co., financed in Detriot, has suspended plans for development, and property is under contract to new interests. Consideration is being given to plans to utilize the mixed sulphur and gypsum product, without treatment other than grinding, for application to the soil to assist in increasing fertility. The district lacks a railroad, which hampers development generally.

VICTORIA, B. C.—Mar. 13

The Construction of Roads to Mineral Claims in British Columbia, as well as that of trails and bridges, involved an expenditure of $207,523.31 by the provincial government since late in 1916, according to a recent announcement in the provincial legislature by William Sloan, Minister of Mines. He explained that originally the sum voted for this purpose was $200,000, which amount had been supplemented during the session of 1918-19 by $75,000. Since Jan. 1, 1917, there have been built with government aid 98¾ miles of mining roads, and 75⅝ miles of mining trails, and 437¼ miles of mining roads and 420¼ miles of mining trails have been repaired. These roads and trails, it is explained, all were of such a character as to be of service, almost solely, to mines in the first stages of development, or claims on which work was proposed, and which were sufficiently encouraging in their prospects to warrant the expenditures. Under the terms of the Mineral Survey and Development Act, which provides the government power to extend the help indicated, the government mining engineers, on receiving applications for aid in building roads or trails, must visit and report on the district or the property it is intended to open up. If their reports are favorable, the Minister of Mines may authorize the expenditure of 50 per cent of the estimated cost.

Construction of the Pacific Great Eastern Ry. to Prince George, B. C., will be pushed this season, according to a recent announcement by Premier John Oliver, the information being of particular interest to the mining industry. Steel was laid from Clinton to Williams Lake last year, a distance of 42 miles. In effect, the section intended for completion this season will make a north-south line about 460 miles long connecting Vancouver with the Grand Trunk Pacific Ry. Eventually, the road will be extended north from Prince George through Pine Pass to the Peace River country and a connection with the Edmonton, Dunvegon & British Columbia Ry. That portion of the road which is to be finished this season will make available for cheap large-scale mining a placer region which has yielded about $50,000,000 from a small area and yardage, though handicapped by high freight cost. That is to say, there will be a new and profitable field for gold dredging, hydraulicking, hydraulic-elevating and other large-scale methods. In lode mining it will permit the development of three gold mines, two silver-lead and one copper, the testing of many prospects and the prospecting of wide areas. The region has coking coal and tungsten. It possesses all the requisites for a smeltery except blocked-out ore.

TORONTO, ONT.—Mar. 15.

A Branch Line of T. & N. O. Railway will be built to the Kirkland Lake camp by the Ontario government, according to a statement that has been issued by the latter, after careful investigation into the mining conditions and requirements at Kirkland Lake. Apart from the advantage of the road in lessening the cost of operations, this decision is expected to have important results in attracting capital as confirmatory evidence of the gold-producing value of the district.

The Canadian Copper Co., which is the producing end of the International Nickel Co., produced at its smeltery during 1918 about 6500 tons of matte a month. In January, 1919, the production was about 4000 tons; in February, 3000 tons; and starting Mar. 1 the output was reduced to 2000 tons. There is talk of a still further reduction to 1000 tons. The company's confidence in the future is, however, expressed by the fact that its entire organization is being retained. Previous to the war about 40% of the output of nickel went into armament and 60% into peace products. Production was showing a normal increase of about 10% a year, and the expectation was that had the war not occurred the normal production would have been nearly up to the output for last year. It is only a question of time until the market for nickel broadens sufficiently to permit of much more extensive operations.

A Blue-Sky Law will soon be brought before the present House by the Province of Ontario. The necessity for some such legislation is evident, but there is a feeling that the proposed act is hardly elastic enough and that too much power is given into the hands of one man. It is felt that, as mining is such a different class of enterprise from the ordinary industrial, there should be a separate commissioner for that branch. The proposal to limit the appeal from the decision of the commissioner to the Ontario Railway and Municipal Board does not meet with approval. The bill provides for the appointment of a commissioner by the Lieutenant Governor in Council. No shares are to be sold or offered for sale, nor shall any advertisement or circular be issued or published soliciting the purchase of shares, in any company not registered under the act. Companies desiring registration must file with the commissioner a statement showing in detail the plan on which it proposes to transact business; copy of all contracts, shares or instruments which it proposes to make with or sell to its contributors; statement containing name and head office; an itemized account of its actual financial condition, the amount of its property and liabilities, and such other information as the commissioner may require. No amendments to the charter, bylaws or constitution shall become operative until they have been filed with and approved by the commissioner. Every company must file its written irrevocable consent that actions may be begun against it in the Supreme Court of Ontario by service of process on the commissioner. The commissioner may make an examination of the affairs of the company at its expense. A company shall have the right to appeal to the Ontario Railway and Municipal Board from the refusal of the commissioner to register it. When a company is formed for the purpose of undertaking commercial, industrial, and manufacturing enterprises in Ontario, or the development of natural resources, and it has not at the time of application appeared that the company can make a fair return on its shares, the commissioner may grant interim registration and may impose the following conditions: Limiting the amount that may be paid for organization expenses and commission on the sale of shares; requiring payment of all moneys to a trustee until a certain amount has been raised within a certain time; and limiting the amount of shares that may be paid for property or services rendered. Failure to observe the conditions may result in revoking the interim registration. Provision is also made for the registration of dealers, the license to be good for one year. Every company must file with the commissioner each year a complete statement of its financial position and such other information as the commissioner may desire, and failure to do this will result in cancellation of the license or registration. Every company shall be subject to examination by the commissioner at any time that he may consider it advisable, and for that purpose the commissioner may exercise the powers of investigation conferred on the Ontario Railway and Municipal Board, and may order that the costs of such examination be paid by the company. Failure to pay such costs will result in revocation of its registration and cancellation of the license of its agents or dealers. Registration may also be revoked and the license of the company's agent cancelled at any time that the commissioner may consider that the assets of the company are less than the liabilities, or that the business of the company is being conducted in a manner prejudicial to the interests of stockholders.

The Mining News

ALASKA

FEBRUARY SHIPMENTS of domestic copper ore, matte, etc., from Alaska to United States were 8288 gross tons, copper contents were 5,176,033 lb., and the value was $1,305,367. January shipments were 10,336 gross tons; copper contents, 5,618,504 lb.; and value, $1,539,767.

KENNECOTT COPPER (Kennecott)—February production, including that of Braden Copper Co., was 5,292,000 lb.; January, 10,040,000 pounds.

ALABAMA

Clay County

DIXIE GRAPHITE (Ashland)—Ground broken on Jan. 1 for graphite mill of estimated capacity of 200 tons in 10 hours. To be complete about July 1.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—Fire which broke out on Feb. 25 between 700 and 800 levels brought under control by means of bulkheading, according to Bisbee reports. Originated in sulphide ore and gained headway for several days. Water obtained from city main and other sources was run into mine. Announced on Mar. 8 that water would reach 700 level within two weeks, when fire would be quenched.

KING COPPER (Rodeo, N. M.)—Under development, according to company statement, for last 18 months. Two double-compartment shafts sunk to 200 and 300 ft. respectively. New power house erected having 200-hp. gas engine and 700-ft. I.-R. compressor. Installing new boilers at Ainsworth shaft and overhauling plant preparatory to sinking to 700 level. Will churn-drill part of property during 1919. Property includes 59 claims on east slope of Chiricahua Mountains about eight miles from Rodeo, New Mexico.

Gita County

IRON CAP (Globe)—January production was 124 cars ore, carrying 1.02 to 3.04 oz. silver and 3.87 to 9.6% copper. Copper output was 773,797 pounds.

Pinal County

ARIZONA HERCULES (Ray)—Average daily production in February was 733 tons ore, averaging 1.427% copper. Extraction was 80.50 per cent.

RAY CONSOLIDATED (Ray)—February production of copper was 4,150,000 lb.; January, 4,470,000 pounds.

Yavapai County

ABE LINCOLN (Constellation)—Crosscutting on 660 level in badly faulted ground.

CALUMET & JEROME (Jerome)—Drilling started on 101 claim.

GRAND ISLAND (Jerome)—At present progress 500-level crosscut will cut main contact within fortnight, recent survey having shown about 300 ft. more work to be done. Drift started on oxidized material 102 ft. from shaft.

JEROME-PORTLAND (Jerome)—Transfer of property to new Jerome-Bisbee company is being contested in Prescott court by holders of stock that had not been recognized as valid.

JEROME VERDE (Jerome)—Further development of orebody struck in Maintop workings shows width of 117 ft. Crosscuts have passed through into barren schist.

PIONEER (Walnut Grove)—Owned by V. E. Messinger, of Glendale, Ariz., who has added compressor equipment and will sink below present 200 level.

PITTSBURGH - JEROME (Jerome) — Compressor repair parts received; work to be resumed on 500 level in two headings and will diamond-drill 100 ft. due south. C. C. Arata in charge.

ARKANSAS

Independence County

LUCKY MACK (Batesville)—W. A. McClure and R. V. McSpadden developing 160 acres manganese land. Have prospected vein one to five ft. thick for 400 ft. Considering the installation of steam shovel.

Marion County

LONNIE BOY (Rush)—Development at this zinc property, recently taken over by Stanley Hanford and associates, of Batesville, is showing rich ground. Will erect mill when enough ground is opened to keep it in operation.

NORTH STAR (Yellville)—New aërial tram completed and in operation. Mill running steadily, producing five tons high-grade zinc carbonate daily. Will hold production for better prices.

ONWATA (Yellville)—First car of zinc carbonate ready. Will not sell on present market.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Mill running steadily on good ore from 3450 level and winze below 3500-ft. point. Underground conditions more favorable than for several years.

OLD EUREKA (Sutter Creek)—Deepening of three-compartment shaft almost completed. Good ore disclosed on 1200, 1600, and 2100 levels. Extensive development under consideration. New mill probably be installed this year.

Butte County

NATOMAS COMPANY (Oroville)—To redredge old fields at one-third less cost than original dredging, with expectation of recovering 99% of gold contents. Planned to replace soil in condition for agricultural use. Tailings on 106 acres from former dredges redredged with profit. Charles H. Thurman, superintendent.

Eldorado County

BEAN HILL (Placerville)—Placer property 12 miles southeast of Placerville being examined by F. L. Kendall, mining engineer of Denver.

BURGER (Placerville)—To install new mill and electric hoist. Situated within town limits.

GEORGIA HILL (Placerville) — Optioned by San Francisco men and being examined by W. E. Plank, mining engineer, of Sacramento.

RISING HOPE (Placerville) — Abundance of water from recent rain for operating barrel mill on washing gravel from deep channel workings.

Modoc County

HESS (Alturas)—Retimbering nearing completion. Small mill has cleaned up $20,000 recently.

Nevada County

SIGNAL (Rough and Ready)—To be reopened. Unwatering started in 200-ft. shaft and crosscuts. Equipped with mill, hoist, and other operating machinery.

Placer County

RISING SUN (Colfax)—Unwatering begun and large pumps being installed. Mine formerly large producer. In litigation for several years.

Sierra County

BROWN BEAR (Downieville)—Mine on St. Charles hill will be reopened after suspension during winter season. Unwatering incline to extend drift to pay-gravel channel.

BRUSH CREEK (Downieville)—Quartz mine south of old Mountain House optioned by S. A. Hendricks, of Wisconsin. Development to start by May 1.

Yuba County

No. 18 DREDGE (Hammonton)—Fifth of large all-steel dredges built by Yuba Manufacturing Co. for Yuba Consolidated Gold Fields launched Mar. 2. Equipped with 18-cu.ft. buckets, designed to dig 80 ft below water line. Cost about $500,000.

COLORADO

Clear Creek County

RANDOLPH (Empire)—Randolph Gold Mining, Milling and Tunnel Co., incorporated for purchasing mining properties formerly owned by Empire Tunnel and Transportation Co. Latter organization in litigation for several years, and properties closed down. New company capitalized at $1,000,000, and since acquiring Empire properties has performed about $60,000 worth of development work, and repairs and improvements. Officers of new company are: W. A. Snyder, president and general manager; Thomas P. Fahey, vice-president; W. C. Danks, secretary; and W. A. Skinner, treasurer. Engineers' reports indicate mines contain approximately 1,770,000 tons of low-grade milling ore, having value of about $6.35 a ton. Estimates have been made on cost of milling this ore, and officers of company believe material can be treated at profit of about $2 a ton.

IDAHO

Boise County

GOLD HILL AND IOWA (Quartzburg)—In February, Gold Hill property reported to be milling over 100 tons per day. New ore found on 400 and 100 levels and a raise has reached surface also in ore. Iowa mine probably will be operated again in summer and connection made with Gold Hill. Considerable development and increase of milling capacity planned. E. E. Carter, manager.

Shoshone County

RICHMOND (Adair)—Annual report for last year shows 3912 tons of copper ore shipped, which netted $23 per ton. During year development work amounted to 1685 ft., 1220 ft. being drifts and crosscuts. Shaft started from main tunnel since Jan. 1; now down 40 ft. and will go to 200. Officers and directors elected as follows: J. E. Codd, president and treasurer; H. W. Classen, vice-president; Charles H. Maloy, secretary; B. N. Sharpe, manager; all of Spokane. Peter Peterson, director, of Saltese.

AJAX (Burke)—Work suspended for two months. A. C. Bixby, general manager, conferring with controlling stockholders in Boston and Lynn, Mass. Recent work has been in Oom Paul tunnel, showing up strong vein with much ore, but not commercial. Will resume work in Moonlight shaft, where there is two feet of ore in drift toward Hercules, end line being about 600 ft. away.

SUCCESS (Wallace)—At delinquent stock sale following assessment of 2c. per share, 231,361 shares were sold at public auction for amount of assessment and costs, amounting to $23 per 1000. Mine closed.

TAMARACK & CUSTER—(Wallace)—At annual meeting old officers and directors were reëlected: Jerome J. Day, president and manager; Eugene R. Day, vice-president; Harry L. Day, secretary. Other directors are Ramsay M. Walker, of Wallace, and F. M. Rothrock and E. H. Knight, of Spokane. Company has surplus in treasury of about $500,000, which directors decided had best be held, owing to unsettled mining conditions. Mine idle since holidays.

KANSAS

Joplin District

DE ARMAN (Miami, Okla.)—Leased to W. B. Waugh, Baxter, Kan., and R. J. Jones, Pittsburgh, Penn. Has been shut down for several months.

U. S. SMELTING (Baxter)—Using small steam locomotive on narrow-gage railway connecting No. 2 mine with 500-ton mill on No. 1 lease west of Baxter. Operation of No. 2 property just begun.

BROWN-HEAD (Baxter)—Has started operation of mill built several months ago. Oil engines used for power. Ground well opened and plant temporarily busy working dump.

MICHIGAN

Copper District

NEW INTAKE AND TUNNEL at Gay mills, under construction by Stanton companies to provide new water supply, progressing rapidly. Tunnel driven 500 ft. under Lake Superior and advancing 15 ft. per day. Will be 2000 ft. to half mile long, depending on formation encountered. Sand shaft on shore is 125 ft. deep, with collar 15 ft. above lake level. Tunnel begins 90 ft. below lake level, and will have overhang of 50 ft. solid rock, and 29½ ft. water at distance of 2200 ft. Will install three electric pumps, total capacity 21,000,000 gal., to be driven by turbine operated by exhaust steam from mills.

CALUMET & HECLA (Calumet)—February production of copper by company and subsidiaries was 9,263,868 lb.; January, 11,758,500 lb. Ahmeek produced 1,703,336 lb.; Allouez, 323,502; Calumet & Hecla, 4,495,087; Centennial, 139,600; Isle Royale, 1,143,915; La Salle, 98,312; Osceola, 959,918; Superior, 125,000; and White Pine, 275,198 pounds.

KEWEENAW COPPER (Calumet)—Retiring directors elected at annual meeting. Unlikely that operations will be resumed this year.

MICHIGAN (Rockland)—February production of copper was 132,137 lb.; January, 154,256 pounds.

MOHAWK (Mohawk)—No. 1 shaft, reopened in February, is producing about 14 lb. copper per ton, ore being selected. Operating one shift per day. Ore shipments in February were 52,000 tons. February production of copper was 1,146,493 lb.; January, 1,169,633 pounds.

SENECA (Calumet)—Concrete skipway in shaft completed, and sinking resumed. Skip installed, and ore being brought to surface from pocket at bottom. Plant completely equipped, and, as development progresses, will be handling 400-500 tons daily, or enough to keep one shift in operation. Mine operations will be confined to sinking to foot wall and beyond and crosscutting back to lode. Drifting on lode will be final operation.

WOLVERINE (Kearsarge) — February production of copper was 440,905 lb.; January, 399,050 pounds.

MISSOURI

Joplin District

BADGER M. AND D. (Joplin)—Mill of 250-ton capacity completed and placed in operation on old Badger mine lease, northwest of Joplin on Spring River. Ore will be taken from four shafts, from levels at 95, 155, and 185 ft. T. E. Forester, Enid, Okla., president and general manager.

MONTANA

Lincoln County

SNOWSTORM MINES (Troy)—Milling about 6000 tons monthly. Operations hindered by weather late in February, and early in March. No. 7 tunnel advanced about 1600 feet.

Silver Bow County

ANACONDA (Butte)—The case of Peter Geddes against the Anaconda, involving validity of sale of Alice Gold and Silver Mining Co. to that company, will come up in U. S. Supreme Court early in April, on appeal from Circuit Court of Appeals, according to advices received by counsel. Geddes represents minority stockholders, who allege that Alice company is not receiving proper compensation for its property. Circuit Court held, one justice dissenting, that sale was legal. Alice property embraces more than 200 acres, in northern part of Butte district, and is being mined at present for silver-zinc by Anaconda.

NEVADA

Humboldt County

SUNSET M. & D. (Unionville)—Company's 35-ton flotation mill, built to treat ore from Arizona mine, ready for operation. Long tunnel driven under flat vein. Ore is silver sulphide.

Lincoln County

PIOCHE DISTRICT ore shipments for week ended Mar. 6 were: Prince Consolidated, 24 cars; Virginia-Louise, eight; Consolidated Nevada-Utah lessees, one.

Mineral County

CANDELARIA (Candelaria) — Large bodies shipping ore developed in exploring below tunnel level in Lucky Hill mine. Company also owns Mount Diablo and Argentum mines. Output about 225 tons monthly, shipped to Kennett smeltery. Much milling ore exposed. A. J. Jarmuth superintendent.

Nye County

BROUGHER DIVIDE (Divide)—Crosscut on 500 level, 75 ft. from shaft, exposed 10-ft. seam of ore and, nearer the vein, a narrower seam of higher-grade ore. Only lateral work on other levels was on 177 level. William Watters is superintendent and A. I. D'Arcy consulting engineer.

DIVIDE CONSOLIDATED (Divide)—Good surface plant installed, with 10-drill compressor, driven by 100-hp. motor. Vein here, prospected by surface cuts, shows well-defined fissure at foot wall. Walter Harvey Weed assisted J. H. Miller, president, in selecting site for shaft now being sunk rapidly. Richard Finn, formerly superintendent at Tonopah Belmont mine, in charge of work.

DIVIDE EXTENSION (Divide)—Hoisting and air equipment from Manhattan Morning Glory now in use, and shaft progressing rapidly from 150-ft. point. Zeb Kendall president and manager.

EAST DIVIDE (Divide)—Shaft at 330 ft. has entered lower breccia zone, which forms casing of Divide vein to west. Two shifts of miners sinking rapidly near large vein that outcrops in prominent blow-out, where good assays have been obtained. Joe Mayer president and manager.

GOLD ZONE (Divide)—Crosscut from northwest drift on 500 level at foot wall near Divide boundary exposed two feet of $20 ore and drift southeast from shaft crosscut on this level exposed ore of milling grade, with 9-in. seam of better grade. Drift advancing away from Divide mine, seeking another orebody.

SUTHERLAND DIVIDE (Divide)—Good equipment provided at 400-ft. incline shaft, which will be sunk 200 ft. deeper while lateral work progresses on 300 and 400 levels. J. B. Kendall manager.

TONOPAH DIVIDE (Divide)—H. C. Brougher, president, and George Wingfield, vice-president, now at property. Opening of vein on 465 level delayed week beyond time expected. Southeast drift on 365 level advanced 380 ft. from shaft crosscut and still in high-grade ore. Crosscuts northeast and southwest started at 350-ft. point in this drift. Raises being driven from second and third levels to connect for air with levels above, and all in good ore. Output, 40 tons daily, all broken in development work, is hauled by teams six miles to MacNamara mill, at Tonopah. Treatment cost $5 per ton. New milling contract provides for treating from 40 to 60 tons daily. Divide ore requires greater settling capacity, but less regrinding than ore of Tonopah mines. Recovery over 90%. William Watters superintendent, and A. I. D'Arcy consulting engineer.

TONOPAH DIVIDEND (Divide)—Two veins explored on 300 level without finding commercial ore in quantity. Sinking resumed recently, and commercial ore said to have been opened in shaft below 300 level. Property well equipped and adjoins Brougher, nearly in line with Divide vein. E. P. Cullinan is superintendent.

TONOPAH HASBROUCK (Divide)—New equipment delivered at 100-ft. shaft, which is being retimbered. Tunnel, 900 ft. long, being extended and nearing main lode of mountain. Harry F. Bruce superintendent.

ORIGINAL KLONDYKE AND GOLDEN STATE (Klondyke)—Two chief producers of Klondyke district, midway between Goldfield and Tonopah, have changed hands. New owners plan to build large concentrator and pipe water from Klondyke wells, three miles distant.

CONSOLIDATED MAYFLOWER (Pioneer)—Mill tests indicate high recovery by all-sliming process to be installed soon. To enlarge 15-stamp mill to at least 150 tons' capacity. A 50-ton car of good-grade ore will be shipped soon.

MACNAMARA (Tonopah)—Additions to mill include settling vats of large diameter, Dorr classifier and additional filter capacity. Changes made to enable company to treat own ore, as ore from Divide mine, 35 tons daily, had involved use of entire mill.

TONOPAH BELMONT (Tonopah)—Bullion production for February estimated by manager at $127,000. President Clyde A. Heller has returned to Philadelphia from visit to company's mine at Surf Inlet. George H. Garry now consulting engineer for company.

TONOPAH EXTENSION (Tonopah)—Mine being explored on 1760 level.

TONOPAH MINING (Tonopah)—Recovery of $8500 in February reported from clean-up of company's mill at Millers, now abandoned and to be dismantled. Ore from company's Tonopah mines treated in Belmont mill.

White Pine County

NEVADA CONSOLIDATED (McGill)—February production of copper was 4,150,000 lb.; January, 4,400,000 pounds.

NEW MEXICO

Grant County

CHINO COPPER (Santa Rita)—February production of copper was 3,552,676 lb.; January, 4,241,000 pounds.

OKLAHOMA

Joplin District

EAGLE-PICHER (Joplin)—Electric motor installed underground. Will do away with mules entirely underground, if electric haulage is satisfactory.

POOR BOY (Miami)—After abandonment, new company has taken over property and opened good ore. Hand jigs being installed. Mill will not be used at present.

TRIANGLE (Miami, Okla.)—Mill on plant near Commerce being torn down, and mine will be abandoned.

SOUTH DAKOTA

Pennington County

AMERICAN TIN (Hill City)—Will purchase a Telsmith gyratory crusher, a Hardinge conical ball mill, three Richards pulsator classifiers, one settling cone, an electric furnace, two oil storage tanks and other equipment at an outlay of approximately $21,000. Ralph A. Meyer, engineer in charge. C. P. Bland, 805 Chestnut St., St. Louis, Mo., treasurer.

UTAH

Davis County

AMERICAN EAGLE (Farmington)—Tunnel to cut vein showing ore on surface, now in 175 feet.

Juab County

GEMINI (Eureka)—Will provide 500-gal. additional pumping capacity for both this and adjoining Ridge & Valley, if ore showing below 1800 level continues good as at present.

Salt Lake County

ALBION CONSOLIDATED (Alta)—Mineralization showing at depth of 800 ft. below and 100 ft. to north of old productive Wellington workings.

SELLS (Alta)—Following elected as directors: A. O. Jacobson, president; John Zinc, vice-president; W. H. Weigher, John Gallacher and Dr. J. F. Flynn. Assessment of 1c. a share levied, due Apr. 12 and delinquent May 5. Operations carried on through winter. Shipments hampered by bad roads.

Salt Lake County

OHIO COPPER (Bingham Canyon)—January production of copper was 395,150 lb.; December, 183,311 pounds.

UTAH COPPER (Bingham Canyon)—February production of copper was 10,335,000 lb.; January, 10,500,000 pounds.

UTAH METAL AND TUNNEL (Salt Lake City)—Note sent to stockholders of special meeting to be held in Portland, Me., Mar. 26, to authorize $750,000 bonds, and increase capital stock from 725,000 shares, $1 par, to 800,000 shares, same par. Company has issue of $225,000 of 6% convertible bonds due Apr. 1; majority of holders of these said to be willing to take new bonds in exchange.

WASHINGTON

Ferry County

ADDISON COPPER (Keller)—To install boiler and small compressor plant. Part of machinery shipped to Wilbur, 28 miles from Keller.

ILLINOIS COPPER AND SILVER (Keller)—Plans extensive development. Under new management.

WALLA WALLA COPPER (Keller) — To start new 500-ft. tunnel soon.

Stevens County

WESTERN TALC (Mondovi)—Installing 1200-ft. tramway from mine to mill.

CANADA

British Columbia

COPPER DISCOVERY reported at head of Gun Creek on Copper Mountain, in Mackinnon Mountain Range.

GRANBY CONSOLIDATED (Anyox)—Smeltery operation still suspended owing to recent fire. Repairs will take about a month. Question of acceptance by employees of proposal to return to sliding wage scale is still undecided.

GRANITE-POORMAN (Nelson)—Kootenay Gold Exploration Co., operating this property, bonded from Kootenay Gold Co., expected to resume work soon.

CONSOLIDATED M. AND S. (Trail)—Ore shipped to smeltery week ended Feb. 28 was 7386 tons, compared with 6921 tons preceding week.

MANDY (Schist Lake)—Ten thousand tons copper ore hauled from mine to Sturgeon Lake since January, and will be brought to The Pas by water in spring and shipped to Trail smeltery.

Ontario

FEBRUARY SHIPMENTS of silver ore over Temiskaming & Northern Ontario Ry. were 1187 tons of 2000 lb. Buffalo shipped 220 tons; Coniagas, 219; Dominion Reduction, 95. Hudson Bay, 31; Kerr Lake, 74; La Rose, 74; McKinley-Darragh, 239; O'Brien, 96; Penn-Canadian, 52; Trethewey, 41; and Pittsburg-Lorrain, 47. Above was shipped to: Deloro S. and R., 491 tons; Coniagas Reduction, 87; and American S. and R., 609. Alexo shipped 83.5 tons nickel ore.

CULLEN-RENAUD (Boston Creek)—Shaft down 50 ft., with satisfactory results. Will be continued to 150 feet.

KERR LAKE (Cobalt)—February production of silver was 95,313 oz.; January, 118,985 ounces.

McKINLEY-DARRAGH (Cobalt)—Pumping equipment with daily capacity of 350 tons ready for pumping sand from bed of Cobalt Lake to oil-flotation mill as soon as weather permits.

NIPISSING (Cobalt)—No shipments in February, though company mined ore of estimated value of $243,176.

BURNSIDE (Kirkland Lake)—Thirty ton mill pronounced in good working condition.

ONTARIO KIRKLAND (Kirkland Lake) —Shaft down 150 ft. and still in vein. Will go to 300 feet.

DOME EXTENSION (Porcupine)—Option to Dome ratified by shareholders, and work started on 600 and 1050 levels to explore Dome Extension ground.

ATLAS (West Shining Tree)—Company formed to develop group of claims comprising 400 acres.

MEXICO

Sonora

NACOZARI CONSOLIDATED (Douglas, Ariz.)—Main development tunnel advanced over 100 ft. in February with hand drills. Machine drills installed on Mar. 3. Heading now in brecciated zone showing sulphides of silver, lead, and copper. Company pushing development work, stoping being limited to extracting gold-silver-lead ore.

CHILE

CHILE COPPER (Chuquicamata)—February production of copper was 5,376,000 lb.; January, 6,878,000; and December, 10,902,000 pounds.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—February clean-up was $88,000.

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver		Mar.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
13	4.7575	101⅛	47¾	17	4 7575	101⅛	47¾
14	4.7575	101⅛	47¾	18	4 7575	101⅛	47¾
15	4.7575	101⅛	47¾	19	4.7575	101⅛	47¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
13	14¾ @14⅞	68	5 20 @5.25	4 95 @5.05	6.05 @6.10
14	14⅝ @14⅞	68	5.15 @5.25	4 95 @5.05	6.05 @6.10
15	14¾ @14⅞	68	5.15 @5.25	4 95 @5.00	6.05 @6.10
17	14¾ @14⅞	68	6.15 @5.25	4.95 @5 00	6.10 @6.15
18	14¾ @14⅞	68	5.15 @5.25	4 95 @5.00	6.12½ @6.17½
19	14¾ @14⅞	68	5.15 @5 25	4.95 @5.00	6.12½ @6.17½

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0 125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

Mar.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
13	76½	72¼	(*a*)	241¼	233	28	25½	38
14	76½	72¼	80	241	232	28	25¼	38¼
15	...	...	...			...	...	
17	77	73	81	238	229¾	28	25¾	38
18	79	74½	81½	238	229½	28	26½	39
19	77¾	74¾	82	237	230	28	27	39

(*a*) No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Mar. 19, 1919

The special features of the markets this week were increased activity in copper and zinc. Copper was firmer in tone, and in zinc there was a slight advance in price. Lead, on the other hand, was duller and distinctly weaker.

Copper, Tin, Lead and Zinc

Copper—An increased business was done, and producers were firmer in their prices, almost all asking 15c., delivered, equivalent to 14⅞c., cash, New York, and getting that price for a large part of the business. However, there was still some shading of prices and indirect concessions, down to a basis of 14¾c., cash., New York, and export business was done at that figure. A particularly noteworthy development of the week was considerable inquiry from abroad and the consummation of some respectable business for export. The stocks of copper in Great Britain and France are known to be large, but it is conjectured that they are not being offered for sale in ways that appeal to buyers, who prefer to some extent to purchase new copper in this market.

During the week freight rates have advanced, and against the former rate of 1c. per lb. the present quotation is 1¼@1½c., but what can be done is nearer the lower figure than the higher.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17@17½c. per lb. f.o.b. mill, carload lots.

Tin—There were no new features of interest in this metal.

Lead—Lead was more freely offered from many quarters, and orders for lots of considerable size were taken at sharp concessions. The market was decidedly duller than in the previous week and the aggregate of transactions was less.

Zinc—There was an increase in the volume of business, which swelled to fair proportions, a large part of it being apparently of speculative character. However, there was some buying by consumers. The effect of the demand was to advance the price moderately.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. There is a slightly better feeling in this market.

Antimony—This market was dull and weaker, small business being done at 6⅞@7c. for spot. There was scarcely anything reported in futures, but shipments were offered at 6½@6⅝ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The decline continued. At the close we quote the market at $70, unsettled. San Francisco reports, by telegraph, $72, steady.

Silver and Platinum

Silver—Silver remains unchanged in London and New York. It is still necessary to secure licenses from the Federal Reserve Board in order to export the metal. There were no London shipments in the last week. Under date of Feb. 27, London advises that there is decided weakness in Shanghai exchange, which for the first time in many months is a shade below parity.

Mexican dollars at New York: Mar. 13, 77½; Mar. 14, 77½; Mar. 15, 77½; Mar. 17, 77½; Mar. 18, 77½; Mar. 19, 77½.

Platinum—Fairly active. We quote refined ingot at $99@100.

Palladium—We quote $115@125.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 15—Blende, per ton, high, $45.40; basis 60% zinc, premium, $42.50@41.50; Prime Western, $41@40; sludge, $39@37; flotation, $35; calamine, basis 40% zinc, $26@25. Average selling prices: Blende, $42; calamine, $30.54; all zinc ores, $41.79.

Lead, high, $62.80; basis 80% lead, $60; average selling price, all grades of lead, $60.10 per ton.

Shipments the week: Blende, 8798; calamine, 199; lead, 1691 tons. Value all ores the week, $475,570.

Buyers stood firm, on offerings of $40 basis for Prime Western grades, and sellers were firm against selling, until, on Friday, it became known that one company, with 10,000 tons, had sold 1500 tons on $40; then there was a scramble among a number to sell. One purchasing company took 4500 to 5000 tons, and others bought liberally.

Platteville, Wis., Mar. 15—Blende, basis 60% zinc, $45 base for premium grade and $41 base for high-lead blende. Lead ore, basis 80% lead, $60 per ton.

Shipments reported for the week are 2271 tons blende and 110 tons galena. For the year to date the totals are 19,601 tons blende, 979 tons galena, and 73 tons sulphur ore. During the week 3464 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—No business.

Manganese Ore—No business.

Molybdenum Ore—No business reported. The market is quoted nominally at 80@85c. per lb. of molybdenum sulphide.

Tungsten Ore—No business was reported. There is probably still some fair quantity of ore that will be pressed for sale on which low quotations will be made, but it is the common understanding that the big stock that exists is in strong hands and will not be offered at any such prices as have been made recently on forced sales.

Other Minerals

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight.

Iron Trade Review

NEW YORK—Mar. 19

Whatever price changes result from the meeting now on at Washington (Wednesday), says "The Iron Age," the week's market, scant as business has been, has further emphasized the downward tendency. Reports have been widespread of sales of basic iron at $25 at furnace, representing a reduction of $5 a ton. One of these, assigned to the Chicago district, has been denied by the reputed sellers. The amount involved was 15,000 tons. An Ohio sale of 10,000 tons seems better established, and one in the East, also at $25.

Representing a similar decline in semi-finished steel is a sale of slabs to an Eastern mill at $40, and in heavy sheets there have been concessions of $6 a ton from the prices prevailing early in the year. Ferromanganese, spiegeleisen, and ferrosilicon have all yielded, the first two being still conspicuously over-produced.

The week's delay has added to the problems of the steel manufacturers' committee. Merchant pig-iron makers, at their separate meeting last week, formally declared against reducing their prices unless the way could be opened by reductions in raw material and labor costs. The Class 3 steel works—those which must buy pig iron at the market price—strongly protested that reductions in their products, without a cut in pig iron, would close their plants.

Among leading producers of steel there has been no change in the feeling that price reductions at this time will not produce the desired revival in buying. Reductions in copper, more drastic than have been proposed in steel, have not stimulated demand, it is argued; and the spelter market, with the price below the cost of well-equipped producers, has no semblance of life.

Meanwhile the Department of Labor at Washington has reinforced the position of the chief objectors to reductions in steel by widespread propaganda urging that high level prices are no temporary thing, but permanent. Buyers are told that in the absence of special reasons for declines in the case of particular products "it is safe to assume that prices are not going to drop."

Another Washington development is the statement from the Industrial Board that a general expectation of radical cuts in prices can thwart the whole stabilizing program; that the main thing is not so much the extent of the reduction as convincing the public that the new basis will be stable.

Many Lake Superior iron mines have checked up operations, not less than 40 on the Mesabi and Cuyuna ranges having closed temporarily. Miners are getting $5.28 per day and surface labor receives $4 84—the highest scale ever paid in the region. Freight reductions are considered necessary by the mining companies if they are to meet the expectation of lower ore prices entertained by blast-furnace men.

PITTSBURGH—Mar. 18

The iron and steel market has been absolutely stagnant the past week, as buyers have been waiting on the price reductions that are expected to result from Secretary Redfield's price deflation efforts. There has been a little buying, but only of such material as buyers absolutely had to have at once. In pig iron the business has been chiefly in carloads. In finished steel orders have run up to 500 tons. On such orders mills will give the buyer the benefit of the reduction on any tonnage unshipped at the time of reduction. The Industrial Board recently made the curious statement that the reductions it hoped to bring about would not apply upon orders already placed, but this of course would not be in accordance with steel trade practice.

It is understood the iron and steel industry's committee is meeting in New York today, preparatory to meeting the Industrial Board at Washington tomorrow, that being the meeting originally scheduled for last Wednesday, but postponed on account of Judge Gary's illness. It is possible that a schedule of tentative prices will be arranged at today's meeting, and will be approved by the Industrial Board tomorrow, but opinion in the trade is about equally divided as to whether the price reductions will be announced this week or not until late in the month. It is understood that the steel trade will insist upon the placing of fair sized Government orders, through the War and Navy departments, the Fleet Corporation and the Railroad Administration, in connection with the price reductions, not simply for the sake of the orders themselves, but as an assurance to the general buying public that the reduced prices are a fixture and constitute a safe level for consumers generally to act upon.

While it is felt that a considerable volume of iron and steel buying is banking up during this period of delay and uncertainty, there is no positive assurance that there will be heavy buying in case prices are readjusted. Even at the best it may require some time for buyers to formulate their plans, for if there is to be heavy buying there must be much construction work undertaken.

Mill operations have been decreasing somewhat from week to week, but are still remarkably large in view of the apparent dullness in nearly all consuming industries. The mills appear to have been running with a sort of momentum, which they are fast losing, and some mills decrease production materially from one week to the next. Steel production in the current week may be estimated at about 75% of capacity.

Steel prices are quite well maintained all along the line, but are subject to but little test, by reason of the smallness of individual inquiries. Plates have been shaded to the extent of $2 to $3 a ton.

Pig Iron—Production of pig iron by merchant furnaces has decreased farther, but is still large. Shipments comprise a smaller proportion of output than formerly. Foundries have accumulated some stock, but have had fairly heavy consumption. The market remains quotable as follows: Bessemer, $32.20; basic, $30; No. 2 foundry, $28; forge, $27, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh.

Steel—There is nothing at all being done marketwise in unfinished steel. Shipments of billets and sheet bars against contracts have materially decreased. Prices are unchanged but nominal as follows: Billets, $43.50; sheet bars and small billets, $47; slabs, $46; rods, $57.

Ferroalloys

Ferromanganese—The market is still in control by resale material, and not much is occurring even along that line. Resale 80% is available at $150 and 70% at about $120, at sellers' works. Spiegeleisen is nominal at $45, furnace, for 16%, with no transactions reported to show how much actual values are below the nominal figure.

Coke—Altogether satisfactory brands of furnace coke for spot shipment or balance of March are available at $4, with indifferent brands offered at less. Foundry coke is quotable at $4 50@6, the higher figure representing the view of two or three producers who have important contracts at that figure. The Pittsburgh Steel Co. has purchased the Alicia coke works, in the Connellsville region, of the W. Harry Brown interest. This is a finely equipped plant, shipping both coke and coal by water, the coke running a trifle high in sulphur, but being quite suitable for making basic iron.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan	75.630	88.702	101.125	36.682	44.356	48 438
Feb	77.585	85.716	101.125	37.742	42.792	48.027
Mar	73.861	88.082	....	36.410	43 620	......
April	73 875	95 346	....	36.963	47.215	......
May	74.745	99.505	....	37.940	48.980	......
June	76 971	99.500	....	39.065	48.875	......
July	79 010	99.625	....	40.110	48 813	......
Aug	85 407	100.292	....	43 418	49.077	......
Sept	100.740	101.125	....	50.920	49.500	......
Oct	87.332	101.125	....	44 324	49.500	......
Nov	85.891	101.125	....	43.584	48 969	......
Dec	85.960	101.125	....	43.052	48.492	......
Year	81 417	98.772	....	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23 500	(a)	110.000	92 238	125 000	106.619
Feb.	23 500	16.763	110.000	78 700	125 000	95.700
Mar.	23.500	....	110.000	....	125.000	....
April	23.500	....	110.000	....	125.000	....
May	23.500	....	110.000	....	125 000	....
June	23.500	....	110 000	....	125.000	....
July	25.904	....	119.913	....	134.913	....
Aug.	26 000	....	122.000	....	137.000	....
Sept.	26 000	....	122.000	....	137.000	....
Oct.	26.000	....	122.000	....	137.000	....
Nov.	26 000	....	122.000	....	137.000	....
Dec.	(a)	....	118.447	....	133.167	....
Year	24.628	....	115 530	....	130 507	....

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248 657
February	92.000	66.801	311.525	223.963
March	(a)	....	318.875	....
April	(a)	....	329.905	....
May	(a)	....	364.217	....
June	(a)	....	331.925	....
July	(a)	....	360.347	....
August	(a)	....	380.900	....
September	(a)	....	343.905	....
October	(a)	....	335 543	....
November	(a)	....	323.550	....
December	(a)	....	267.736	....
Av. year	(a)	....	330.138	....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5 432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	......	7.091	......	29.00	......
April	6.772	......	6.701	......	29.00	......
May	6 818	......	6.704	......	29 00	......
June	7.611	......	7.511	......	29.00	......
July	8.033	......	7.750	......	29 00	......
August	8.050	......	7.750	......	29 00	......
September	8.050	......	7.750	......	29 00	......
October	8.050	......	7.750	......	29.00	......
November	8.050	......	7 750	......	31.20	......
December	8.564	......	6.324	......	40.00	......
Year	7.413	......	7.222	......	30 10	......

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7 272	7 661	6 922	54 000	56 045
February	7.814	6.623	7 639	6.273	54 000	48.160
March	7.461	....	7.286	......	54 000	....
April	6.890	....	6 715	......	54 000	....
May	7.314	....	7.114	......	54 000	....
June	8.021	....	7 791	......	54 000	....
July	8.688	....	8 338	......	54 000	....
August	8 985	....	8 635	......	54 000	....
September	9 442	....	9 092	......	54 000	....
October	8 801	....	8 451	......	54 000	....
November	8 491	....	8 141	......	54 100	....
December	8 163	....	7.813	......	56.050	....
Year	8 159		7 890		54 180	..

New York and St Louis quotations, cents per pound London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33 60	$33 95	$31 40	$33 95	$32 40
February	37 25	33 60	33 95	31 40	33.95	32.40
March	37.25	....	33 95		33.95	....
April	36 15	....	32 95	....	33.95	.....
May	36 20	....	33 00		34 00	......
June	36 36	....	33 16	......	34 16	......
July	36 60	.....	33 40	......	34 40	......
August	36 60	...	33 40	......	34 40	......
September	36 60	......	33 40	......	34 40	.....
October	36 60	......	34 40		35 40	....
November	36 60	......	34 40	......	35 40	......
December	36 60	......	34 40	......	35 40	......
Year	$36 67	.....	$33 70	...	$34 45	....

‡ As reported by W. P. Snyder & Co

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 18
Alaska Gold M	3⅛
Alaska Juneau	2
Am.Sm.&Ref.,com.	68¼
Am.Sm. & Ref., pf.	105
Am.Sm.Sec., pf., A.	91
Am. Zinc	13½
Am. Zinc, pf	45
Anaconda	60⅝
Batopilas Min	1½
Bethlehem Steel	64
Butte & Superior	20½
Butte Cop. & Zinc	6¼
Cerro de Pasco	32¾
Chile Cop	18¼
Chino	33¾
Colo. Fuel & Iron	42¼
Crucible Steel	66¾
Crucible Steel, pf.	93¾
Dome Mines	12¾
Federal M. & S.	10
Federal M. & S., pf.	38½
Great Nor., ore ctf	42¾
Greene Cananea	42
Gulf States Steel	56½
Homestake	98
Inspiration Con	48¼
International Nickel	25¼
Kennecott	30
Lackawanna Steel	69
Mexican Petrol	185½
Miami Copper	22½
Nat'l Lead, com	66½
National Lead, pf.	106
Nev. Consol	15¼
Ontario Min	6½
Ray Con	19½
Republic I &S.,com.	81¼
Republic I &S., pf.	102
Sloss-Sheffield	54
Tennessee C. & C.	12½
U. S. Steel, com	94¼
U. S. Steel, pf	114¾
Utah Copper	71
Va. Iron C. & C.	58
Worthington Pump	66½

BOSTON CURB*	Mar 18
Alaska Mines Corp.	‡.12
Boston Ely	.95
Boston & Mont	.50
Butte & Lon'n Dev.	.12
Calaveras	1
Chief Con	3¼
Contact	.05
Corbin	‡.25
Cortez	.13
Crown Reserve	.48
Crystal Cop	.30
Eagle & Blue Bell	2½
First Nat. Cop	1½
Houghton Copper	.25
Intermountain	‡.05
Iron Blossom	.44
Iron Cap	10½
Majestic	.16
Mexican Metals	.25
Mines of America	‡.05
Mojave Tungsten	.05
Nat. Zinc & Lead	.10
Nevada-Douglas	.18
New Baltic	1
Oneco	.20
Pacific Mines	‡.35
Rex Cons	.05
Yukon Gold	.75

SAN FRAN.*	Mar 18
Alta	.01
Andes	.08
Best & Belcher	.04
Caledonia	.05
Challenge Con	‡ 03
Confidence	‡.03
Con. Virginia	.27
Gould & Curry	.03
Hale & Norcross	.17
Jacket-Cr. Pt	08
Mexican	15
Occidental	.40
Ophir	28
Overman	01
Savage	08
Sierra Nevada	.16
Union Con	.17
Utah Con	‡ 02
Belmont	3.25
Jim Butler	.35
MacNamara	.51
Midway	.32
Mont.-Tonopah	.13
North Star	.08
Rescue Eula	.08
West End Con	1 10
Atlanta	.05
Booth	14
Comb. Frac	‡ 02
Florence	32
Jumbo Extension	12
Kewanas	05
Nevada Hills	.02
Nevada Packard	25
Round Mountain	40
Silver Pick	08
White Caps	14

COLO. SPRINGS*	Mar 18
Cresson Con	4 75
Doctor Jack Pot	04
Elkton Con	06¼
El Paso	15
Gold Sovereign	‡ 02
Golden Cycle	‡ 79½
Granite	14
Isabella	05½
Mary McKinney	06
Portland	75
United Gold M	14½
Vindicator	41

BOSTON EXCH.†	Mar. 18
Adventure	75
Ahmeek	66
Algomah	‡.30
Allouez	39
Ariz. Com	11½
Arnold	‡.20
Bingham Mines	‡8½
Bonanza	‡.10
Butte-Balaklava	‡ 22
Calumet & Ariz	‡59½
Calumet & Hecla	308
Centennial	‡13
Copper Range	39½
Daly West	‡3
Davis-Daly	‡5½
East Butte	8⅞
Franklin	‡3½
Granby	‡70
Hancock	5½
Hedley	‡12
Helvetia	‡.22
Indiana	‡.75
Isle Royale	24½
Keweenaw	‡.09
Lake	‡3½
La Salle	‡2½
Mason Valley	2½
Mass	‡4
Mayflower	3½
Michigan	‡2½
Mohawk	52½
New Arcadian	‡1½
New Cornelia	15
New Idria	‡9½
North Butte	9½
North Lake	‡ 50
Ojibway	‡1½
Old Dominion	32
Osceola	‡49
Quincy	55
St. Mary's M. L.	‡42½
Santa Fe	‡ 25
Seneca	‡14
Shannon	2
Shattuck-Ariz	‡14½
So. Lake	‡1
So. Utah	‡.14
Superior	5
Superior & Bost.	1⅜
Trinity	2½
Tuolumne	‡ 82
U. S. Smelting	49½
U. S. Smelting, pf.	49½
Utah Apex	2½
Utah Con	8
Utah Metal	2
Victoria	‡1½
Winona	‡ 90
Wolverine	‡17½

N. Y. CURB†	Mar. 18
Big Ledge	50
Butte & N. Y.	‡ 50
Butte Detroit	‡ 05
Caledonia	.31
Calumet & Jerome	⅞
Can. Cop. Corpn	1⅞
Carlisle	‡2
Cashboy	08
Con. Ariz. Sm	1½
Con. Coppermines	‡5
Goldfield Con	‡ 18
Goldfield Merger	.06½
Greenmonster	½
Hecla Min	4¼
Howe Sound	‡3½
Jerome Verde	‡ 75
Louisiana	25
Magma	‡27
Marsh	‡.03
McKinley-Dar-Sa	47
Milford	‡.75
Mother Lode	37
Nixon Nevada	‡ 40
Ohio Cop	⅞
Rawley	‡2½
Ray Hercules	2½
Richmond	‡ 56
Rochester Mines	‡.17
St. Joseph Lead	11
Standard S. L.	½
Stewart	15
Success	‡.05
Tonopah	13½
Tonopah Ex	2⅛
Tribullion	½
Troy Arizona	‡ 10
United Eastern	4½
United Verde Ext	32½
United Zinc	½
Utica Mines	‡ 08

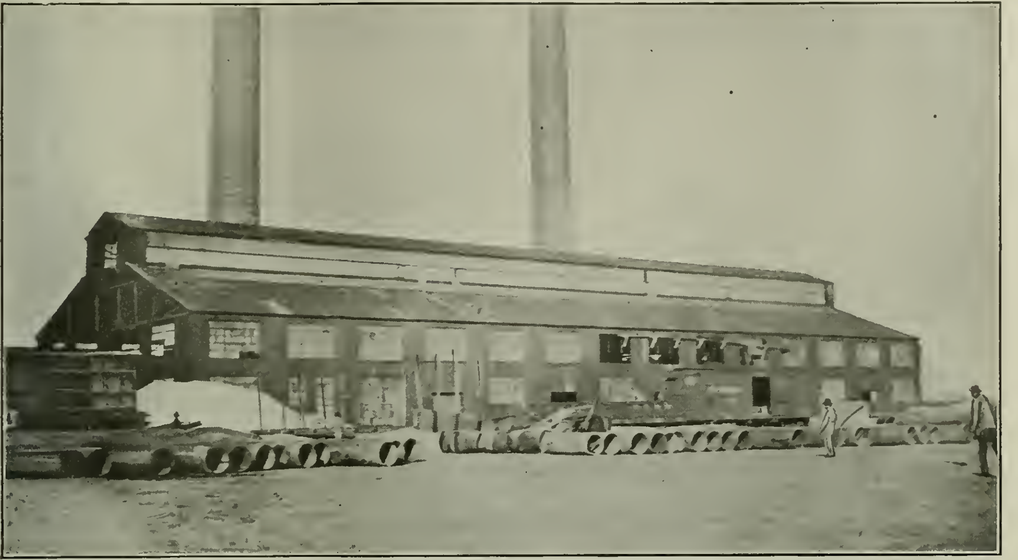
TORONTO*	Mar 18
Adanac	20
Bailey	04
Beaver Con	41
Chambers Ferland	10
Coniagas	2 25
Hargraves	02
Kerr Lake	‡5 12½
La Rose	31½
Lake Shore	‡ 91
Min. Corp. of Can	2 00
Nipissing	‡8 75
Peterson Lake	08
Temiskaming	31
Wettlaufer-Lor	‡ 03
Davidson	65
Dome Exten	27
Dome Lake	24
Hollinger	5 12½
McIntyre	.68½
Newray	.08
Porcu Crown	27
Teck-Hughes	.25
Vipond	22
West Dome	13

* Bid prices † Closing Prices ‡ Last quotations

Engineering and Mining Journal

March 29, 1919

Volume 107 *Number* 13



THE STEAMING PLANT BUILDING OF THE TEXAS GULF SULPHUR COMPANY

Operations and Properties of the Texas Gulf Sulphur Company

The sulphur deposits near the Texas coast are among the most important sources of this element. The exploitation of such deposits has been made feasible by the Frasch invention by which the sulphur is melted in situ and then pumped to the surface. Owing to the seepage of water and local collapses of ground as the sulphur is withdrawn, the operation increases in uncertainty as exploitation proceeds. The deposit described possesses several favorable features, and it is expected that an output of 1000 tons a day can be maintained when the equipment is in operation. Systematic drilling has indicated the presence of reserves of more than 10,000,000 tons.

THE sulphur deposits on the property of the Texas Gulf Sulphur Co., at Matagorda, Tex., are found at a depth varying from 800 to 1000 ft. The property is situated about 80 miles from Galveston and one mile from the coast, and is served by a branch of the Santa Fé Ry. The Gulf Coast region is noteworthy for the occurrence of domes of very slight elevation. These marked the spots where sulphur was encountered in a few instances when drilling for oil was in progress. The Matagorda dome is the center of the Texas Gulf Co.'s deposit and has a diameter of about 4000 ft. The sulphur occurs in an almost flat stratum, above which there is an unconsolidated sediment consisting of bands of shale, gumbo, and boulders. On the sides of the dome the dip becomes steep, over 45°, and the sulphur horizon thins out. The general shape is like a flat-topped umbrella. The flatness of the sulphur deposit is noticeable in view of the disturbed condition of the overlying strata, the conformation being favorable for economical removal of the product.

The various bore holes have demonstrated that there is no correlation in the matter of the deposition of the respective strata. Gumbo, shale, boulders, and limestone occur unexpectedly and in widely differing sequence. The formation of sulphur is occurring at the present time, this fact being proved by the discovery of deposits on straw used for plugging.

A stratum of salt and gypsum is found underneath the sulphur, then a layer of salt of undetermined but considerable thickness. The sulphur content of the deposit is fairly uniform, although generally one side of the dome is lower in grade than the remainder. The bore holes have, however, demonstrated that the reserves, as at present surveyed, contain over 10,000,000 tons of sulphur, thus constituting the largest of the accessible known deposits of the world.

METHOD OF EXTRACTING THE SULPHUR

The system in general use for extracting the sulphur from such a deposit as that of the Texas Gulf Sulphur Co. is of particular interest on account of novelty, simplicity, and comparative cheapness. The mining of sulphur deposits hundreds of feet below the level of the soil is done by means of apparatus well known in the mining of salt and petroleum. Indeed, many of the salt wells extend to far greater depths than are encountered in the mining of sulphur. The contribution which Frasch made to the art was the novel and ingenious idea of converting the sulphur to be mined into a liquid by melting it with hot water. When so melted it could, of course, be pumped to the surface in any usual and familiar way.

THE PROPERTIES OF THE TEXAS GULF SULPHUR C

Patents were issued to Frasch in 1891, according to which a well is bored from the surface of the dome to the sulphur deposit, "as usual in making salt and oil wells." In this well a casing is inserted, for which a diameter of 10 in. is suggested. Within the 10-in. casing, concentric pipe, for which a diameter of 5 in. is suggested, reaches to the bottom of the well. The patents state that the 10-in. pipe may be stopped at the caprock or be extended down into the mine, and that the 5-in. pipe may be provided with perforations at the side, or otherwise be "provided with a strainer." The patents further describe the heating of the water and forcing it into the mine at a suitable temperature sufficiently above the melting point of sulphur to be effective when it reached the sulphur deposit, and, accordingly, to melt the sulphur and reduce it to a fluid. Both the 10-in. pipe and the 5-in. pipe are described as connected with the heater, so that the hot water may pass down through either of them. The hot water might be forced down the outer pipe under such pressure as to force the melted sulphur up the inner pipe to the surface, or "the liquefied sulphur need not be forced up by the heat-conveying liquid, but might be pumped up in any ordinary or suitable way."

The Frasch patents, after running their full course of 17 years, expired in 1908. The process and apparatus which they covered then became public property under the provisions of the patent law. There are, in fact, only two fundamental requirements for the mining of sulphur by hot-water fusion. One is to pump down into the deposit an adequate volume of hot water at a sufficient temperature to melt the sulphur and to keep it melted. Another is to raise the sulphur out of the well by what Frasch calls "a pump or pumps" or "other fluid-moving means," including "any known or suitable substitute for a pump." With the apparatus which is provided in these expired patents, hot water can be pumped down into the deposit in ample volume and at the requisite temperature, and, when the sulphur is thus reduced to liquidity, it can be pumped out.

Instead of the sucker-rod pump an ordinary air lift was subsequently used. It was a second-hand air lift, bought for the purpose, and, when inserted in place of the sucker-rod and its various adjuncts, it operated, as might have been expected, without a hitch. Whether the sucker-rod pump was used or the air lift, the mode of operation was necessarily the same, in that in both cases the hot water forced into the sulphur deposit melted the sulphur, and the pumping devices (i.e., the sucker-rod pump or the air lift—both of which were common expedients for raising liquids from great depths in the mining industry) raised the liquid sulphur to the surface.

Almost at the end of the term of the expired Frasch patents, the Patent Office nevertheless issued additional patents to Frasch, assuming to give him a monopoly of the use of an air lift as the means of raising the melted sulphur from the deposit; but an appeal in the case of the Union Sulphur Co., *vs.* the Freeport Texas Co., in the U. S. Circuit Court, sitting at Philadelphia, has resulted in a decision which insists that the patent in question lacks the essentials of an invention. The use of an air lift, therefore, involves no infringement.

If the sulphur is melted at the proper temperature to bring it to the necessary liquidity, which is wholly a question of supplying it with hot water in sufficient volume heated to the appropriate degree, it may then be raised from the well, by any appropriate pump, including the air lift, which for many years prior to its use by Frasch had been similarly employed for raising all kinds of liquids from deep wells.

The mining method is peculiarly effective in that a refined product is delivered at the surface. No further purification is needed, the sulphur being of the highest quality, and with less than 0.5% of foreign constituents. The Texas Gulf deposit contains no deleterious elements, such as arsenic, with the result that a high-grade product is obtainable by following simple operating methods.

The molten sulphur flows to an inclosure, where it hardens. Boards are placed to maintain the shape of the accumulation, which may be of any size desired. There is no deterioration and no limit to such a method of storage. After being broken up as required, it is loaded by steam shovel into railroad cars.

The fuel efficiency of the system is, at best, low and seldom exceeds 3%. Extensive seepage of hot water occurs, particularly as the exhaustion of the deposit continues, with the result that a reliable and ample water supply is a necessity. The Texas Gulf Sulphur Co. is particularly well situated in this respect; and, in addition to a satisfactory water supply, both from wells and the Colorado River, possesses a reservoir with a capacity of 250,000,000 gal. It is believed that the water consumption will average from 2000 to 4000 gal. for every ton of sulphur recovered. A quantity of water at a comparatively high temperature is "bled" through drill holes to the surface, but it has been found impracticable to utilize it or recover any proportion of the heat units contained. As some lime and gypsum are dissolved in the water during its underground peregrinations, it can only be run to waste.

The Texas Gulf Sulphur Co.'s boiler plant consists of 14 Stirling boilers of a total capacity of 10,000 hp. and operating at 125-lb. pressure. Steam from these boilers is used to heat the water pumped underground to melt the sulphur. The buildings are of fireproof construction throughout. Surface and underground tanks are provided for the storage of oil used as boiler fuel, which is procurable locally at a comparatively low cost, or can be obtained from Mexico by steamer. A complete auxiliary equipment is provided, consisting of machine shop, warehouse, and other buildings.

MATAGORDA, MATAGORDA COUNTY, TEXAS

A Large Turbo Blower

At its plant at Copper Cliff, Ontario, the International Nickel Co. has installed what is probably the largest turbo blower yet constructed. Commenting upon this installation, *Iron Age* says:

"The machine is driven by a self-starting synchronous motor, running at a speed of 1500 r.p.m. on 25-cycle, 3-phase, alternating current. The motor is direct-connected to the turbo blower, which is an 8-stage machine with casing completely water jacketed. The blower compresses 42,000 cu.ft. of air per min. to a pressure of 14 lb. per sq.in. The machine is equipped with a constant pressure or volume regulator, which causes the blower to deliver at a constant and adjustable pressure and which may be connected to deliver air at a constant and adjustable volume.

"The exceedingly large size of the blower is due more to the low speed, 1500 r.p.m., than to the power of the machine, and if driven up to a speed for which it is amply strong, it would have 6000- or 7000-hp. capacity. As it is, when running at 1500 r.p.m., the machine absorbs approximately 2500 hp. The shipping weight of the blower is approximately 350,000 pounds.

"With this type of blower construction a stiff shaft is always employed, which never goes through the critical speed, and the impeller blades are mounted directly in 'T' heads machined in the shaft forging. The impeller blades are robust in construction and taper rapidly to the periphery. In addition to the strength which this construction gives, no end thrust is developed within the blower, as there is a complete absence of longitudinal disks, against which any small air pressures could act to create end thrust. The entire impeller is placed with reference to proper clearance to the casing by comparatively small thrust collars carried in one of the supporting journals. The row of large rectangular openings along the side of the blower casing gives access to the water-cooling jacket, which completely encircles the air end casing. The 2000-kw. motor which drives this unit can be started without taking from the line more than approximately its full load kva. rating and requires no auxiliary starting apparatus other than the usual auto transformers and switchboard equipment. Both motor and blower bearings are lubricated with centrifugal oil pumps."

Metallurgy of the Oklahoma-Kansas District[*]

BY ROBERT W. JOHNSON AND C. E. HEINZ

MILLING methods in the Oklahoma-Kansas section of the Joplin district have been changed and improved from time to time during the history of the field, but as the changes and improvements have been only a gradual growth from the first days of the district to the present time, the authors can attempt to make this paper only a review of the results obtained to date, and from the information thus compiled venture a prediction as to why and how they are subject to improvement.

In a typical mill under present conditions most of the ore is handled under a standard flow sheet. The ore or "dirt" hoisted is sent over a 6-in. grizzly constructed of railroad rails; at this point it is hand culled, the rich boulders being hand broken and dropped into the hopper with the "dirt"; the lean or bare rock being hand trammed and dropped into the waste or boulder pile. From the hopper the "dirt" passes through a Blake-type crusher, set to less than 1½ in., and two sets of rolls—"dirt and return"—and is screened usually to ⅜ in. by a trommel. The complete undersize from this trommel screen serves as the feed for one or two Cooley rougher jigs, Harz type, usually of six compartments or cells, from which two products are obtained—a tailing, deslimed, sent to the waste pile, the sands of less than 2 mm. going to the sand tanks with the overflow water, and a smittem product, which serves as feed for a Cooley cleaner jig, usually of seven compartments or cells. From this cleaner jig the cleaned lead and zinc concentrates go to the bins, and the tailings go to supplementary sand and chat jigs. The middling product of the cleaner, after being crushed, is sent back over the cleaner circuit. The tailings from the sand and chat jigs are sent direct to the sand tanks, the sands from which are screened to 1½ to 2 mm. and distributed to the tables by launders with "pseudo" classifiers.

This standard flow sheet of milling has been altered in some respects in a few of the mills of the district. Some have cut the fines from the coarse at the head of the mill and jigged them separately, with a recrushing of a portion of the larger sizes; others are crushing all the ore to a finer size at the head of the mill and paying more attention to recrushing middlings. Much better systems of dewatering and desliming of tailings are in use, as are also many Dorr thickeners for the saving of fines, in some of the mills being followed by flotation units. Many of the mills have eliminated the classifying launders for the table feed and are using a mechanical distributor; and most of them have ceased to return the enriched cleaner middlings over the cleaner circuit, but, instead, treat the middlings on a separate jig or crush them and send them to the table feed.

Results at the present time can best be exhibited by presenting statistics and analyses showing an average of the entire district. It should be understood that many analyses varied, as two mills almost within a stone's throw of each other may have widely varying ore—one free milling and the other chatty; one extremely leady and the other free from lead; therefore the application of these figures should take this into consideration, as they are an average of the entire district for the last one and one-half years, covering all types of mills and grounds.

TABLE I. AVERAGE ANALYSIS OF ORE (CONCENTRATES) SOLD IN PAST ONE AND ONE-HALF YEARS (MADE FROM OVER TEN THOUSAND CAR SAMPLES)

	Per Cent. Metallic	Per Cent. Minerals
Zinc content	58.60	87.90
Iron content	1.60	3.44
Lead content	1.04	1.18
Lime content (CaO)	.90	1.72
Acid insoluble (sand)	5.20	5.20
Sulphur	31.28	.....

TABLE II. AVERAGE ANALYSIS OF COARSE MILL TAILINGS (COVERING NINE-MONTH PERIOD, FIFTY MILLS AND ONE HUNDRED SAMPLES COMPLETELY SCREENED)

	Per Cent.
Zinc blende (ZnS) content	3.45
Galena (PbS) content	0.16

TABLE III. AVERAGE SCREEN ANALYSIS ON COARSE MILL TAILINGS

Mesh	Mm.	Per Cent. by Weight	Per Cent. as ZnS
3—10	(plus 1.5)	65.60	3.20
10—48	(plus 0.29)	24.50	2.40
48 through	(through 0.29)	9.90	6.20

This shows 63% in the plus-10 mesh, 18% in the minus-10 plus-48 mesh, and 19% in the minus-48 mesh.

TABLE IV. AVERAGE ANALYSIS OF ROUGHER TAILINGS

	Per Cent.
Zinc blende (ZnS) content	3.09
Galena (PbS) content	0.06

TABLE V. AVERAGE SCREEN ANALYSIS OF ROUGHER TAILINGS

Mesh	Mm.	Per Cent. by Weight	Per Cent. as ZnS
3—14	(plus 1.25)	77.00	2.90
14—48	(plus 0.29)	20.40	2.30
48 through	(through 0.60)	2.60	13.10

This shows 72% in the plus-14 mesh, 15% in the minus-14 plus-48 mesh, and 13% in the minus-48 mesh.

TABLE VI. AVERAGE ANALYSIS OF SLUDGE OR TABLE TAILINGS

	Per Cent.
Zinc blende (ZnS) content	4.56
Galena (PbS) content	0.25

TABLE VII. AVERAGE SCREEN ANALYSIS OF SLUDGE OR TABLE TAILINGS

Mesh	Mm	Per Cent. by Weight	Per Cent. as ZnS
20—48	(plus 0.29)	35.40	2.70
48—100	(plus 0.14)	33.20	2.20
100 through	(through 0.14)	31.40	9.40

This shows 20% in the plus-48 mesh, 15.3% in the minus-48 plus-100 mesh, and 64.7% in the minus-100 mesh.

TABLE VIII. AVERAGE ANALYSIS OF FLOTATION TAILINGS

	Per Cent.
Zinc blende (ZnS) content	5.11
Galena (PbS) content	0.47

TABLE IX. AVERAGE SCREEN ANALYSIS OF MILL FEED

Mesh	Mm.	Per Cent. by Weight
0—14	(plus 1.25)	75.00
14—48	(plus 0.29)	14.00
48 through	(through 0.29)	11.00

The above are average results from a number of different mill-cleaner jigs. Many of the different individual results varied greatly.

---

[*] Abstracted from the Joplin *Globe*.

The average recovery from the mills of the district is said to be 6%—meaning six tons of concentrates, both blende and galena, are recovered from each 100 tons of "dirt" milled. This average varies, of course, for individual mills, in the ratio that their respective grounds vary from rich to lean or poor.

From the numerous complete screen analyses of mill heads, mill tailings, rougher tailings, sludge or table tailings, flotation tailings, and concentrates, of which the preceding average analyses are a summation, the following pertinent facts concerning mill tonnage have been derived:

Disregarding the concentrates taken out, and also the middlings, smittem, and tailings returned through any circuit, the screen analysis of mill feed, and of mill, sludge, and flotation tailings, shows as follows:

Mill feed average contains 11% of minus-48 mesh material; flotation tailings are 100% minus-48 material; table tailings are 64.9% minus-48 material; mill tailings are 9.9% minus-48 mesh material. Therefore, of the 11% minus-48 mesh material in the feed, flotation tailings are 1.00 ÷ 174.5 × 100 × 11, or 6.6 parts; table tailings are 0.646 ÷ 174.5 × 100 × 11, or 4.0 parts; mill tailings are the remainder, or 0.4 parts. Derived in the same way, of the 14% of minus-14 plus-48 mesh material, table tailings are 8.1 parts; mill tailings are 5.9 parts. Of the 75% of plus-14 mesh material, mill tailings are 75 parts. Considering the screen analysis of rougher jig tailings, the mill tailings are split into 58.7 parts rougher and 22.6 parts cleaner.

Summarizing the above, gives the following totals:

	Per Cent.
Rougher tailings	58.70
Sand or chat jig tailings	22.60
Table tailings	12.10
Flotation tailings	6.60

However, since the mill at various points returns smittem, middlings, and tailings, it is necessary to follow the above percentages through the mill flow sheet to attain actual tonnages handled by various units. The rougher jig receives 100% by weight of material. This becomes 55.18% tailings and 44.82% smittem. The latter becomes, on basis of 6% recovery, 4.88% concentrates, 18.70% middlings, and 21.24% tailings. The middlings and tailings become: Sand and chat jig feed, 39.94%; middlings, 5.24%; and table feed, 34.70%. The table feed becomes, considering table and flotation together, on basis of 6% recovery, 29.47% tailings, 4.10% middlings, and 1.13% concentrates.

TABLE X. AVERAGE ANALYSES OF JIG CONCENTRATES FROM NOS. 1, 2, 3, AND 4 ZINC CELLS

	No. 1 Cell			No. 2 Cell			No. 3 Cell			No. 4 or Last Cell		
Mesh	Per Cent. by Weight	Per Cent. Zn	Per Cent. Pb	Per Cent. by Weight	Per Cent. Zn	Per Cent. Pb	Per Cent. by Weight	Per Cent. Zn	Per Cent. Pb	Per Cent. by Weight	Per Cent. Zn	Per Cent. Pb
4	2.0	62.9	0.03	0.4	63.0	0.02	....	....	....	....	....	....
6	12.1	62.3	0.03	6.0	63.0	0.10	2.7	62.9	0.03	0.03	57.0	0.55
8	21.3	62.1	0.10	10.0	63.0	0.04	.1	62.7	0.03	1.7	56.0	0.42
10	17.0	61.3	0.16	7.9	62.6	0.02	.6	62.7	0.06	7.3	57 0	0.32
14	13.1	61.2	0.17	8.5	62.2	..	10.6	62.0	0.06	12.8	59 0	0.14
20	8.5	61.0	0.17	6.9	62.0	0.02	1.2	62.1	0.06	10.7	60.0	0.05
28	6.7	61.3	0.30	12.1	61.2	0.06	7.7	63:0	0.04	20.6	60.0	0.02
35	4.4	60 0	1.10	11.7	58.2	0.06	3.0	62.3	0.02	19.4	61.5	....
48	3.7	58.0	2.10	11.0	57.0	0.10	9.6	60.3	0.02	10.7	61.4	...
65	4.4	57.3	3.60	10.8	57.3	0.16	9.0	60.0	0.02	8.2	60.3	0.02
100	3.6	53.2	7.80	8.0	57.0	1.10	5.4	59.4	0.20	5.3	59.0	0.06
100	3.2	34.8	24.20	6.3	45.1	12.00	5.0	50.6	0.60	3.8	53.0	3.10

It is assumed that all jig concentrates come off at cleaner, sand, and chat jigs, and table concentrates at tables; and that all chat jig middlings return to cleaner, and all table middlings return to tables.

Therefore, of each 100 parts of ore entering the mill, the rougher jig handles 100 parts, making 55.18 parts of tailings. Cleaner jig handles 50.00 parts; sand and chat handle 45.18 parts; tables handle 44.04 parts, making 38.82 parts of tailings.

This tonnage includes both new feed and that portion of middlings and tailings returned through various closed circuits. It has also been assumed that no sands were floated off at any jig—that the only fines at those points were those included in the tailings—those which would float off were assumed as going through to the tables, instead of calculating them out to the sand tanks and back again.

Reassembling on the basis of 94 parts of tailings out of each 100 parts of feed:

	Parts
55.18 parts rougher tailings become	58.70
38.82 parts table tailings become	41.30
Total tailings	100.00

Contents of tailings based on percentages of ZnS and PbS parts:

	Parts
Rougher tailings at 3.15% × 58.7	1.85
Table tailings at 4.81% × 41.3	1.98
Total	3.83

Of this 3.83% of ZnS and PbS combined as average analysis of tailings, 48.3% are in the rougher tailings alone, and 51.7% are in the sludge or table tailings.

Flotation units as part of the mill flow sheets operate on the sands and slimes received from sand tanks or Dorr thickeners taking jig overflow waters and sand and chat jig and table tailings. In the figures previously given, the equivalents of these fines are those given in Table VII, as no account has been taken of those floated at rougher, cleaner, etc., but they have been considered as going through to the tables.

Sludge tailings are 41.3% of total tailings and are 64.6% flotation feed—that is under minus-48 mesh—which gives 26.67% of total tailings as flotation feed. Average analysis is 5.69%. On 26.67%, this gives 1.50 parts of valuable material. Considering flotation as 70% efficient, 1.05 parts will be recovered, which is 27.4% of the total valuable content in the total tailings. This results in increasing the recovery to 7.05% and reducing tailings average percentage to 2.78.

The information thus assembled shows the following average results of the milling practice of the district:

	Per Cent.
Average metallic contents of ore (concentrates) sold	58.60
Average recovery, 6.0%, with flotation	7.05
Average tailings, 3.83%, with flotation	2.78

On these averages, the results show that present milling practice is recovering one ton of ZnS and PbS together out of every 1.64 tons of ZnS and PbS together contained in the original run-of-mine ore. This tonnage of 1.64 in the original ore is based on the assumption that tonnage of concentrates recovered, plus tonnage of valuable material in the tailings figured from analysis percentage, is not actual tonnage, however, since there is another factor not herein considered—that of the valuable material carried by the excess overflow waters when they are finally released to pond or creek as waste water. Analyses of these show a considerable proportion in slimes which probably approximate 0.1 more tonnage, or 0.06% more total valuable material, which will change the given figures proportionately.

In arriving at the averages presented it has been necessary, owing to the great variation in ore character of many of the mills, to strike a general line. The averages, therefore, are not typical of any one mill, but are for the entire district. The percentage of recovery has been greater than 6 in some of the mills, varying according to the richness of the ground mined.

In what proportion of the tailings does the flotation feed lay? Flotation requires from minus-48 to minus-65-mesh for feed. Mill tailings are 58.7% of total tailings, and contain 2.6% of minus-48 mesh material—1.53 parts of minus-48 mesh. Sludge tailings are 41.3% of total tailings and contain 64.6% of minus-48 mesh material—26.68 parts of minus-48 mesh. The two combined make 28.21% of minus-48 mesh material in the total tailings, with an average analysis of ZnS and PbS of 5.7%. Total valuable matter, therefore, in the flotation material is 1.61 parts, or 42% of the total valuable content of the tailings. If therefore, following the present practice in mills, flotation units at 70% efficiency are put in operation on tailings piles, the recovery is 1.12 parts of 29% of the total valuable contents in the tailing piles. This would increase the total recovery of 7.12%, leaving the tailings still with an average concentrate content of 2.71 per cent.

At present, therefore, there seems to be a line where the limit of flotation is reached. This limit, when flotation is used as a unit of the mill, is the percentage of fines in the ore—when the flotation process is used as individual units on residue tailing piles, it is the problem of separating and recrushing the great excess tonnage of coarser material containing 58% of the valuable matter.

The screens and analysis of cleaner jig cells show another point which also limits flotation, namely, that there is a limit to which fine crushing can be carried unless all present milling methods are discarded and all the ore is sent direct to flotation or screen classification. The analysis shows that under present crushing the presence of fines is already lowering the grade of the ore, as it is those fine particles of possible flotation feed in the concentrates that lower the zinc content and raise the sand content. Instead of increasing fines for the purpose of following up with flotation, it would seem reasonable to reduce or separate the fines. Owing to these three limiting features, flotation seems at present to have a definite place marked out for it to work upon—leaving to some other means the problem of the balance. And the biggest portion of that balance seems to lie in the plus-14 mesh material.

However, with flotation now entering the field to care for a portion of these valuable constituents that operators have neglected, a big forward step has been taken. The other portion of these valuable contents will also eventually be saved. A more careful study of the mill as a whole, as well as of the individual units of it, would make it possible for the jigs, tables, and flotation units to make a higher recovery without radical changes in the mill flow sheet. It needs only the consideration of each mill as a problem by itself successfully to accomplish it.

Licensing Hoisting Engineers In Nevada*

As a result of years of experience I am convinced that fewer accidents will occur if hoisting engineers are required to obtain licenses which mean something, and when once issued carry the dignity and recommendation that a man is a first-class mechanic in so far as the operation of a hoist is concerned. The majority of hoisting engineers with whom I have discussed the matter are in favor of such a law. In nearly every walk of life where the lives of men are entrusted to a single individual, such as a railroad engineer or a steamship pilot, standards of qualification are prescribed, and credentials are required before such men are entrusted with the lives of their fellows.

It is my recommendation that all hoisting engineers who are required to hoist men be compelled to obtain licenses before undertaking such work, and that operators be prohibited from employing men in such capacity unless a license is exhibited. The licenses should be issued, without limit as to number, by a board, which shall examine the applicants in detail and give practical tests before passing upon the qualifications. The board should be composed of a technical man, a practical man, and at least one other conversant with mining. Such a law can be put into effect without great expense and without unduly upsetting the existing scheme of affairs of the present operating engineers.

Provision can be made for the issuance of temporary licenses upon practical tests in the event of emergency, so as not to work a hardship upon the men who must earn a living that way, or upon the operators who may at times require the service of a hoisting engineer in an emergency. However, this would be only at the beginning of the working of the act, for in a short time all engineers would provide themselves with licenses. Doctors, dentists, and others are subject to the test before beginning practice, and must await the issuance of licenses, and I feel that there would be no great hardship encountered among the miners because of such a requirement.

New Shaft-Sinking Record

A new world's record in shaft sinking was obtained in December, 1918, at the Crown Mines, Johannesburg, South Africa. The shaft at which the record was made is circular, having a diameter of 20 ft. inside the walling, and during December was sunk 279 ft., or from a depth of 655 to 934 ft., the average speed being nine feet in 24 hours. The cost of sinking, exclusive of walling, was between £13 and £14 per ft. during the month.

The previous world's record was also held at the Crown Mines, where 252 ft. was made in a 31-day month at the No. 14 circular shaft of the mines; this was also a 20-ft. shaft. R. C. Warriner, 120 Broadway, New York, was consulting engineer at the Crown Mines up to the end of 1918.

---

*Abstracted from the Biennial Report, 1917-1918, of A. J. Stinson, State Inspector of Mines of Nevada.

Steam Economics in Simple Terms

By S. A. WORCESTER*

Discussion of several of the most prevalent wastes in steam-boiler and engine plants, so that managers or men in charge of properties, who have made no thorough study of steam-plant economics, may have brought to their attention possibilities for substantial savings in fuel costs. The simplest remedies for preventing waste are indicated in non-technical terms and are usually merely matters of proper adjustment and operation.

ONE of the wastes that are obvious to the trained engineer is the result that comes from the use of a boiler pressure too low for economy. The economy of the higher pressure depends on the fact that about as much fuel is burned in generating 1 lb. of steam at 1 lb. pressure as the additional fuel needed to raise this pressure to 100 lb. The given weight of steam will do about 100 times as much work at 100 lb. as at 1-lb. pressure, though requiring only twice as much fuel for its generation. Early in the history of the steam engine, the usual boiler pressures were below 5 lb. per sq.in., and the greater part of the work of the engine was done by atmospheric pressure on the piston, and was made effective by the vacuum produced at the opposite side by condensing the steam. Boiler explosions are recorded at these crude plants with pressures as low as 10 or 15 lb. per square inch.

THE ADVANTAGES OF HIGH-PRESSURE STEAM

Since the economy possible with higher pressures was learned, and materials and mechanical construction of boilers and engines were improved, steam pressures have gradually risen so that comparatively few plants of importance now use less than 150-lb. boiler pressure. and recently constructed plants carry as much as 250 lb. per square inch.

The value of higher pressure steam was impressed on me early in my apprenticeship as a machinist by an interesting experience. I was engineer and fireman for a plant of 20 nominal hp., doing usually about 10 hp. work when running only the machine shop, but using 20 hp. for a period of three hours twice a week, when it was necessary to run the foundry cupola blower at casting time. The first two days I had no difficulty in making steam for the light load, but on the third day, when the blower was started, I fell into trouble. Having had no warning of the extra demand for steam, I was not prepared and was carrying the usual boiler pressure of 45 lb. When the blower was started, the extra load soon began to pull the steam down. The coal was rather dirty and fine, and my experience in firing limited, so I put in lots of coal and stirred it often. Soon the foundry foreman appeared to inquire why the blower was running so slowly. The rest of the afternoon passed with a succession of vigorous stirrings and attempts to get more fuel into the fire box, and several unpleasant visits from the foundry men helped to keep me bathed in perspiration, and the steam kept going lower and the engine running slower until the heat was over. The next day, a machinist who had served his apprenticeship in the same shop told me of a similar experience with the same plant, and advised me, when taking on the heavier load, to have about 85-lb. boiler pressure at the start and a clean fire of coarse coal. The steam pressure should be watched closely and not allowed to fall much below 80 lb., he said. To do this I would have to partly close the drafts at times to prevent wasting steam at the safety valve, and there would be no trouble in making steam to carry the full load. He said, further, that the pressure must not get below 75 lb., or it would be impossible to get it up again with the heavy load on. I followed his instructions the next time the blower was used, and had no difficulty in keeping the fan up to top speed, proving to my satisfaction that the same plant which would not make steam to carry a certain load at 40-lb. pressure would make plenty of steam at 80 lb. to do the work.

FUEL CONSUMPTION NOT LESSENED BY LOW STEAM PRESSURE

Some years later, at a large smeltery at Monterey, Mexico, I found several Mexicans energetically trying to keep steam with a battery of modern boilers at 25-lb. pressure for a 250-hp. Corliss engine, the plant being designed for at least 125-lb. pressure. This could not have been the usual condition at the plant, because the engine was running at less than half its proper speed. If, however, someone in charge had known the importance of higher steam pressure, much labor and fuel would have been saved, and the engine could have been kept up to its speed.

It is a common idea among non-technical men that the lower the steam pressure can be kept, and still maintain the engine speed, the less the fuel consumption. A brief study of the steam tables and other information found in mechanical engineers' handbooks will make evident the economy of the higher pressures.

STEAM EXPANSION AND ADJUSTMENT OF ENGINE VALVE GEAR

The expansive use of steam in the engine cylinder and proper adjustment of the engine valve gear are matters of considerable importance in plants of any size and should be better understood by the average engineer. To illustrate the difference between expansive and throttling use of steam, suppose that the speed of an engine is controlled by admitting steam to the cylinder through a throttle valve during the whole stroke of the piston. Let the boiler pressure be 100 lb., and partly close the throttle so that the average pressure on the piston will be 25 lb. throughout its stroke.

Assuming the content of volume of the cylinder is 4 cu. ft., 1 cu.ft. of steam at 100 lb. will be required to maintain a pressure of 25 lb. for one piston stroke. Comparing this with the expansive use of 1 cu.ft. of steam at 100 lb. pressure, let the full boiler pressure be admitted to the cylinder by a wide-open throttle until the piston has made one-quarter stroke, using 1 cu.ft. of steam. At this point cut off the steam admission, using Corliss or other cut-off valve gear, and admit no more steam during this stroke. Then, as the piston travels the steam expands, filling the enlarging space, and its pressure decreases in inverse proportion to the increase in space or volume, so that at one-half piston stroke the pressure is 50 lb.; at three-quarter stroke, 33⅓ lb. and at full stroke, 25 lb. Taking an average of the four pressures, the result is 52½-lb. "mean effective pressure," as compared with the 25 lb. from the same quantity of steam by throttling.

---

*Mechanical engineer, 559 Pennsylvania St., Denver, Colorado.

Many engines run on loads so light that they cut off at one-quarter stroke or earlier, and give high expansion. Several years ago I found an ore-mill engine running regularly with a load so light that it showed, by indicator diagrams, a cut-off at less than one-tenth stroke, the steam being admitted to the cylinder at 150 lb. pressure and expanded to less than 15 lb. at the point of exhaust.

Hand-Operated Cut-Offs and Valves

Some steam engines, particularly air compressors and pumping engines, have cut-off valves made so that they may be adjusted by hand, and the steam economy of these plants depends largely on the care with which the engineer maintains the cut-off at the earliest practicable point. I once found a steam-driven air compressor at a gold mine operated by throttling control, although it had hand-adjusted cut-off valve gear. The cut-off adjustment was out of repair, and as none of those in charge knew its usefulness or importance, it was out of use. I guaranteed a 10% saving in steam and fuel if allowed to do, at my own expense, some work on the steam plant, not specifying the exact nature of the work, but agreeing not to interrupt the regular operations, and my compensation was to be a percentage of the saving accomplished. By merely making the trifling repair necessary to the cut-off adjustment, and instructing the engineer to run with the throttle wide open, regulate the speed by using the cut-off adjustment, and keep the boiler pressure uniformly high, I effected a 25% saving in fuel and was paid on that basis and thanked for my services. At another air-compressing plant operating under better conditions I saved 5% of a $1200 monthly coal bill by merely changing the adjustment from throttling regulation to governing by cut-off with a wide-open throttle.

Proper Adjustment of Automatic Cut-Offs Necessary

The majority of stationary engines of considerable size now govern their speed by using some form of automatic cut-off valve gear; that is, the valves cut off the steam early or late in the piston stroke, accordingly as the load on the engine is light or heavy. The point of cut-off is regulated automatically by a speed governor. At one steam plant which included a large cross-compound, steam-driven air-compressor, with Corliss automatic cut-off valve gear, the monthly coal bill exceeded $2400. By simply adjusting the cut-off mechanism so as to make it operative, a saving of 5% was made in the fuel bill. The master machanic, a man of experience but of no technical education, found it sometimes easier to start the compressor with the low-pressure valves not cutting off, so he left the cut-off inoperative at all times, thereby wasting fuel which cost at least $120 per month, to say nothing of the waste of water.

Noisy Exhaust Usually Indicates Waste

A practiced, observant engineer can usually tell, from the appearance and sound of the exhaust of a non-condensing engine, whether it is working economically or not. It may be assumed as a general rule in most cases that, when the exhaust is loud, steam at a pressure sufficient for considerable work is being wasted. If the noise is a succession of short, sharp coughs, quite distinct, with no roaring or hissing sound continuing between the puffs, steam is being exhausted before it has expanded to an economically low pressure.

If the engine will carry its load with an earlier cut-off, this may be the remedy. Perhaps a higher boiler pressure is allowable and necessary to make the engine carry its load with expansive use of steam. In some cases where a belted engine is running too slowly to carry its load with an early cut-off, the sizes of pulleys may be changed and the engine run at higher speed. If the engine is running near or at the practical speed limit, and so loaded that it will not maintain speed without the highest allowable initial pressure and a late cut-off, the only remedy is a larger engine.

Condition of Pipe Often Causes Contracted Exhaust

A continuous, roaring exhaust, without distinct puffs or coughs for each emission of steam, usually indicates either leakage in piston or valves or unduly contracted places in the exhaust pipe or connections. Leakage can be distinguished from a contracted exhaust by listening at the exhaust when the engine is first started from rest, at which time the hissing or roaring noise will be noticeably different from the cough of the exhaust. Contracted exhaust is most noticeable when the engine is running at full speed and load. In some cases the exhaust pipe is too small and in others it is unduly contracted at some turn, or perhaps at its end. Occasionally an exhaust is found passing through a feed-water heater with tubes too small to afford a free passage. I once found a Corliss engine operating against a back pressure of 7 lb. caused by a feed-water heater having very small tubes and preventing free escape of the exhaust.

I lived for several years within sight and sound of one of the largest steam-operated mining plants in Colorado, which included a direct-acting hoisting engine and a large cross-compound, steam-driven air compressor, both having Corliss valve gear and capable of high economy. Although in charge of well-paid managers and master mechanics, these engines have continued for years to exhaust with noise often audible at a distance of a mile or more. When the manager was once approached by a consulting engineer of broad experience with a proposal to adjust the plant so as to make a handsome saving of fuel, and asking a contingent fee of a small percentage of the saving effected, he was met with the statement that such work might antagonize the master mechanic; hence it could not be considered. The waste still continues.

At one time the engine furnishing the power for a Montana planing mill was leaking badly through the piston rings, as I judged from the sound of its exhaust. To make sufficient steam it was necessary to burn considerable coal, as well as all of the shavings and scraps made by the mill. After I had rebored the cylinder and fitted new piston rings to stop the leakage, the boiler not only required no coal but consumed only part of the mill shavings, so that the plant had shavings for sale. The repair repaid its cost in a few weeks.

News From Paris

By Mark R. Lamb

Paris is full of people. Besides the Peace Commission, there are the men from the American-British armies, the Red Cross, the Y. M. C. A., and nearly a score more organizations. There are 1600 Red Cross people here ready to go home, and no steamer space.

The soldier boy with 10 days' leave generally overstays a few days, and that helps increase congestion. Today 300 new, zealous, extra military police are stopping all our men and officers and examining papers. The results are surprising, and quite a few men will return promptly to where they belong. Hotels are full. Lodging houses have been full for a long time. Private families do not like the idea of renting rooms or providing board, even when good prices could be obtained. The result is that the French consuls have been advised that no more people are desired in Paris. Those of us who saw no war, and who did not suffer, are inclined to wonder why things do not get down to a peace basis more quickly. Ordinarily, what a city wants is visitors, but here is Paris imploring the visitor to stay away, and actually trying not to receive him for another six months. An American company with headquarters in London has been trying for three months to get its employees here to a branch office.

Good business will be done here—much more than before the war. The country is starved for good things to eat and wear. I tried to buy some dresses for my little girl, but the merchant advised me first to ship the silk and dyes to France. No silk has come here for years, and the dyes available are not of the best. No one, however, will succeed in replacing the art and craft of the Frenchman in building gowns, and so he ought to be supplied with the materials. The railways are said to be in bad condition, but to me the rails I have seen and ridden over seem good enough. There is a shortage of locomotives and cars, but the Boche is kindly sending these over at top speed, and France will soon have all she needs. The American Army will have much rolling stock to sell, and France cannot afford to let England or Germany or Russia buy it.

The rivers are normal again, and traffic has begun. It requires only five or six days by canal from Havre to Paris; and now that French steamers are sailing from that port, transportation to the capital will be measurably improved. The Reconstruction Commission is busy around Lille, and, to begin with, has bought all brick and similar construction material in sight.

The French nation looks askance at the combines being formed in the United States. An example of this is the combination of the manufacturers of sugar machinery, formed by one of the large New York banks. It is not difficult for the French manufacturer of this class of machinery to visualize the destruction of his business. Even with a 60% import duty on autos, the local manufacturer finds food for thought in the recent news of the combinations planned to "dump" in Europe. If, therefore, it seems that France is not eager to welcome *every* American company or business man or bank, it must not be considered an affront nor taken too seriously, nor considered as an unfriendly act. Keen competition must be expected.

One thing is certain. Food will be welcome for a long time and in any quantity that can be imported. Four very ordinary apples cost $3.20. At that rate a real Oregon apple would sell for $1. Butter is $4 a pound, but none is served at the hotels. Perhaps the newly released German ships will better this situation. It must be plain, however, that until food costs are brought down at least to American levels, Europe cannot be expected to offer a very attractive market to America; and those terriers in Washington who are barking at Hoover should be reprimanded by the business people as quickly as possible.

A snowstorm and a subway, surface car and bus strike occurred simultaneously in Paris recently, the result being astonishing. The sidewalks were congested with people. Fortunately the distances are not great, and, also fortunately, the strike lasted only one day. The surface cars and busses have an interesting way of determining priority when the crowd exceeds the capacity of the car. The passenger, on arrival at the station, takes a numbered ticket from a rack. This ticket is intended to obviate the necessity for standing in line, as the conductor calls the numbers, and the respective passengers step aboard as their numbers are called. How would that system work on the New York subway or on the "L"?

The hotels here, even with the diplomats out of the way (and they will be here for years) are wholly inadequate. Of course no new ones are being built. At best, some old buildings are being remodeled and used as annexes to present hotels. M. René Werthemie has just purchased a five-story building which was begun before the war and is not yet completed. It is to be made into a modern office building, but it will be several months before it is complete. It will surely be filled immediately, as offices are extremely scarce and unsatisfactory. Paris surely needs food and hotels and office buildings.

Beginning on Feb. 1, one will be permitted to have and to use a registered cable address. This is a great improvement, as it means an economy in every cable dispatch. Business cables arrive promptly from the United States and are slightly delayed returning from here. It would be a great help if Mr. Burleson would have the cable companies indicate date of transmission on the cable itself. This is done by the French and English postoffices through which cables are sent. The delay is less important if one knows its extent. As late as the beginning of January it was necessary to show one's passport in sending cables. Now this is not demanded in every case, which indicates a relaxation in the rules.

After being closed for five years, the famous, gorgeous restaurant of the Grand Hotel was opened recently. You New Yorkers who like to loaf in Paris will know what that means and what a throng was there—diamonds and pearls, paint and powder, goldlace uniforms and plain American khaki mixed with a confusion of laughter and tinkling glasses. Paris is not dry—positively!

The Rise in Cost of Zinc Mining in Wisconsin

BY W. F. BOERICKE*

A comparison of costs of mining and milling zinc ores in Wisconsin in 1918 with similar operating expense in 1914. A constant tonnage has been assumed, and on this basis the variation in cost of the different items involved has been considered. The analysis permits a detailed study of the problems which have arisen; and the author of the paper classifies and discusses possible developments which would insure a continuance of mining operations in the district and the future prosperity of the zinc-mining industry.

THIS article has been prepared in an effort to obtain definite figures to denote the ratio of increase in the cost of zinc mining in Wisconsin between January, 1914, and December, 1918, or, in other words, to record the increase in costs between the pre-war period and the signing of the armistice. It is obvious, upon reflection, that no correct ratio can be obtained by comparing *per-ton costs* of 1914 with those of 1918. As costs are dependent on tonnage hoisted, other things being equal, the consequent variations will depend entirely on the condition of the mine, the efficiency of the labor, and the ability of the management. It would be possible to operate at much lower costs in 1918 than in 1914, in spite of higher wages and prices of supplies, if the tonnage had been increased largely by improved conditions in the mine during this period and by the substitution of labor-saving machinery and cost-reducing appliances under a progressive management. On the other hand, if the case be reversed, it might have been good policy to try selective mining, with a decrease in tonnage, which would show an increase in cost out of all proportion to the actual rise.

Cost Comparison Possible by Assuming Fixed Tonnage

It follows, therefore, that, to ascertain the precise ratio of the increase in mining costs, it is necessary to assume a constant tonnage, and to investigate the increase in the separate elements that enter into the cost of mining. This comparison appropriately may be made on the figures for 1914, as related to those of 1918. A true ratio of increase of such items will then be available, assuming that all conditions of mining, and the efficiency of labor and management, have remained constant.

It may be objected that it is not fair to make this assumption, because, in all successful enterprises, there is, or should be, an increasing efficiency of labor and management that tends to lower costs every year. To this objection the reply can be made that the purpose here is to inquire solely into the rise in operating expense that has entered into nearly every element of mining. Such an increase has been largely beyond the power of the individual to influence one way or the other; and it may be left to the manager to determine whether the increased efficiency of his mine and methods has compensated for that rise.

Considered from another angle, it may be said that such a comparison of cost figures will serve to show, theoretically at least, the price that a zinc operator may justifiably expect to receive for his product to compensate him for the increased cost of operation over 1914, assuming that his mill recovery and grade of concentrate are no better and no worse than in 1914, and that his mine "dirt" contains the same number of pounds of zinc per ton as formerly.

The typical costs of a Wisconsin zinc mine may be divided into: Mining: Labor—includes all underground and surface men, except in the mill; powder; supplies—all except for milling. Milling: Labor; supplies. Power.

In a typical cost sheet for 1914, the expenditure under these heads was divided about as follows, in percentages of the total per-ton cost: Mining: Labor, 50.5%; powder, 7.3%; supplies, 8.5%. Milling: Labor, 6.6%; supplies, 4.6%. Power: 22.5%. This classification allows nothing for general expense, including such items as head office, taxes, and insurance charges, the disposition of which may be considered distinct from the working cost.

By regrouping and simplifying the figures given, the following percentages are obtained: Total labor, 57.1%; powder, 7.3%; total supplies, 13.1%; power, 22.5 per cent.

Payroll Uniform in Larger Mines

The advance in price of labor can be easily calculated from a comparison of the payrolls of 1914 and 1918. The wage scale at the various mines in the district is fairly well standardized, although there are small differences, in some instances on account of special local conditions. But the larger mines maintain wage scales that do not differ much from one another; and this is especially the case where a number of mines are run by a single operating company. Hence a comparison of the wages paid to the different classes of labor at one of the leading mines will serve as a fair index of the rates of pay in the entire district. The following table gives the main division of a typical mine payroll, with rates paid in 1914 and 1918, respectively, and per cent. of increase:

WAGE RATES IN TYPICAL WISCONSIN ZINC MINE, 1914 AND 1918

Occupation	Wages, 1914 (a)	Wages, 1918	Increase, Per Cent.
Drill men	$2 25	$4 00	77
Shovelers, contract, per car	.08	12	50
Shovelers, day pay	2 00	3 50	75
Trammers	2 00	3 50	75
Track men	2 25	3 40	51
Hoist men	2.25	3 40	51
Jig men	3.00	4 25	42
Mill helpers	2 00	3 50	75
Ordinary unskilled hands	2.00	3 40	51

(a) Nine-hour shift.

No great error is involved in taking the average of these increases to be the increase in the cost of labor, although for mine accuracy these occupations should be prorated in the total payroll, and the average increase thus obtained. A somewhat long calculation based on this showed the average increase of wages to be 57 per cent.

---

*Mining engineer, Galena, Illinois

The price of 40% dynamite, the standard explosive in the district, in 1914 was $10.56; in 1918, $21.50. This is an increase of 103.6%. The increase in the price of supplies is difficult to estimate, except approximately, on account of the great variety and number of articles needed at the mine and mill, and the changing demand. Some supplies, for instance, that were in good demand in 1914 have been almost totally eliminated from use in 1918. Inasmuch as the whole amount allowed for supplies is only 13% of the total cost, even a considerable variation will not materially affect the record. The following figures provide a comparison of the costs of materials in 1918 with like costs in 1914, the increase being as follows: Drill steel, 93%; shovels, 111%; mule feed, 41%; mine rail, 100%; oils, 54%; pipe, 125%, and carbide, 46%. An average increase of 60% in the cost of all supplies for mine and mill is probably a conservative estimate. As practically every mine in the field is now operated by electric power, a direct comparison can be made of the increased cost of power. The increase allowed by the commission amounts to 32.5% for the large consumers. By applying these increases against the separate costs already shown, it is possible to obtain the increased cost of operation, thus:

INCREASED COST OF OPERATION AT WISCONSIN ZINC MINE

	Per Cent., 1914	Per Cent., 1918	Ratio of Increase
Labor	57.1	89.6	1.57
Powder	7.3	14.8	2.03
Supplies	13.1	20.9	1.60
Power	22.5	29.8	1.325
		155.1	

The unit costs have therefore increased 55.1% over those of 1914. Applying these figures concretely, it is patent that if the working cost per ton of mine "dirt" in 1913 was $1, a result generally obtained by the large operators who were working on a tonnage of over 10,000 tons a month, the cost in December, 1918, for the same amount of labor, supplies, powder, and power, would be $1.55 per ton. If the mines were then making a 10% recovery of concentrate in the mill, the cost per ton of concentrate would in 1913 have been $10. In 1918, with the same recovery, it would be $15.51.

THE SOLUTION OF THE PROBLEM

Under these conditions, the operators have four possible sources for relief: First, a reduction in unit costs to pre-war figures, through reduction in wages, and prices; second, a rise in the price received for concentrates that will compensate for the increased costs; third, an increase in the efficiency of mining methods which will offset the increased wages to labor by yielding a larger tonnage per man; fourth, to raise the grade of the ore by mining richer ground, thus increasing the mill recovery at the expense of the mine, and so lowering the cost of making concentrates.

It is questionable, however, if there is any conviction among operators that a radical reduction in wages should be made at the present time. In common with the general sentiment of business throughout the country it is felt that wages are not out of proportion to the cost of living and that any marked reduction would result in considerable hardship and ill feeling. But a readjustment in general wages is likely to occur in the near future, unless ore prices should advance.

Unfortunately for all concerned, the operators cannot expect a higher price for their product. They had their heyday of prosperity, but the high tide of inflated prices for black jack has fallen back to the old pre-war basis, leaving in its wake only a burden of high operating costs. The average price of all grades of zinc ore in 1913 was $42.69 per ton. Present prices (February) are not far from that figure.

EARLIER EFFORTS RESULTED IN IMPROVED EFFICIENCY

The third resort of the operators is to increase the efficiency of their mining methods to such a point as to compensate for the increased unit costs. Nothing is impossible, but this a large order, considering that in 1914 much progress had been made by the large companies in the direction of low costs. The question really resolves itself into this: Labor has received a 57% increase in wages. Has it returned the equivalent in increased output? Such a question put to the ground-boss would be greeted by a stream of vigorous profanity. Yet in some lines of work the output per man has notably increased, though the credit might be given more to the machine than to the operator. In drilling, especially, there has been a great improvement, due to the practically universal adoption of light one-man hammer drills; and contract prices for breaking rock in stopes are generally lower than in 1914. Output of shovelers per man has been increased about 30%, a result attributable largely to high contract rates paid and closer study of the shoveling problem, with the elimination of weaker and unfit men from this particular work. Shoveling machines have been tried at some mines, but local conditions make them difficult to operate, and little or no saving has been shown over hand work. Better tracks and the substitution of animal and mechanical haulage for hand tramming have resulted in improved efficiency in this work.

It has been hoped that the high price of powder and supplies generally would tend to make the men more careful in their use, and so aid in reducing the cost. No doubt some progress has been made along these lines, where intensive means have been taken to impress on the men the necessity of economy. With regard to economy in the use of powder, however, little comfort can be gained, for the consumption per ton of rock broken in the mine is, if anything, a trifle higher than in 1913. Of course, on account of the shortage of labor during most of 1918, it was often necessary to use powder liberally, as, for instance, in popping boulders and springing holes, when, under normal conditions, more holes might have been drilled at no greater labor cost, and some saving made in explosives.

THE WORKING OF RICHER DEPOSITS

There is no doubt that good work has been done in power economy, by closer adjustment and alignment of machinery, and better inspection generally; but the total saving, in comparison with the other factors of the cost sheet, is small. The operators therefore generally have been obliged to resort to mining richer ground; and, by thus increasing mill recovery, they have kept the concentrate cost from rising in the same marked degree as the working cost. Where this has been impossible, on account of the nature of the ore deposit, the usual policy has been to close the mine rather than to exhaust ore reserves on an unprofitable market.

Although present conditions in the district are depressing, it is believed, with reason, that much can be done in the matter of decreasing costs, even on the present wage scale. The attitude of the men generally is good, and it is thought that they will enter heartily into anything that will help keep the mines above water. Some assistance is expected from lower prices for powder and supplies. The operators feel that they have demonstrated in the past their ability to work ground at as low a cost as has been possible in any other zinc district, and, with a turn in the market, it is probable that production will again reach a high figure.

Recording Flue Temperatures[*]

When the temperature of hot gases surrounded by colder surfaces is measured with an ordinary thermometer or a protected thermocouple, the temperature indicated by the measuring instrument is always too low. Heat is constantly radiated from the measuring instrument to the colder surfaces, thus keeping the temperature of the instrument lower than that of the hot gases. The error may amount to several hundred degrees Fahrenheit.

The greater the difference is between the temperature of the gases and that of the surrounding surfaces, the greater is the error. Also, the error is larger with instruments having the exposed parts large than with those in which such parts are small. Thus, for an example, a couple having the hot junction inclosed in a protecting tube will invariably read considerably lower than an unprotected couple. The smaller the wires at the hot junction of the couple, the nearer is the temperature indicated by the couple to that of the gases.

The true temperature of the gases would be indicated by a couple having the hot junction made of wire of zero diameter. The true temperature can be obtained approximately by using three or more couples of various sizes and determining from these readings by extrapolation the theoretical indication of a couple of zero diameter.

Ordinary methods of measurement of flue-gas temperatures are on the average about 20° F. too low. Copper-constantan can be used advantageously for this purpose.

Engineering Education[†]

By George F. Swain[‡]

In the words of that fine old English schoolmaster, Richard Mulcaster, who wrote over 300 years ago, which cannot be improved even today: "The end of education and training is to help nature to her perfection in the complete development of all the various powers." Its aim is to give the student power to meet the problems which life will bring him. Education is strictly utilitarian, using the word in its widest sense. The student should be taught first what is necessary, second what is useful, third what is ornamental. All of these are utilitarian, or useful in the largest sense. The objects to be aimed at are mainly two, discipline of mind, and interest; knowledge is secondary, but discipline should be acquired in subjects which will bring knowledge with it. No effective results will follow unless the student is interested and sees the value, use, and application of what he studies. He cannot appreciate what he studies, or become really and profitably interested in it, in a concrete way, unless he can relate it to his experience. Education cannot turn out a finished product, that is to say, a man fitted to take a responsible position at once. It can only fit him to begin at the bottom of the ladder, and give him the foundation upon which to build. Experience is necessary before he can advance, but, if he has a well-trained mind and the proper attitude, he should gain and assimilate experience rapidly, and progress much faster than otherwise.

We live in a world of other men. To make our way, we need, besides a disciplined mind, many other qualities, such as knowledge of men, tact, personality, perseverance, energy, enthusiasm, power to concentrate, ability to work hard and effectively, and, above all, character. Education should aim to cultivate such qualities as far as practicable.

Education may, on the one hand, be liberal or professional, or it may be vocational. The latter aims to fit young men specificially for a definite occupation, such as a manual trade, or for stenography or bookkeeping. Professional education has essentially the same object, except that a profession is broader in scope and requires a stronger and broader foundation of general principles. Vocational education may be concerned mainly with training the body, or even one muscle, rather than with training the mind. Vocational education will not be considered here, but it may be remarked that it possesses in a high degree one of the most important elements, namely, interest. The pupil becomes at once interested in the work, it is related to his experience, he sees the use and meaning of it all the time. Its results are therefore likely to be satisfactory, even more so than the results of more formal education, and its importance is steadily increasing with the recognition of the fact that one of our main problems is to put the boy in the right place and fit him for a specific job.

Engineering education is in a sense vocational, but as the field of engineering is wide, and rests upon a substantial body of principles of science, it must be broad and must deal rather with those general principles than with any specific job. Yet the line between the two is not sharp, and many graduates of vocational schools make the best of engineers ultimately.

Magnesite in California

The magnesite industry in California, in common with the other special mineral industries, experienced marked restriction at the close of the war, and, in fact, during the war, on account of the retarding of operations in the building industries. The state for years produced practically all the magnesite of domestic origin in the United States; until 1917 it was practically the only source of the American supply, according to the report of Charles G. Yale, of the Geological Survey. In that year California produced and sold 318,838 short tons, of a total value of $2,116,818, an increase of 37% in value over 1916. The Government requirements after the United States entered the war increased development and production, but the order of the Government curtailing private building operations gave the industry a sharp setback.

---

[*] Abstracted from *Bull.* 145, "Measuring the Temperature of Gases in Boiler Settings," by Henry Kreisinger and J. F. Barkley, Bureau of Mines, Department of the Interior.

[†] Abstracted from the *Bulletin* of the Society for the Promotion of Engineering Education, Dec., 1918, p. 97.

[‡] Professor of civil engineering, Harvard University.

Tunnel Driving at Copper Mountain*

BY OSCAR LACHMUND

The driving of a mine adit under the unfavorable operating conditions that existed during 1918 and the latter part of 1917 is of interest to mining engineers. The adit in question was driven with a daily average progress of 19.3 ft. and at a cost of $35.56 per ft. Before planning the work, the engineer in charge visited mining properties in the West and Southwest to observe the latest methods. This commendable practice is well worthy of more extended recognition and emulation on the part of mining companies.

DURING the driving of the main haulage level at the Copper Mountain mines of the Canada Copper Corporation, Ltd., near Princeton, B. C., remarkably rapid progress was made, though no claim for a world's record is advanced. Conditions, however, were unfavorable for economical operations. The cost of power was high, for the fuel was of poor grade; besides, during the time the work was in progress, little other power was needed, and most of the power cost was charged against the footage. The transmission line consisted of No. 4 galvanized iron wire, with the result that the line loss was considerable. The voltage transmitted was about 30,000. The plant was operated under a lease, which was due to expire about the same time that the work was supposed to be completed. An extension was refused; therefore speed was most important.

The plans called for a straight adit 2900 ft. in length. At a point 2800 ft. from the portal there are two raises to the next nearest workings, a difference in elevation of about 800 ft. One of these is to be a two-compartment hoistway and the other a zigzag ore pass, or muck run. The position of these raises had been determined by a number of diamond-drill holes, but the material to be penetrated by the adit was not known. It seemed imperative to get the tunnel work completed as rapidly as possible, to allow for delays in the raising program, which were sure to occur. To indicate how closely these operations were timed, it is interesting to note that the date of expiration of the power plant lease was Sept. 1, 1918, and the last round, making the connection between the upper and lower workings, "broke through" in the night of Sept. 3, 1918.

The plans called for a tunnel 9 ft. high by 11 ft. wide; but, owing to the "blocky" nature of some of the rock, a considerable "over-break" occurred. This enlarged the tunnel cross-section to 10.4 ft. by 12 ft. indicated by measurements taken at 200-ft. intervals after the work was finished, and slowed up the work, on account of the extra waste handled, besides increasing the cost per foot of driving. Several zones of geological disturbance were crossed, and the heavy ground encountered necessitated the use of timber supports. More than 350 ft. of heavy timbering was placed at various points along the course of the tunnel; this also retarded the work to the extent of about 6 ft. per day for each set of timber placed. Once the working force was organized and the work well under way, three shifts were put on, each working eight hours.

The drills used were of the Dreadnaught No. 60 type. They were mounted four on a horizontal bar, from which position all but the four bottom holes, or lifters, were drilled, the miners working on the muck pile. Upon completion of the upper part of the round, most of the muck had been removed. That which was left was rapidly thrown back from the face, all hands helping on this work. The horizontal bar dropped to the lower position, from which the lifters were drilled.

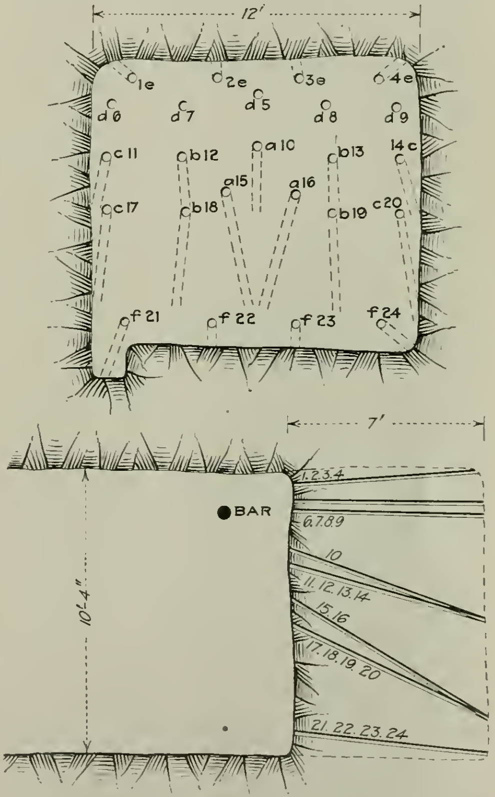


FIG. 1. DRIFT ROUND USED IN MAIN HAULAGE LEVEL, COPPER MOUNTAIN, B. C.

The holes were pointed to pull a 7-ft. round, and averaged about 9 ft. in depth. The center, or "cut holes," were fired first, after which followed the side holes, then the back holes, and finally the lifters. The drift round commonly used in this work is illustrated in Fig. 1, which also indicates the order of firing of the holes in groups. The blasting was done by hand, the fuses being spit. The timing of the shots was regulated by cutting the fuse in different lengths—the shortest for the center holes, the next longest for the side holes, and so on. The lifters were loaded with extra heavy charges of powder, so as to throw the muck back from the face as much as possible. This was sometimes helped by placing charges of explosive outside and beneath the lifters; these were called muckers, and were timed to go off after the rest of the round had been fired. The powder used was a non-freezing kind, varying in strength from 40 to 60% nitroglycerin, the selection of the grade of powder depending on the hardness of the rock at the face.

---

*A paper to be presented at the Chicago meeting of the A. I. M. M. E., Sept., 1919.

The rock was handled in small, V-shaped, hand-dump cars of about 1000 lb. capacity. Tramming was done by hand until the distance from heading to dump became too great, when horse haulage was substituted. Later, this was replaced by an electric installation. Steel plates were laid on the bottom for a distance of 30 to 40 ft. from the face, to facilitate shoveling, also to permit shunting empty cars past the loaded trains and thereby eliminating the need for double track.

The cars, being light, were easily pulled from the track and, with bodies tilted, were passed on the steel plates, alongside of the loaded cars, and then pushed back on to the track at the muck pile and loaded. Temporary track was laid close up to the face before firing a round. The T-rails were laid on their side, allowing the flanges of the car wheels to run on the grooves thus formed.

The foul air and gases were removed, after each round was fired, by a Connersville rotary blower, of 10 cu.ft. capacity, stationed at the portal of the tunnel. Later, a similar machine was placed about half-way in the adit and worked in tandem with it. The blowers were set to exhaust toward the surface through a 12-in. wire-wound, wooden-stave pipe. The men were able to return to the heading within 15 min. after firing.

The mucking crew was divided into three gangs, on each shift, averaging 11 men per shift. The work was divided so that one gang was shoveling muck, another was picking down from the muck pile, while the third was bringing up empty cars and forming them into trains after they were loaded. This latter work did not take up the entire time, so that this gang had an opportunity to rest. As soon as a train was loaded, the gangs changed jobs; that is, the pickers went at shoveling, the car handlers took the picks, and the shovelers took the easy work, and so on. Greater efficiency was maintained in this manner, as the change of work rested the men, and they were able to work continuously.

A bonus system was also a large factor in keeping the men up to the mark. This was based on a daily advance of 9 ft., upon which the then "going" wages were guaranteed; for all advance over 9 ft., $6 per foot was added as bonus. For each set of timber placed, an allowance of 3 ft. was made, which applied on the bonus. Current wages at the time were $4.50 for miners, $4 for helpers, and $3.50 for common labor. The bonus distribution brought these amounts up to $5.91 for miners, $5.25 for helpers, and $4.59 for muckers. The foreman and the shift bosses also shared in the bonus, the distribution being made by pro-rating the bonus in the same ratio as the amount of regular wage received by each man. Everybody seemed satisfied, and no difficulties were experienced as far as the labor situation was concerned.

The work was begun on Oct. 9, 1917, and the tunnel was finished Mar. 11, 1918, a total of 154 days. The actual working time was 150 days, four days being lost on account of a break in the power line.

The length of the adit is 2903 ft., and the daily average progress was 19.3 ft. for each working day. The greatest advance in any one month was in December, 1917, when a total of 645 ft. was driven. The amount of rock handled is estimated at 185 tons per day. The material penetrated was granodiorite, for the greater part of the distance. The total cost of driving the tunnel was $103,242.15, which brings the cost per foot of tunnel to $35.56. Certain equipment and supplies were charged against the work that should have been carried in a suspense account, as most of these had a certain salvage value, because it was intended to use them in the future operation of the mines. For reasons already mentioned, such as expensive power, the cost given does not really represent the actual expense of driving. Had speed not been so important a consideration there is no doubt that the work could have been done more cheaply. A few of the cost items are given in the table.

TUNNEL AND ADIT DRIVING COSTS AT COPPER MOUNTAIN MINES

	Totals	Cost per Foot
Total driving cost		
Labor	$25,517.81	$8.80
Explosives	16,616.75	5.72
Drills, parts and repairs	2,767.82	0.95
Steel, sharpening and replacement	3,979.78	1.37
Miscellaneous supplies	1,908.27	0.66
Power	8,410.24	2,90
Total	$59,200.67	$20.40
Rock disposal		
Labor	$21,843.40	$7.52
Supplies	1,685.24	0.57
Power	558.64	0.20
Total	$24,087.28	$8.29
Timbering		
Labor	$1,335.52	$0.46
Timber and supplies	2,513.18	0.86
Total	$3,848.70	$1.32
Indirect expense		
Air and water lines	$5,439.09	$1.88
Electric lighting	1,018.81	0.35
Ventilation	3,198.38	1.10
Dump, track, and trestles	503.67	0.17
Depreciation on drills	970.76	0.33
Depreciation on cars	301.82	0.11
Surface hoisting and hauling	3,464.58	1.19
Miscellaneous supplies	1,208.39	0.42
Total	$16,105.50	$5.55
Total cost	$103,242.15	$35.56
Timbering details		
53 sets timber installed, cost per set	$72.62	
354 ft. of tunnel timbered, cost per foot	10.83	
Drilling details		
Actual drilling hours	8022	
Actual working days	$149\frac{11}{12}$	
Average drilling hours per day	53.5	
Cost of upkeep per drilling hour, in cents	22.53	

Before planning any of the work, the engineer in charge visited large mining properties in the West and Southwest, where all the latest methods were observed. From notes taken upon these trips, the layout for future work was developed. The method of driving the main haulage level was derived from the operation of the Pioneer Tunnel, at Glacier, B. C., a few years ago, by the Canadian Pacific Railway.

The credit for perfecting the plans and details of this work belongs to F. S. Norcross, Jr., at that time superintendent of mines of the Canada Copper Corporation, now a captain in the 27th Regiment of Engineers, the mining regiment, recently returned from France. Captain Norcross was unable to complete the job, as he enlisted in December, 1917, but the work was carried out by his successor and former assistant engineer, P. F. Crane.

Peculiar Mining Rights

By Chesla C. Sherlock*

Many mining rights are acquired by reason of relationship through contracts, or their many forms, which give rise to situations that may be aptly termed peculiar, because they in turn have their origin in situations which are unusual. Many mining rights are conferred by contract between the operator and the owner of the land in which is located the mineral matter. There is nothing unusual about an ordinary mining contract that will distinguish it from one entered into in other business relations. It has been held many times by the courts that the same rules of law apply to mining contracts as to ordinary contracts; so where there are misrepresentations, deceit, or fraud in the sale of a mining property, or when the rights are acquired by means of a contract, the same rules of law apply as if the contract had other subject matter.

One authority has said: "There is no presumption of law that one who, when about to purchase a mine, makes an investigation himself, and consults others as to the condition of the mine or its value, does not rely upon representations made by the seller. Nor is it necessary that a mine be shown to be worthless to entitle one defrauded into purchasing it to hold the seller liable for the loss inflicted upon him."

It is a fundamental proposition of the law of contracts that the law of the jurisdiction applies in construing contracts; and the same rule ordinarily applicable to contracts will apply unless the statute has provided differently in the case of mining contracts. In regard to concealment and misrepresentation of the value of mining property, it is generally held that the seller will be liable. Surface indications, on the other hand, which are open to all observers and which must have been known to the vendee, cannot be the subject of concealment or misrepresentation. This is based upon the theory that what is open and readily discernible to all is presumed to be seen and known by all, particularly by a purchaser; and it is therefore impossible for the seller to be guilty of concealment of something which cannot be concealed.

A substantial breach of the contract will naturally permit the other party to escape performing his share of it, but an unsubstantial breach of a contract will not justify the entire abandonment of it. In the case of options, some peculiar rights arise which are often misunderstood by the parties. In the first place, an option to mining property creates no right or interest in the property until it, the option, has been exercised. It comes into being, or its distinguishing features come into being, only after it has been exercised.

An option is, of course, a form of a contract, but it possesses only potential rights in one sense. It may be of great value, but it has no value whatever until it is used. The mere taking of an option creates no estate in the property itself until it has been exercised, so a failure to exercise it in the manner agreed affects the holder in precisely the same way as if there had never been an option.

Time may be, and very frequently is, of the essence of the contract for sale, and it may arise either by express agreement of the parties, their relation, or from the nature of the property. When an option is made to a particular person, an assignment of it to another, not considered as a party in interest at the time the agreement was entered into, will confer no rights upon such assignee. This is particularly true in instances where the option is given to "John Jones and none other," or "only to John Jones," but it has also been held to apply to cases where the particular person is specificially designated, so as to have the inference that it was to be exercised only by him.

These rights often arise under the form of a lease. The subject of whether a lease was merely a lease of lands or a sale of the property has already been discussed in these columns. There are two views of the matter, the one holding that it is merely a lease of lands, whereas the other maintains that a lease of mining property is a sale of the land. The solution of the question is to be determined in each case by two things: (1) the facts surrounding each case and (2) the law of the jurisdiction.

Assuming that a lease of mining property is merely a lease, the owner of the surface is held to be the owner of the whole land. The lessee has the right to use the land only for a specific purpose—getting out the mineral. Under the other rule it is held that a lease creates title in the mineral, the time specified being merely an indication of the time in which the lessee must get his property out of the land.

There is more or less doubt over this question, and it can be settled in each instance only in the manner suggested, although it is a principle of the courts to look upon the intention of the parties as the controlling factor. It is true that a lease may be given; but, if a sale was intended, then it is as much a sale as if a deed had been executed instead of the lease. Likewise a deed of sale may be given when only a lease was intended. As one court has pointed out, the question as to what kind of paper was given does not amount to much, but, rather, the intention of the parties is the important factor.

There is no implied warranty in a mining lease as to the fitness of the property for the purpose intended. A lessee has a right, under a lease, to work all open mines, even those of which no mention is made, but he has no right to open new mines. Likewise, if there are open mines, the lease will not extend to unopened mines; and if there are no open mines, a lease covering all mines will entitle the lessee to open new mines.

Mining rights are often acquired through the form of a license. It is hard for many persons to understand the distinction between a lease and a license. In the first place, a lease is a distinct conveyance of an actual interest or estate in lands. A license is a mere incorporeal right to be exercised in the lands of another. And it is necessary to go to the law of the jurisdiction to determine whether the writing is a lease or a license.

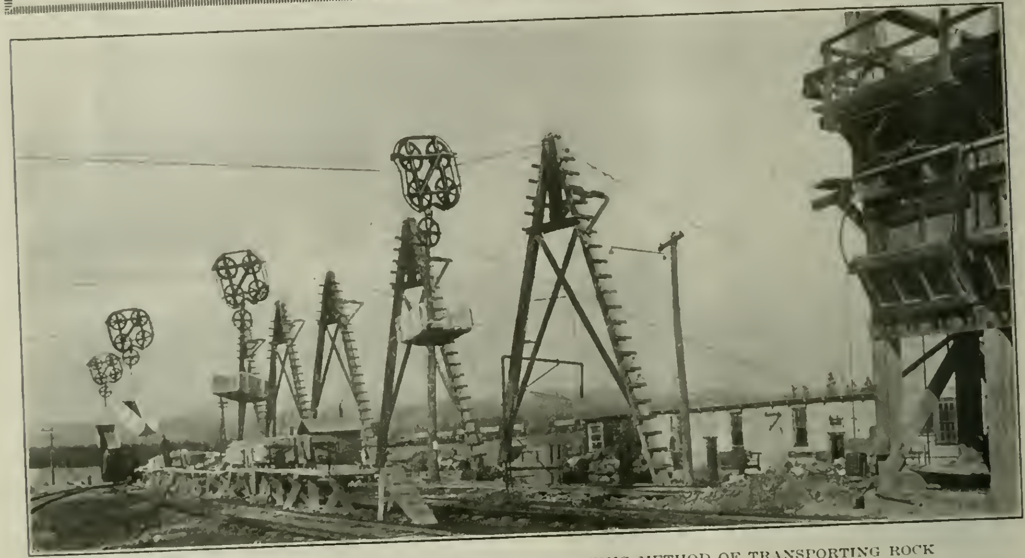
In Indiana it was held that a writing acknowledging receipt of certain money in payment for a certain sand bar for one year, with "the exclusive right to all gravel and sand for the year above named and excluding all other parties from said premises," was a lease and not a mere license. A license may be the subject of revocation, unless the law of jurisdiction by specific provision states otherwise, and if it has not been executed, and no expense incurred upon it, so that revocation would cause injury.

A license is non-assignable in quality, but where a person holds a license to dig ore on the property of another, it will exempt him from an action for trespass, and conveys property in actual ore dug under such provisions.

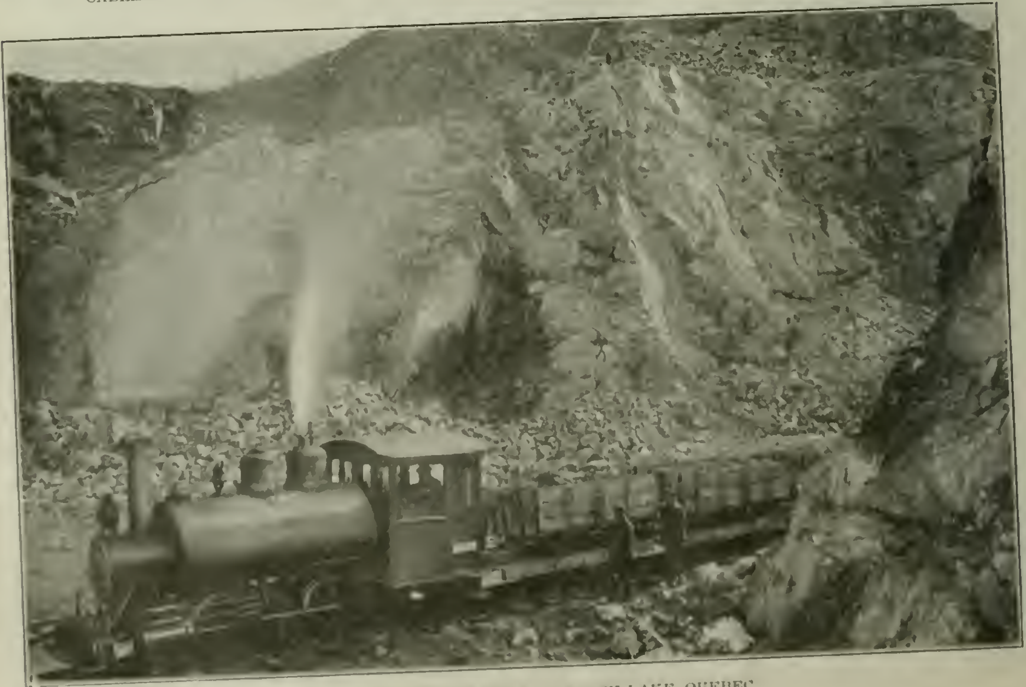
---

*Box 84, University Place Station, Des Moines, Iowa.

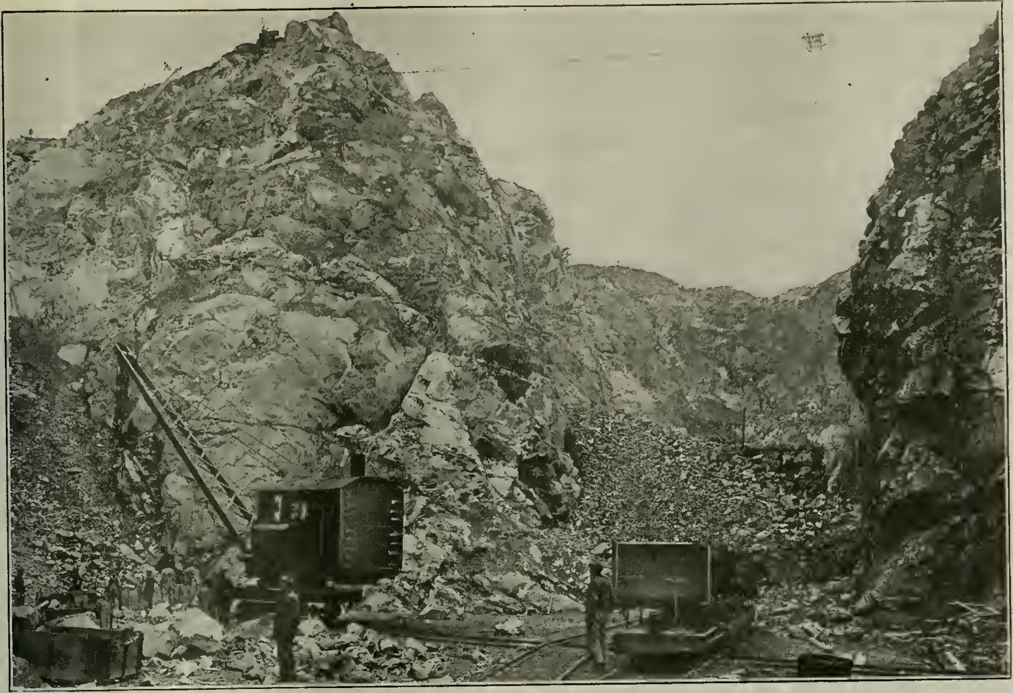
Mining Asbestos in Quebec



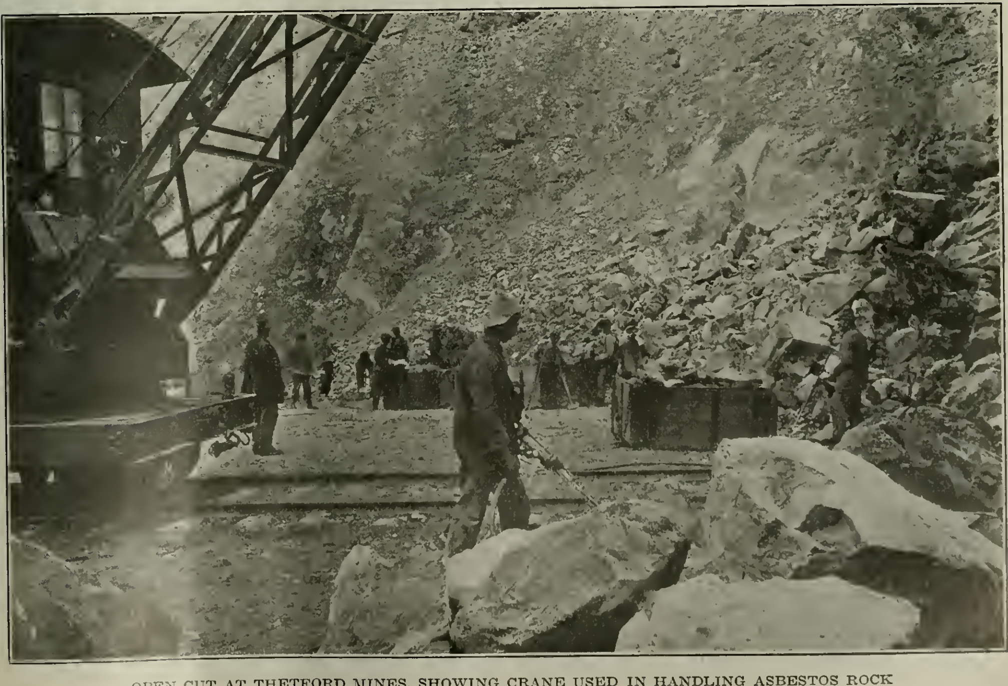
CABLEWAYS IN THETFORD ASBESTOS DISTRICT, SHOWING METHOD OF TRANSPORTING ROCK



OPEN-CUT ASBESTOS MINE AT BLACK LAKE, QUEBEC



PART OF ASBESTOS OPEN-CUT MINE AT THETFORD MINES, QUEBEC



OPEN CUT AT THETFORD MINES, SHOWING CRANE USED IN HANDLING ASBESTOS ROCK

The Problem of Treating Impure Manganese Ores*

BY EDMUND NEWTON

WHEREVER manganese ore is mined on a commercial scale, the product of the mine contains impurities. The presence of some of these will be obvious by simple inspection; others may require chemical analysis for their determination. The impurities associated with manganese minerals may be classified as (1) those derived from associated rocks, or rocks partly replaced by manganese-bearing solutions, (2) those associated with the manganese in solution, and deposited simultaneously, and (3) those chemically combined with manganese in the mineral. From the point of view of the metallurgist, all are impurities, and must be removed either by hand or by metallurgical treatment, and they may be classified according to certain general physical and chemical principles as follows:

1. Metallic—Iron, lead, zinc, silver, and, in some cases, nickel, copper, and tungsten.
2. Gangue—"Basic" lime, magnesia, baryta, "acid" silica, and alumina.
3. Volatile—Water (atmospheric moisture and molecular water), carbon dioxide, and organic matter.
4. Miscellaneous—Phosphorus and sulphur.

The chemical behavior of the impurities mentioned affects metallurgical operations, whereas the physical form in which they occur controls the possibility of removal previous to smelting, and the choice of methods by which such removal might be possible. The proportion of manganese to useless or harmful constituents of the ore determines its value and desirability.

The presence of appreciable quantities of any impurity means that more ore must be mined and smelted to produce a given weight of manganese alloy. Some impurities, however, are more detrimental to alloy manufacture than others. Metallic impurities, of which iron is the most common, will usually be reduced and retained by the alloy. The quantity present naturally affects the character of the alloy produced, which, in turn, controls its desirability for use in steel manufacture. Other metallic impurities occur usually in such small amounts that they are not detrimental to the resulting alloy. Zinc is an exception. This metal is largely volatilized in the smelting operation, and, if present in appreciable quantities, the fume will condense as oxide in the hot blast stoves, which may interfere with furnace operation. Unless the furnace top gases are washed, the stoves must frequently be cleaned, with consequent loss of time. The zinc oxide recovered from the stoves yields a substantial sum when the price of zinc is high.

Silver is neither detrimental to manganese alloys from the standpoint of the steel manufacturer, nor is it advantageous. The silver content of a manganese alloy has no value; consequently, no credit is allowed the miner for silver contained in an ore to be used for manganese-alloy manufacture. In some cases, the amount of silver contained in a manganiferous silver ore is such that it has greater value for the lead smelter. The manganese then acts as a flux, and the silver may be recovered by purification of the lead.

The gangue impurities classed above as basic and acid may also be called "slag-forming impurities." In smelting, these impurities must be fluxed to form slag. Slag is usually considered a waste product of a smelting operation, but it has important metallurgical functions, and just sufficient slag must be present to properly and economically perform those functions. An excess of slag must be avoided. In manganese-alloy manufacture, the slag contains more or less manganese, which does not enter the alloy. The quantity of manganese thereby lost is dependent upon the basicity of the slag, the temperature, and the slag volume. The first two factors control the quantity of manganese in a given weight of slag, and it is obvious that a greater quantity of slag will result in a greater loss of manganese. A large slag volume will rapidly decrease the daily alloy output of a blast furnace of given size. The overhead charges must be distributed over a smaller daily tonnage of alloy, and the profit from the sales of alloy for a given unit of time will decrease. It follows that more than the quantity of slag required to provide for the metallurgical functions is undesirable.

Silica is usually the predominating slag-forming constituent in domestic manganese ore. A certain quantity of silica is reduced to the metallic state in the smelting operation, and is recovered in the alloy as silicon, but the larger part must be fluxed with lime, magnesia, or other bases to form slag. Manganese-alloy slags should be basic; hence a larger quantity of slag will be produced from an ore with acid gangue than is the case in normal iron blast-furnace practice. Alumina is a slag-forming constituent, and although usually classed with silica, it acts somewhat differently in blast-furnace operations. Brazilian ores are notably high in alumina, but most domestic ores contain relatively small quantities.

Lime, magnesia, and baryta in an ore are also slag-forming constituents, but they combine with the silica and alumina present and thereby reduce the quantities of those bases necessary in the form of limestone or dolomite for the furnace charge. Baryta is not common as a gangue mineral. It is not as strong a base as either lime or magnesia. Though these constituents offset the metallurgical effects of silica or alumina, as regards evaluating an ore, they represent weight, and if the ore must be transported a considerable distance to the point where it is smelted, it is doubtful whether their value as bases would equal the additional freight charge. Limestone can generally be obtained at low cost close to the smeltery.

Volatile impurities are removed from the top of a blast furnace largely by the surplus heat. It is desirable, however, to reduce the loss of manganese from this cause, to keep the top of a manganese-alloy blast furnace cool. Volatile compounds are not particularly detrimental to smelting. When carbonate ores are being treated the case is somewhat different. Some metallurgists claim that in treating rhodochrosite ores the ratio of carbon monoxide to dioxide in the furnace gases is disturbed, which has a detrimental effect on the reduction of the oxides in the upper part of the furnace. It has also been suggested that the carbon dioxide driven off combines with carbon of the coke, forming carbon monoxide in the upper part of the furnace, and thus increases the coke consumption. Definite data are not available on these points.

---

*Abstracted from Pamphlet 9, War Minerals Investigation Series, U. S. Bureau of Mines.

From the practical standpoint, all the phosphorus in the ore mixture, together with that contained in the coke and limestone, is recovered in the resulting alloy. The permissible quantity of phosphorus in an alloy—the amount that does not produce detrimental effects when added to steel—has not been definitely determined. The higher the manganese content of an alloy, the larger the quantity of phosphorus that may safely be contained. Ordinarily, steel makers desire as large a margin of safety as possible, and therefore have specified that phosphorus shall not be above a certain percentage in an ore. Sulphur usually exists in relatively small quantities in oxidized manganese ores; but in the primary rhodocrosite ores of Butte and other parts of the West considerable quantities of sulphides of iron and zinc may be present. Sulphur is not a serious factor, as the conditions of blast-furnace operation, when making manganese alloys, are such that sulphur combines with manganese or lime, and is readily retained by the slag. Only traces enter the alloy.

Knowing the effect of impurities in manganese ores on blast-furnace practice, the methods of eliminating them may now be considered. In the first place, it is essential that the physical and chemical characteristics of the ore be determined. These factors are conditioned largely by the type of deposit from which the ore is mined. The following are recognized as types of ore, entirely disregarding genesis:

1. Rhodochrosite and rhodonite; carbonate and silicate ores, deposited in fissure veins or replacing original rocks.
2. Nodular ores, accretions of manganese oxide in soft plastic clays.
3. Manganese oxides deposited in small fissures or fracture planes, as breccia fillings, or as more or less impure beds.
4. Manganese oxides occurring as infiltrations, deposited in minute pore spaces, as partial replacements, or otherwise intimately mixed with the rock or gangue.

In the first class of deposits, the principal gangue impurity is silica, although sulphides of silver, lead, zinc, and iron are often found in appreciable quantities. The silica occurs both as quartz and chemically combined in rhodonite ores. In the carbonate ore, the carbon dioxide may be removed by calcination, thus effecting a concentration of manganese, reducing the bulk, and lowering the freight rate per unit of manganese contained in the original ore, but rhodochrosite decrepitates strongly when heated to a temperature where the oxide is formed, tending to produce an excessive amount of fines which is undesirable in practice. The breaking up of the particles by calcination will isolate some of the free silica, which on account of the larger sized particles might be screened out. The sulphide minerals may occur in such quantity that it is desirable to remove them by gravity methods of separation.

In the second class of deposits, the nodules are of variable size and usually high in manganese. They do not appear to be contaminated internally with the enclosing material. The clays are soft, whereas the nodules are generally hard. This type is common in the Appalachian region of the United States. The clay may be separated from the manganese nodules by log washers, followed where necessary, and where the size of the deposits warrants the installation, by picking belts, crushers, screens, and jigs.

In deposits of the third class, the manganese minerals, although closely associated with the inclosing rock, are not generally contaminated by it, and may be relatively pure. The method of treatment will vary with the size of the manganese particles and the hardness of the rock, but will not differ essentially from the treatment of the second class. If there is little or no clay, the log washer will be omitted and crushing, screening, jigging, and possibly tabling will make up the concentrating process.

It should be noted that if the mineral is largely pyrolusite, and therefore friable and soft, crushing may produce an excessive quantity of fines, composed of manganese minerals which are difficult to recover by gravity or water methods of separation. If, however, the manganese mineral is of hard, dense, massive variety, and the inclosing rock more friable, the problem is simpler. When the specific gravities of the minerals and the gangue approximate each other, wet concentration is difficult unless there be a marked difference in the size of particles.

As regards concentration, it is obvious that the association of gangue materials with the desired mineral in ores of the fourth class is so intimate that the finest crushing imaginable would not permit separation by mechanical means. To this type, the siliceous manganese ores of the Western States may be assigned. Ore-dressing experimentation has conclusively shown that where the silica is chemically combined with the manganese, or where colloidal silica envelops the manganiferous particles, any wet process or gravity concentration will not give the desired results.

The Victory Loan

Americans want to make money individually.

Americans want their nation to be prosperous.

Americans want their Government to be recognized as a world-leader—liberal, enlightened, powerful.

Americans want to support their Government in all the difficult tasks which attend the turning from war to peace.

These are worthy and commendable desires. Americans can accomplish all this by subscribing to the Fifth Liberty Loan—the Victory Loan—as enthusiastically and liberally as they subscribed to the four preceding loans. Through saving and thrift they can buy the new short-term notes. In buying them, they assure themselves a good interest rate on the investment and obtain securities absolutely safe and otherwise desirable. They will contribute to an era of national prosperity. They will enable their country to maintain the proud position of eminence it has gained through its position in the war. They will have the consciousness that their dollars have helped to reap the fruits of victory, as their dollars lent to the Government before helped to win that victory.

About thirty million Americans have bought Liberty bonds in the four previous issues. There is not a single reason why every one of them should not become a subscriber to the Fifth Liberty Loan.

Principles of Taxation[*]

Professor Seligman briefly outlines the history of the principles of taxation, drawing attention to the fact that they have changed from century to century with the alteration in economic conditions. Perfection can never be reached, because methods of taxation cannot overtake those changing economic conditions just ahead of them. The most modern conception of the subject regards wealth in terms of flow rather than in terms of a fund; and, if tax is collected on income only, perfection of method is approximated.

IN A SHORT address it is a little embarrassing to know how to pick and choose from such a subject as the principles of taxation, so perhaps if I confine myself to those broad principles which may be of interest to you as mining engineers it will be best, and may help to throw light on some of your practical problems.

There are principles of administration, of assessment, of convenience of payment; there are principles connected with economic results and social consequences of taxation, as the securing of economic efficiency, which is just as important in fiscal matters as in other business. I believe, however, that what interests you above all are those principles connected with equality of taxation—those ethical principles of taxation which in a democracy are of the greatest importance, and which make all the difference between justice and injustice.

The world has been struggling with the equality of taxation for years. We are not the first to whom the problem has been presented. The primary question is with what criterion are you going to measure equality and uniformity of taxation? It is easy to say, as our laws have said almost from the very beginning, that individuals should pay in accordance with their ability or faculty, and we all give lip homage to that conception. But how are you going to measure a man's ability or faculty? The ideal democratic conception is that equality of taxation consists in every man paying what he can afford to pay, and that is the criterion of what he ought to pay.

If we take a broad view of history, we will find that many different answers have been given to the question of how to measure the ability of people to pay. In the beginning, in primitive society, we find the theory that everybody should pay as a poll tax so much per head. It existed in all democratic communities at the outset, and today it survives in a few centers. The United States is about the only country outside Switzerland where you still find the poll tax. This criterion of the peoples' ability to pay is antiquated and absurd, because with the development and differentiation of property there follows inequality between individuals.

The next stage was that of the Middle Ages, when the theory was *"le fort portant le faible,"* or that the rich man should bear the burden of the poor man. In practice it worked out the other way—the poor man paid most of the taxes. When this failed, an attempt was made to reach the rich man by taxing him upon what he spent. Then for a long time in England, France, and Germany the test of ability to pay was deemed to be expenditure.

This practice was abandoned as democracy developed, for the simple reason that, whereas the poor man must spend all that he earns, the rich man is under no such compulsion. The opinion grew and was strongly held (as evident from the discussion on our income tax in Washington a few years ago) that so far as possible we must do away with tax on expenditures, except perhaps during war, when the object is largely to reduce consumption to the lowest possible limits. With the disappearance of expenditure as a criterion, the world came to accept the idea which is still found universally in our state laws—that property is the test of ability to pay, whether held by persons or corporations. Property is a legal, not an economic, term. Wealth, of course, is what we are after. When we say that people should pay in accordance with their ability to pay, we mean in accordance with their wealth. Wealth may be measured in terms either of a fund or a flow. It may be measured either in terms of capital or in terms of income received during the year. Capital is capitalized income.

Under the feudal system of England land could not be bought or sold; hence a man's wealth was sometimes measured in terms of rent received from his estate. When our country was constituted, however, the feudal system had disappeared. Land was freely bought and sold. Therefore it became possible to measure wealth in terms of property, which is nothing but capitalized income. From the beginning, therefore, we have developed in this country the system of property taxation.

For a long time property was a good test of ability to pay—an admirable test under the only conditions of a simple economic life. It has certain advantages even today, as in local real estate, where one can easily measure the value of a house or lot. As a result of modern economic life, with its complexities, people began to find that there were shortcomings to this mode of measuring wealth. An ordinary business man is averse to measuring his business in terms of his property. This is so because of the interrelation of economic conditions. Speculations and hazards have no exact equivalent of capital. If you were to compare the owner of a $10,000 farm with the owner of $10,000 worth of a speculative stock you would not find the economic faculty and ability of the two precisely the same. There is often a disparity between income and the capitalization of income due to the changes in our modern economic life.

Again, take the business man, whose capital consists of his stock in trade, and his prospects of business. If you take property as the test, no consideration is given to the frequency of turnover or other factors affecting his profits. Of two men having precisely the same stock in trade, one may make ten times as much in a year as the other. Hence, some doubt has been cast upon the alleged equivalency between actual property and the ability of the individual to contribute to the support of the state.

In modern society we find other changes. In former times, as in early New England, every man worked, and few had more than an insignificant amount of property. Now there are two divergences from this idyllic period. On the one hand, the careful, thrifty worker may accumulate some property, whereas the spendthrift of a much larger income may spend all and accumulate nothing. The taxing of property makes its accumulation by thrift a penalty. In the second place there are many individuals in modern times who secure their incomes from professional services rather than from property. A gets $10,000 from his property or business, B gets $10,000 from his professional services. If property is taxed, A pays, B does not pay. It lets you professional men off too easily. When we think of our railroad presidents, with incomes of $100,000, of our Carusos and Charlie Chaplins, and recollect that a tax on property does not reach them, more and more doubts are cast upon the property criterions of ability to pay. Leaders in all European countries have seen this and have abandoned property as the test of ability.

---

[*] Abstract from an address by Prof. E. R. A. Seligman before the New York section of the M. M. S. A., Feb. 27, 1919.

To what did they turn? They turned to the product. Whether it was a mine or anything else, they took the yield of the land, or the yield of the business, or the yield of the money, as the test of ability. This was done as far back as Biblical times, when gross receipts were the measure. A tax on gross receipt is very unjust and primitive, because it does not consider expenses, and puts no premium on good management. Later, the plan of considering net receipts or the net yield of the taxable object as a criterion was tried for a long time.

The trouble with net receipts or net yield as applied to a business lies in the fact that no attention is given to the personal characteristics of the owner of the property or business. A uses his own capital and gets net results of $10,000. B borrows his capital, and out of his net receipts pays a large amount of interest. The net receipts tax or net yield tax does not consider the personal position of the owner of the property, and it too has been abandoned.

Thus first in England, then in all other democracies, and finally in this country, we came to the taxation of income as the best test of ability or faculty. When this country needed a great additional revenue at the time of the war with England a century ago, we imposed a tax on property. When we needed a great revenue in the present war, we imposed a tax on income. Our whole point of view had changed in a hundred years. We see that modern economic life depends primarily upon income rather than upon property.

In this country we are in a stage of transition, which has been accomplished everywhere else in the world. France achieved the result a few years ago, but we have only just begun. Some states are trying to tax the yield or produce of the property. The taxation on mines in some states is upon gross receipts; other states are taxing what they call the net receipts, but something that is really not net receipts at all. Finally, some of the most advanced states have adopted what is now being considered in New York—the tax on income.

I have tried to point out that an equitable system of taxation must be one that is in harmony with the economic features of the day, and that an attempt to perpetuate an antiquated system, a system which was once admirable but which no longer responds to the economic environment, can by no possibility form an adequate, satisfactory test of ability to pay. Many of us are trying to cope with the practical difficulties connected with the valuation of property for taxation, and they are difficult because it is a transition problem. We can clearly see, from this sketch of the historical development, in what direction we are going and where the remedy lies.

If you measure wealth in terms of flow, rather than in terms of a fund, you are getting much closer to the modern conception of justice in taxation. I venture to predict that in mines, as in other forms of enterprise, the problems of income taxation, difficult though they be, will gradually turn out to be far less difficult and far less involved than the almost insuperable obstacles that confront us when we attempt to measure the wealth in mines in terms of a fund.

Even though you have worked out the general principles or criterion of ability to pay, the practical solution depends upon your administrative system. Here again we are living in the early stages of a transition which has long since been passed in the more developed countries of the Old World. In the early days taxes were farmed out and were collected by the tax farmers, such as the publicans of the Bible. Then came the period of local assessors, which we still have in this country. Finally, with the development of the principles of equality and uniformity of taxation, we get centralized assessors.

The great struggle confronting mineral and other enterprises today is the attempt to secure equality by removing the administration of the tax from the hands of poorly equipped local officials to the more highly efficient administrators of the central government. Wherever you find a successful state income tax today, you will find it only where you have a centralized state administration.

The two points which I should like to leave with you are that (1) in the solution of the mining-tax problem it must run on "all fours" with the solution of all taxation problems, and (2) that it must certainly be in harmony with two principles. It must be in conformity with the facts of the changed economic environment of modern times, and it must respond to the newer ideas of administrative efficiency.

If you adopt a system which is based on these two principles, you will get about as close as you can to a just one. You will, however, never reach it, because, as the old adage says, "He who expects an honest tax to see, expects what ne'er was and ne'er will be."

Geology of Montreal River District Of Northern Ontario

TORONTO CORRESPONDENCE

The Summary Report of the Canadian Geological Survey (Part E) for 1917 includes a paper by H. C. Cooke on the Montreal River district of northern Ontario, embodying the results of an exploration undertaken on account of the interest aroused by the Matachewan gold discoveries, rendering it probable that prospecting would be carried into the adjoining districts. Micrometer and prismatic compass surveys of the water routes were made through the townships of Midlothian, Montrose, Hincks, Argyle, Bannockburn, Doon, Yarrow, and Powell. Hitherto little information as to the territory covered has been available, owing to the fact that there are no large streams or lakes to render travel or survey easy.

The district is the source of many streams whose drainage basins interpenetrate one another complexly, and is characterized by numerous small creeks and lakes. The portages connecting these were in many places poorly marked Indian trails, difficult to find and to follow. The district includes the northern boundaries of the large area of the Cobalt series of sediments, which extend northward for many miles. Within the limits of the Cobalt series the country is rugged, with a relief in places of as much as 600 ft. Beyond the limits of the Cobalt series to the north and west, where older rocks prevail, the general elevation is much lower, with an average relief of not more than 100 ft., except in a few places where a knob or ridge of unusually resistant rock protrudes. Much of the flatter country has been made the depository of accumulations of glacial moraine.

At the base of the rock formations of the district lies the complex of igneous rocks commonly known as Keewatin, though the name may not be altogether applicable, as it appears probable that some of the units at present mapped with the igneous complex may prove to be much younger. The igneous complex consists of basalts, andesites, rhyolites, and other volcanic flows. Some or all of these are cut by later dikes or diabase, strongly resembling the Cobalt gabbros, but which are nevertheless older than the Cobalt series. The relations of these dikes, some of which are highly porphyritic, with phenocrysts of feldspar an inch or more in diameter, are well shown on the Davidson claims in Powell Township. The volcanic flows are also cut in the western part of the district by silt-like bodies of peridotite, now altered more or less completely to serpentine, in which deposits of asbestos have been found. In Midlothian, Doon, Bannockburn, and Powell townships, the basement complex is overlaid by what has been termed the Temiskaming series, which the writer prefers to call the Kiask series, as the term Temiskaming implies an unproved correlation with the Temiskaming of Cobalt and vicinity. The Kiask series, so far as observed, is wholly sedimentary in origin, consisting of coarse conglomerates, grits, and slates. Granite and syenite in large and small masses intrude the basement complex throughout the district, but no locality was found where granitic rocks came in contact with the Kiask series. The Cobalt series, cut by dikes of quartz and olivine diabase, overlies all the other rocks described.

The gold discoveries in Powell Township on the Davidson and Otisse claims are of two types, those in porphyry and those in schist. On the Davidson claim the gold impregnates an irregular body of porphyritic syenite intrusive into the basement complex. The periphery is cut by a network of closely spaced veinlets of quartz. The gold is usually found in or near these veinlets, though Mr. Davidson states that it is occasionally found in the porphyry several inches from a veinlet. It appears probable that the gold was introduced by the solutions forming the veins.

On the Otisse claims gold is found both in the porphyry and in the schist, its occurrence in porphyry being similar to that on the Davidson claims. The principal schist occurrences appeared at the time of examination to be in beds of calcareous tuff, which has been heavily impregnated with small grains of pyrite. These have since been reported, by engineers examining the property, to carry high metallic content.

The area to the west, especially in Argyle, Hincks, and Montrose townships, may well yield similar discoveries if carefully prospected, especially in the neighborhood of small granite masses. One such small mass crosses the Powell-Bannockburn line between the 3 and 4½ mile posts. Another granite ridge runs north and south through the center of Hincks Township, and a third much larger mass crosses the southern parts of Cleaver and McNeill townships. It is probable that dikes of granite porphyry will be found in the neighborhood of these masses and that some of the dikes will have gold associated with them. With the exception of these granite masses, the townships mentioned are underlain largely by Keewatin rocks, in which may be expected tuffaceous beds of the type which occur enriched in Powell Township. The probability of the occurrence of gold in this area is indicated by the statement of J. Davidson that he had panned gold in several places during prospecting trips.

Asbestos appears to be a valuable potential resource of the district which would repay more attention than it has hitherto received from prospectors. George Rahn has held several claims of asbestos in the western part of Bannockburn for some years. The asbestos, which occurs in serpentinized peridotites, is of fair quality, if fiber of sufficient length can be obtained. The attention of prospectors is also called to the possibility of finding chromite in the serpentine.

American Tin-Slag Analysis

The following report gives the results of a number of exhaustive tests made on a sample of American tin slag by M. G. F. Söhnlein, of Machacamarca, Bolivia. The results are so noteworthy and the descriptions of the various tests so complete that the information is of general interest:

CONTENTS OF AMERICAN TIN SLAG

	Per Cent.
Total tin content	14.59
Content of metallic tin	1.92
Content of tin in form of unreduced barrilla	0.58
Content of tin in other form, presumably silicate	11.93
Content of metallic iron	3.71

Ten grams of the sample was ground to pass a 200-mesh screen, using an agate mortar and pestle so as to avoid contamination with iron from grinding apparatus. Small flakes of metal that remained on the screen proved all to be magnetic, and, if metallic tin is present in the slag, it must be extremely finely divided. Two grams of the finely ground material, into which the metal flakes had again been carefully mixed, were used to run a duplicate assay for total tin on 1-gm. samples, which returned, respectively, 14.61 and 14.57%, from which the average was taken as the correct figure.

The amount of tin in the form of unreduced barrilla is usually determined by digesting the sample with aqua regia, and assaying the residue for tin. This method is open to objection because, if metallic iron and tin be present, the nascent hydrogen evolved by the reaction between the acid and the metals may reduce some SnO_2 to Sn, which will be dissolved in acid, thereby diminishing the amount of SnO_2 left in the residue. It is therefore better to remove all metal before digestion with aqua regia. Metallic iron can be removed magnetically, and metallic tin by amalgamation.

A portion of the finely ground sample was treated by magnetic separation, yielding 7.20 gm. of non-magnetic product and 0.45 gm. of magnetic product. The latter was gently heated with diluted hydrochloric acid (1 to 10) so as to dissolve the metallic iron only and leaving the remainder, consisting of slag, which is a mechanical contamination of the magnetic product undissolved. There was 63.1% of metallic iron in the magnetic product, or, computed on the whole sample, 3.71%. Only a trace of tin was found in the solution that had extracted the metallic iron. The residue of the magnetic product was digested with aqua regia, evaporated to dryness, taken up in strong HCl, evaporated again, and finally dissolved in strong HCl, diluted and filtered. The amount of tin in the residue was determined in the usual way by fusing with Na_2O_2 and titration with iodine, and proved to be equal to 3.1 mg. of Sn. The solution contained 44.6 mg. of Sn. Recalculated on the whole sample, these figures give a content of 0.04% Sn in the form of unreduced barrilla, and 0.58% in Sn as silicate.

The non-magnetic product was amalgamated for one hour by rubbing it down with 2 gm. of quicksilver in a porcelain mortar. The amalgam was separated by careful and repeated panning, and digested with strong HNO_3 to dissolve the Hg and leave the Sn as metastannic acid. This was filtered off, and the amount of Sn contained in it determined by fusing with Na_2O_2 and titrating with iodine. The amount of Sn extracted by amalgamation amounted to 147.1 mg., which is equal to 1.92% on the whole sample.

The tailing from amalgamation was digested with aqua regia, evaporated to dryness, dissolved in strong HCl, evaporated again, and taken up in HCl. The residue was filtered off and assayed for Sn in the usual way. The content of soluble tin in the form of silicate was 12.06% and of insoluble tin as SnO_2 retained in the residue, 0.58%. Referred to the whole sample, these figures are 11.35% and 0.54%, respectively.

Adding to these figures those found in the magnetic product, it will be seen that the total content of tin as reduced barrilla in the original sample is 0.58%; and of soluble tin, presumably as silicate, 11.93%. By adding the partial tin content, a total of 14.43% is derived, instead of 14.59% found directly.

This method of analysis is open to discussion on one point. The metallic tin contained in the magnetic product has not been determined, and is probably accounted for as silicate. This could have been avoided by amalgamating the whole sample before magnetic separation, but an objection against this is that the sample is then reduced to so fine a state that magnetic separation becomes difficult. The error is small, because the non-magnetic material carried away in the magnetic product is about 37% of the weight of the latter, or 2.1% of the whole sample. If great accuracy be required, the residue, after treating the magnetic product with dilute acid to extract the iron, can be added to the non-magnetic product and amalgamated with it.

Future of Cornish Tin Mining*

A deputation of the Joint Industrial Council of the Tin Mining Industry of the United Kingdom, headed by C. A. Moreing, was received recently by the Parliamentary Secretary to the Board of Trade. The object of the deputation was to secure such financial assistance as will enable mines to continue working, and so bridge over the reconstruction period. Meanwhile, it is requested that a state inquiry shall be held, as recommended by the committee on production. In the statement of case to be presented by the deputation for submission to the inquiry, the reasons for state assistance are summarized as follows:

1. The necessities of the state in the matter of labor for the army, and in the control of the prices of tin, have helped to bring the industry to its present parlous condition.

2. The high prices of coal and materials, the former mainly due to the increase of wages of coal miners authorized by the government coal controller, have had a serious effect on the industry, and have prevented the tin miners from being paid a wage adequate to meet the increased cost of living.

3. The price of tin for approximately the first two and a half years of the war was less than its pre-war selling price, and the subsequent rise was checked by government control and reduced to such a figure that tin cannot be produced in Cornwall under existing conditions other than at a heavy loss, except in the isolated cases of abnormally rich lodes and with the assistance accorded by the sale of the byproducts—wolfram and arsenic.

4. That in each recent case of an inquiry by the government committee into the condition of the industry and the causes of the existing state of affairs, evidence has been adduced sufficiently strong to show the necessity for practical support and confirming the statement now made.

5. That the government man is now being provided with out-of-work donations, which could be spent to better advantage in another way.

6. Unless the mines now working can be maintained, the labor now employed must in due course be thrown out of work, and no work will be ready for the miners now being demobilized. In that event it is clear that large sums of money will have to be expended by the state as unemployment benefits.

It was stated on behalf of the deputation, that in time of war or other emergency the supply of tin, and in some cases the production of wolfram and arsenic, were absolutely essential. A regular and increasing quantity could be obtained from Cornwall, without danger of delay or loss to which supplies from abroad were subject through submarine warfare. The deputation further submitted that in normal times approximately 8000 persons were engaged in the industry. In 1917 this number was reduced by enlistment to approximately 5000, and upon the return of the men from military service they would be thrown into unemployment unless measures are taken to maintain the industry at pre-war level.

---

*Abstracted from the *Mining Journal*, Feb. 1, 1919.

Efficiency

It ain't a senseless hoardin'
Nor stinting of our need,
But efficiency in spendin'
That should become our creed.

It ain't some money set aside
On impulse once awhile,
But steady savin' day by day
That builds the solid pile.
—S. V. Perlman.

"Always Taking Out of the Meal Tub and never putting in soon comes to the bottom."—(Benjamin Franklin). Buy W. S. S.

Correspondence and Discussion

The Professor and the Anaconda

Dr. Louis Levine, by publishing his essay on "The Taxation of Mines in Montana," through B. F. Huebsch (price $1), got into trouble with his superiors in the University of Montana, who had refused publication of the essay as a university document. Dr. Levine has received much sympathy from people who have viewed him as a David fighting a Goliath, a professor boldly challenging an anaconda, but who probably did not take the trouble to read his essay. As is not uncommon in such cases, few paused to consider whether the president (or chancellor) may be right and the professor wrong.

Dr. Levine did me the honor to cite me as an authority several times during his essay. Indeed, it may almost be said that an economic paper by me on "Anaconda Finances," which he characterizes as "a careful and penetrating analysis," is the Rosetta stone from which he draws his deductions as to the value of the Anaconda properties. The fact that he consistently misspelled my name in his text, but once used it correctly in a footnote, however, with an incorrect reference to the publication of my paper that he cites, did not predispose me toward him for accuracy. Let me say, moreover, and at once, that I do not sanction his derivatives from my analysis.

Dr. Levine's essay is in part a well-considered study of the subject of mine taxation in general, in which there is much to commend, and partly it has the aspect of a campaign document against the Anaconda Copper Mining Co., in which it loses all scientific character and is marred by citations to the literature of stock brokers, and other unworthy references. The culmination of the essay is in Chapter 6 on "The Anaconda Copper Mining Co." At the end of that long chapter, which is replete with tables of figures, Dr. Levine says: "All the calculations made in this chapter can be summarized in a few lines. During the five years 1913-1917, the average assessment of the A. C. M. Co. was 6.6% of the total assessment of the state, and the company paid 6.7% of all taxes collected in the state. The company was assessed at about 25% of the true value of all its properties in Montana, while agricultural land is reported to have been assessed at 35%, livestock at 45%, bank stock at 60 per cent."

Dr. Levine assumes the fixed and current assets of the company as of Dec. 3, 1916, as $224,014,841, as reported officially by the company, and uses that figure in his table of comparison between assets and assessment. There is a relatively small and immaterial error in his total, which may be typographical or clerical, although it is repeated, but not so lightly may be passed over his omission to state that upon the same date the debts of the company were approximately $54,000,000, wherefore its net assets were about $170,000,000. Those net assets included holdings in other companies, not in Montana, and stocks of metals, etc., that were largely in plants of the company outside of that state. My own analytical figures as to the value of the property of the company in Montana are twisted into shapes that I do not recognize. I stated specifically that the mines and metallurgical works of the company in Montana came to about $47 per share of the company's capital stock, which would make a total of about $110,000,000. Adding to this the value of the timber lands, the total would be about $115,000,000 and the state assessment of $55,600,000 would be about 48% of that. An additional allowance for the material, merchandise, etc., carried by the company in Montana would not materially reduce that percentage, which manifestly is a very different thing from what Dr. Levine calculates.

The Chancellor of the University of Montana may not have examined Dr. Levine's manuscript in just this way, and may have merely considered its general tone, but without any doubt he acted upon a true instinct when he refused its publication as a university document. W. R. INGALLS.

New York, Mar. 20, 1919.

About Spanish

A discussion, the subject of which is "About Spanish," appears in your issue of Jan. 25, and I beg to take exception to almost everything George Washington (aged 10) has to say about this matter. For his view to become established among our younger mining men who may come to Spanish America would undo years of work in trying to make all employees and future employees feel the necessity of knowing how to talk Spanish.

I know the manager of the huge copper mine to which he refers, and, although he was not proficient in Spanish when he arrived, he realized the necessity of instituting compulsory Spanish classes in his organization. Spanish instructors were placed on the payroll, and all the staff asked to attend—convenient hours having been arranged. Conferences on this subject were held, and it was the opinion of all present that a man who could not talk to his men was fully 30% less efficient than the man who could.

The manager of the next biggest copper mine in South America, in cabling for men to the New York office, used words that have since become familiar to South American mine operators. He said "Send me men with guts, go and *habla*"—"guts" meaning fearlessness, "go" meaning a keen, snappy, ambitious interest, and *habla* a working knowledge of Spanish. It is usually understood that the New York office will not send a chimney sweep if one asks for a blacksmith, and it is their business to see that whoever is sent is proficient in his line. In addition to this proficiency, he should have the qualifications embodied in the three little words mentioned.

The manager of the third biggest copper mine in South America said, "It is unfortunate that more of our staff are not fortified with a knowledge of Spanish, as it makes such a difference in handling their men." The manager of the fourth biggest copper mine in South America speaks Spanish splendidly and requires no middleman to carry on his conferences with the President of the Republic or with his legal advisors. He takes nothing for granted, but asks questions of this man or that; and Georgie must admit this a decided advantage. His views on this subject are identical with the others.

These men are not very well camouflaged here, so I would ask George, and anyone else who has any doubt about this thing, to write to some of the men who know, so as to get the matter straightened out before some novice really swallows the impression set out in Georgie's discussion "About Spanish."

I don't believe that all the children in the world should study Spanish, as far as that goes, but let me state here and now that if any American student mining engineer can cram in an hour of Spanish on his card, let him do so by all means. If it turns out that he goes to Russia, this grounding won't help him much, but the chance that he might come down here is such that the little effort is worth while.

I am talking purely from a standpoint of mining, and readers can draw their own conclusions as to the same argument along other lines of endeavor. Little Georgie has stated that his axioms "can be proved" and that "he is here to do it." I frankly admit that he has made no impression on those of us down here who are digging copper ore; and I feel perfectly safe in saying that the profession at large in Spanish America is of the same opinion. "Experience."

South America, Feb. 16, 1919.

Calibration of Thermocouples

In the article by C. S. Crouse on "Calibration of Base-Metal Thermocouples" in the *Journal* of Mar. 8, page 433, I note an error in the manner of applying the cold-junction correction of the precious-metal thermocouple. As is well known from fundamental considerations, the temperature of the cold junction cannot be added to the temperature as indicated by the galvanometer without applying a correction factor which will depend upon the type of couple in use and will vary both with the cold-junction and with the hot-junction temperatures. This factor is necessary because there are only certain couples having a linear relation between the temperature and the electromotive force. For example, in the case given, with a cold junction of 16.8° C. (assuming that this is correct, instead of 87° F., as given) and hot junction near 800° C., the factor would be about 0.5 for Pt, 90Pt = 10Rh couples. Thus, the corrected reading for the rare-metal couples would be 777.1°+(0.5) (16.8) = 785.4° C., instead of 739.847° C., as given. For base-metal couples, the cold-junction correction factor will vary from 1.5 to 0.3, depending upon the type of couple and the temperatures involved. On account of the magnitude of the normal errors in the use of base-metal couples, the cold-junction correction factor is often neglected when using these couples.

Further on in Mr. Crouse's article, he states that the correction of the base-metal couple is 10° F., and that this must be deducted from any temperature measured with this couple. In some cases this would lead to correct results, but in many cases a couple reading 10° F. high at 800° C. may indicate correctly at a lower or a higher temperature.

Mr. Crouse also falls into the common indiscretion of using figures that purport to be more accurate than the data on which the figures are based. Thus, 87° F., the cold junction of the precious-metal couple, was probably measured on a thermometer accurate to the nearest half degree, yet this figure is rendered into 16.775° C. (it should be 30.5° C.). The first decimal place is all that is needed in the progress of the calculations to arrive at calibration figures that will be accurate to the nearest degree. This is a greater degree of accuracy than is usually obtainable when using base-metal couples at high temperatures. W. F. Dietrich,

Assistant Professor of Mining.

Stanford University, California, Mar. 14, 1919.

Regarding the Mine Physician

The discussion following the reading of the paper, "Prevention of Illness Among Mine Employees," by Dr. A. J. Lanza, at the February meeting of the A. I. M. E., suggests a point that is worthy of the attention of mine operators. It developed that an inquiry among a number of mine doctors disclosed the fact that the greater number of those questioned admitted that they had not at any time visited the underground workings of the properties operated by the companies by which they were employed. Briefly, the situation is probably as follows: A miner is injured underground, perhaps seriously. The physician is called to the mine office, where he awaits the arrival of the injured man, who is brought to him by means of such facilities as are afforded at the mine. Perhaps the doctor remains at his office or hospital and the man is taken there. In any event, it would appear that the convenience of the doctor is given the most consideration.

The mine may boast of an excellent first-aid hospital, a well-trained corps of first-aid men and be otherwise well able to consider the condition of the injured man. A question that naturally arises is: What influence does the place of the accident and the general conditions surrounding the work of the injured man have upon the nature of the injury? The mine authorities are doubtless competent to pass on the physical aspects of the accident; that is, their familiarity with the methods of work that are employed and their knowledge of the surrounding territory are sufficient to enable them to make a complete analysis of certain conditions, but are they fitted to give consideration to all of the factors that contributed to the accident? And, frequently, is there not some cause, unknown to the mine management and with which the physician may be familiar, that, by reason of his experience, he is able to throw light on?

The argument of "too many cooks" may be applied, perhaps, in rebuttal of the suggestion, but it would seem that further discussion and a full consideration of all facts would more nearly approach the desired result, namely a solution, which would eliminate the possibility of the occurrence of a similar accident.

Physicians, as a rule, desire to make themselves familiar with the surroundings of their patients, so that they may suggest certain corrective measures which will bring about the prevention of disease or shorten the period of disability. And should not this principle apply to the mine physician as well? We have excellent examples of research work along preventive lines that have been carried out by Government doctors, but these have not been accomplished by laboratory methods or consultations alone, but by an actual contact with all the contributive factors. The mining industry owes its success to constructive suggestion, experimentation, and consideration of all ideas which bear directly or indirectly on its operations, and it would seem that great good is to be gained by securing the opinions of mine physicians as to underground conditions.

New York, Mar. 17, 1919. D. E. Charlton.

Ore Dressing and Metallurgy

Rock-breakers of the swinging jaw type are usually employed in small or medium-sized plants, especially in isolated localities where simplicity of design is a factor which tends to insure the minimum of interruption and expense. Two practical notes on the subject are given.

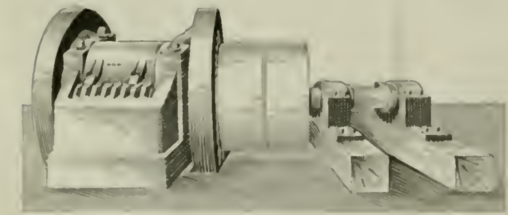
The measurement of water or solution is often necessary at many stages of operation of a hydrometallurgical plant. Meters are not always satisfactory with corrosive liquids or with those which deposit an incrustation on parts of the apparatus. A description of an orifice bucket is here presented, which combines simplicity with a fair degree of accuracy, accompanied by a chart showing the results obtainable from a 20-in. bucket, measuring up to about 6000 tons per day. For smaller amounts a certain number of the holes may be plugged, and additional curves drawn.

Trouble With Rock-Breaker Pitmans

Heating of the pitman in the swinging jaw type of rock breaker is common, and usually results from faulty or uneven bearing surface, inefficient lubrication, dirty lubricant, and unprotected grease cups or oil reservoirs. Troubles arising from such causes may be reduced to a certain extent, but, nevertheless, the heating usually persists, despite ordinary precautions and normal attention. Water-cooled pitmans are desirable, and there is no particular reason why they should be considered only with large sizes and types of such machines. As a matter of fact, conditions around the primary crushing department of a small plant are usually conducive to overheating of bearings, and the duty expected is often continuous and, comparatively speaking, severe.

Idle Pulley for Rock Breakers

Rock breakers in small mills are often placed in out-of-the-way positions, and attention is paid to their condition only when they are in use. It usually happens that primary rock crushing is practiced during a small proportion of the 24 hours. For a part of the remainder of the time, at least, the crusher may operate without load, or the driving belt may be running over an idle pulley on an extension of the crusher shaft. Under the conditions often prevailing, the duty is usually severe, and the belt has to be kept tight. When running on the idle pulley the strain is still there, in fact to such a degree that it is found difficult to eliminate friction by means of ordinary lubrication.



UNCONNECTED IDLER FOR ROCK BREAKER

Trouble from such a cause may be reduced or minimized to a large extent by the provision of an idle pulley keyed to a separate shaft running in separate bearings, as shown in the accompanying cut. The shaft is collared so that the idle pulley is a small fraction of an inch from the crusher driving pulley; and the transfer from the one to the other can be made as easily as if both fast and loose pulleys were on the same shaft.

Orifice Bucket for Measuring Water*

The orifice bucket provides a convenient method of measuring water by simple and inexpensive means. It is a cylindrical vessel into which water to be measured falls vertically, and passes out through a number of holes or orifices in the bottom. A vertical glass tube placed just outside the bucket is connected to the sides near the bottom, and the height of the water in the tube indicates the head on the orifice.

The orifice bucket was devised for the purpose of measuring the discharge of several artesian wells pumped by means of air lift, the water from each of which discharged into a separate cistern or small reservoir through a vertical pipe. In each case the water left the pipe with considerable blast and momentum. Several possible methods for the measurement of the discharge were considered, but were thought to be impracticable for various reasons, or inapplicable for the particular case. After some preliminary laboratory experimenting, an orifice bucket was devised which served satisfactorily in determining the discharge from each of the wells. It was at first thought that the water would enter the bucket with such a blast that entrained air would enter the vertical glass tube and cause trouble in determining the height of water in the bucket. There was, however, no difficulty from this cause.

The orifice bucket has also given satisfaction in tests made to determine yields of well pumps of the reciprocating type, where simplicity of construction and portability are desirable, and where extreme accuracy is not of great importance.

An illustration of the most elaborate orifice bucket used in the experiments is shown herewith, the capacity of which is about 1000 gal. per min. It contains a checkerwork of vertical tubes through which the water flows in passing to the orifices. The gage glass which indicates the head on the orifices is connected to a piezometer ring or chamber around the base of the bucket. The pressure of the water in the bucket is

---

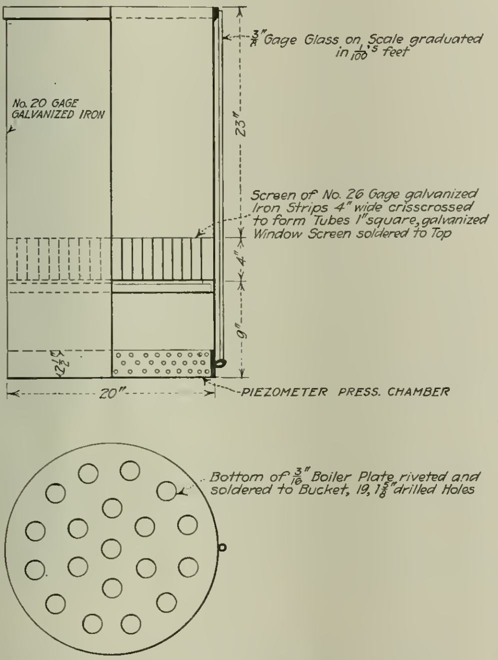
*Abstracted from *Bull.* 105, issued from the Engineering Experiment Station of the University of Illinois.

transmitted to the piezometer chamber through a large number of $\frac{1}{8}$-in holes. The bottom of the bucket consists of $\frac{3}{16}$-in. boiler plate in which nineteen $1\frac{5}{8}$-in. circular holes are drilled.

The calibration curves for this orifice bucket are also shown, for all holes open and for 10 holes open. The discharge for any other number of orifices open may be found with a fair degree of accuracy from the equation

$$Q = 32.7\ n\ \sqrt{h}$$

in which q is expressed in gal. per min., n is the number of holes open, and h is the head on the orifices in feet. The average coefficient of discharge for the $1\frac{5}{8}$-in. orifices of this bucket is 0.61.

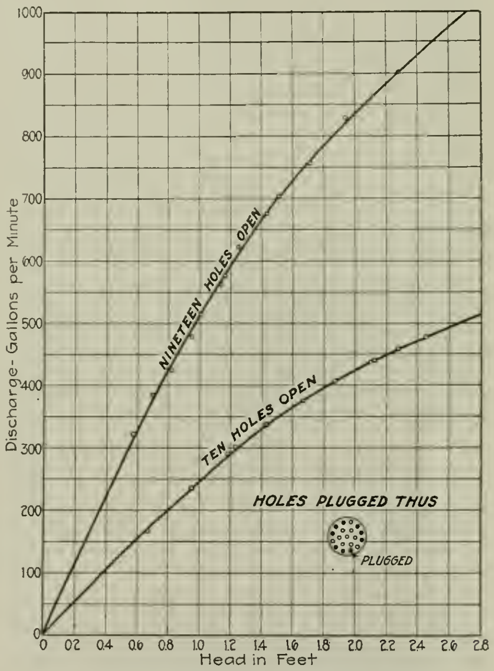

3/8" Gage Glass on Scale graduated in 1/100's feet
No. 20 GAGE GALVANIZED IRON
23"
Screen of No. 26 Gage galvanized Iron Strips 4" wide crisscrossed to form Tubes 1" square, galvanized Window Screen soldered to Top
4"
9"
2½"
20"
PIEZOMETER PRESS. CHAMBER
Bottom of 3/16" Boiler Plate riveted and soldered to Bucket, 19, 1⅝" drilled Holes

TWENTY-INCH ORIFICE BUCKET HAVING 19 ORIFICES

The curves shown were obtained when the bucket was supported firmly in an upright position, with the stream to be measured discharging vertically in the center of the bucket and with the free fall into the bucket small. The velocity of the inflowing stream, furthermore, was not high (2 or 3 ft. per sec.), thereby causing but little agitation of the water in the bucket. Experiments, however, in which more or less variation from these conditions were allowed, indicated that no serious errors resulted.

The conditions under which the discharge of water may be measured are so varied, and the purpose or aim in determining the discharge is subject to so much variation in different problems, that nearly all the many common methods of measuring water have a restricted field of usefulness, and some methods apply only to special conditions. The orifice bucket is designed to meet such special conditions. It is peculiarly adapted for the measurement of water where a device which is portable (light in weight and of small size), simple in construction, and low in cost is an essential requirement. The measuring capacity, moreover, covers a considerable range. The orifice bucket is particularly fitted for the measurement of water when it discharges with considerable blast and momentum from the end of a vertical pipe, in such a manner that the spray covers the entire surface of the water in the bucket, as in the case of air-lift pumping. When so used the orifice bucket gives results which should be correct within 5% if the proper precautions are observed in its use, as is shown by the calibration curves, and correct within 10% for the more unfavorable conditions to be met in the field.

The highest accuracy is obtained when the orifice bucket is supported rigidly in an upright position with the center of the discharging stream vertically over the center of the bucket. The free fall of the water should be as small as possible, and the velocity of the water as it enters the bucket should not be high, unless the stream is distributed, so as to avoid high local velocities in the bucket. The device, however, gives satisfactory results even when there are considerable deviations from these desirable conditions and is applicable under conditions in which other systems may not be adapted.



CALIBRATION CURVES FOR 20-IN. ORIFICE BUCKET WITH 19 ORIFICES

Turning 54-in. Diameter x 20-in. Face Rolls, without the use of a lathe, is done in the Southeast Missouri lead district, according to A. P. Watt, in Bull. 130 of the A. I. M. E. The cost of turning in the roll house by this means was $5 to $8 per shell, as compared with over $13 when the rolls were sent to a machine shop with a lathe sufficiently large to handle them.

Company Reports

Butte & Superior Mining Co.

The report of operations of the Butte & Superior Mining Co. for the fourth quarter of 1918 contains the following information:

OPERATIONS OF BUTTE & SUPERIOR MINING CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Tons of ore milled	110,039	108,182	114,716	135,877	468,814
Average zinc content (per cent.)	15 501	15 647	16 242	16 233	15 928
Average silver content (oz per ton)	6 515	6.331	6 154	6.346	6 335
Zinc concentrate produced (tons)	30,391	29,683	32,653	42,814	135,543
Average zinc in concentrate (per cent)	52.635	51 9708	51 882	49 181	51.217
Total zinc in concentrate (lb)	31,994,804	30,852,947	33,881,677	42,112,311	138,841,739
Average silver in zinc concentrate (oz. per ton)	21,047	20 500	19 763	19 209	20.029
Mill extraction (per cent. of zinc. in ore in concentrates)	93.785	91 133	90 925	95.462	92 965
Direct mining costs (per ton)	$7.9478	$8 2078	$7 0494	$5 9110	$7.1916
Direct milling costs (per ton)	$3 2443	$3 0145	$2 8841	$2 6082	$2.9188
Total direct costs (per ton) mining and milling	$11 1921	$11 2223	$9 9088	$8 5192	$10.1104
Indirect, or general, costs (per ton) exclusive of freight	$0 6716	$1.1134	$1 5363	$1 2182	$1.1435
Total cost (per ton)	$11 8637	$12 3357	$11 4451	$9.7374	$11 2539

The increase in tonnage of ore milled as compared with the third quarter is not as great as was expected, owing to the reduced forces during the early part of the period, occasioned by the serious epidemic of Spanish influenza, which resulted fatally in the case of 30 of the employees of the company, some of whom occupied responsible and important positions. Increase in production was also prevented by the entire discontinuance, for a period, of hoisting through No. 1 shaft, and, during the latter half of the quarter, by the lack of satisfactory market for the production during the period following the signing of the armistice.

FINANCIAL RESULTS OF OPERATIONS OF BUTTE & SUPERIOR MINING CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Net value zinc concentrate at mill.	$983,362 32	$1,122,021 43	$1,124,894 67	$1,405,271 39	$4,635,549 81
Net value lead concentrate and residues.	398,352.34	342,225 75	302,609 10	236,517 69	1,279,704 83
Miscellaneous income	20,262 53	15,702 11	13,815 63	9,291 15	59,071 42
	$1,401,977 19	$1,479,949 29	$1,441,319 40	$1,651,080 23	$5,974,326 11
Operating costs, taxes, etc	1,305,470 56	1,334,501 53	1,312,932 53	1,323,098 70	5,276,003 32
Profits	$96,506 63	$145,447 76	$128,386 87	$327,981 53	$698,322 79

The No. 2 shaft was completed to a depth of 1900 ft. (from which elevation it is expected that it will be completed to the 2050 ft. level within the next three or four months), and the pumping equipment on the 1200-ft. level at shaft No. 1 was removed to the new pump station at shaft No. 2 and put in satisfactory operating condition. With the somewhat curtailed output this has permitted the discontinuance of hoisting through No. 1 shaft and the hoisting of all the ore through the new No. 3 shaft, from the ore bins of which it is delivered to the new coarse-crushing plant. This change in practice will result in material economies in operation, so that, in spite of a reduced scale of production, it is expected that some reduction of mining and milling costs will be brought about in the immediate future.

Underground development work resulted in the discovery of no new orebodies, but, nevertheless, has shown favorable results in the further development at greater depth of the orebodies already known on the Four Johns and Raymond claims, which adjoin the Black Rock claim and workings to the eastward. These are known to continue below the stopes on the 1300-ft. level, of good grade and extent, to a depth at least as great as the 1800-ft. level, at which point, and below, developments are not yet sufficiently extensive to demonstrate the character or extent of the orebody. The ore reserves were increased during the period, and development work now in progress should, within the next three months, add a material tonnage to such reserves.

Some decrease was evidenced in the cost of mining as compared with the previous period. The supply of labor is now plentiful, and the improvement in efficiency which is taking place will in all probability permit of some reduction in mining costs in spite of the increase in the proportion of overhead expenses incident to the reduction in output, which will, no doubt, prevail for several months. The grade of ore mined and milled was maintained at approximately the same average as during the previous quarter.

The results of milling operations showed a marked improvement over those of the preceding quarter, the extractions of zinc being increased 2.66% and the grade of zinc concentrate improved to the extent of 0.65% zinc. There was an increase in the milling costs due to the absorption of some unusual items of expenditure during this period.

Financial results of operations for the fourth quarter, as compared with the other quarters of the year, are shown in the table.

The motion to dismiss the appeal in the apex litigation, which was noted for Nov. 18, was submitted on that date, and the Supreme Court of the United States on Dec. 10 set the case for hearing upon all matters for Jan. 6, 1919, since which date the case has been argued and is now under submission before the United States Supreme Court, and it is entirely probable that no further steps will be taken in this matter until a decision has been rendered.

In the flotation litigation the Supreme Court of the United States granted the application of Minerals Separation Ltd., *et al*, for a writ of certiorari, and the case is now pending before that court. The Minerals Separation Co. made application to the court for an order to restrain the Butte & Superior Mining Co. from disposing of its assets pending the actions on the mandate of the Supreme Court, at the same time moving the court to advance the cause for a hearing. On Jan. 6 the Supreme Court denied the motion for the restraining order and set the case for hearing on Mar. 3, 1919.

It is expected that, before the next quarterly report is issued, the Supreme Court of the United States will have decided the Elm Orlu case, and that during the succeeding quarter a decision will be rendered by that court in the Minerals Separation case.

Superior & Boston Copper Co.

The report of the Superior & Boston Copper Co., operating at Copper Hill, Ariz., for the year ended Sept. 30, 1918, states that receipts totaled $352,500.30 and expenditures $364,703.30. Deducting the deficit for the year from the balance of Oct. 1, 1917, there remains on hand Oct. 1, 1918, a balance of $129,374.35.

Principal operations during the year consisted of development work at the east end of the mine at the 800 and 1000 levels and also the reopening of the 1200 level. Development includes the following: Winzes, 47 ft.; drifts and crosscuts, 1504 ft., and raises, 350 feet.

Victoria Copper Mining Co.

The Victoria Copper Mining Co. at Victoria, Mich., reports that during 1918 there was produced 1,533,536 lb. of refined copper, or 79,104 lb. less than in 1917. Operations for the year (including expenditures of $17,045.52 for construction and development of water power) show a profit of $31,405.44, which, added to surplus and deducting supplies and stock in store at the mine, leaves a balance of $238,227.53, which amount is represented by cash, Liberty bonds, and copper on hand figured at 18c. per pound.

A total of 120,616 tons of rock was hoisted, 106,730 tons of which was stamped and produced 2,451,413 lb. of mineral. Drifts driven totaled 2447 ft.; crosscutting, 140 ft.; raising, 229.5 ft., and shaft sinking, 30.5 feet.

Arizona Copper Co., Ltd.

The Arizona Copper Co., Ltd., reports for the year ended Sept. 30, 1918, that the surplus, after the year's business and after paying preferential dividends of $119,221.15, amounted to $1,333,036.20. The directors recommended that a dividend for the year to Sept. 30, 1918, be declared on the ordinary stock at the rate of 72c. per share, and this will absorb $1,107,994.15. Production for the year was 40,442,000 lb. of copper, of which 27,262,000 lb. was refined, and the remainder, 13,180,000 lb., was sold as bessemer metal. Total ore mined was 1,095,568 tons, which yielded 35.08 lb. of copper per ton.

Prospecting with churn drills was begun to determine the character of the ground east of the Coronado adit, and during the year about 6000 ft. was drilled. Among the improvements made were: Retimbering of No. 6 shaft and equipping same with water sprays for fire protection; the laying of a new pipe line from Morenci to Coronado; extension of the King incline 400 ft. down to the level of the Torpedo tunnel, and the installation of a rock crusher at the lime quarry.

No. 6 Concentrator, at Morenci, treated 935,861 tons of ore, having an average grade of 2.36% copper. During the year 12 motors of 125 hp. were installed in the grinding department, 12 Allen thickening cones, 12 Dorr classifiers, 8 Callow flotation cells, and several large Dorr thickening tanks for treatment of concentrates and tailings. No. 4 Concentrator, at Clifton, treated 113,257 tons of ore, having an average grade of 2.13% copper. Changes were made in the flotation department and Deister tables installed to replace the old vanners. The total amount of new material smelted during the year was 213,336 tons.

Vindicator Consolidated Gold Mining Company

The report for the year ended Dec. 31, 1918, of the Vindicator Consolidated Gold Mining Co., operating in the Cripple Creek district of Colorado, reflects the difficulties of gold mining in times of high prices, as the value of the product remains fixed, though labor and supplies advance. In addition, the Cripple Creek district suffered severely from the influenza epidemic.

Development in 1918 amounted to 5112.5 ft., of which 2899 ft. was driven by lessees. Of this, 2622 ft. was drifting and 2490.5 cross cutting. Early in 1918 development work was discontinued on the 20 or bottom level of the Golden Cycle shaft. On this level a total of 4240 ft. of development has been done, without exposing ore of commercial grade. This level is 2150 ft. below the shaft collar.

There are possibly bodies of ore at a greater depth, but it is the opinion of the management that there could not be enough commercial ore to warrant the expenses of sinking and exploring. Ore reserves were greatly depleted during the year covered by the report. On Jan. 1, 1918, they were 255,500 tons; on Jan. 1, 1919, reserves were 104,230 tons. The 19th and 20th levels were cleaned up, all pipe, tracks, pumps, and other materials removed, and pumping was discontinued on June 27, 1918. The workings filled rapidly, and the water continued rising after the level of the Roosevelt drainage tunnel was reached, so that on July 27 pumping was resumed from the 18th level. This appears to indicate that an impervious dike lies between the Vindicator and Portland properties, and that the drainage tunnel will not drain the former.

Closer picking of the shipping ore and careful sorting of the rejects before sending them to the flotation plant resulted in great savings. During the year, 230,304 tons of company ore was hoisted, of which 21,392 tons was shipped, having a value of $1,166,295 and giving net returns of $1,015,917. On lessees' account, 53,463 tons was hoisted, having a gross value of $463,514 and a net value of $321,098. A total of 222,626 tons of ore was sent to the flotation plant, having a value of $2.13 per ton, from which 176,623 tons was screened out, with an average value of $1.42, and 46,003 tons, of an average value of $4.18, was sent to the flotation-plant crusher. Concentrates recovered totaled 6029 tons, of a value of $30.20 per ton.

The company purchased the Ferro Alloy Co., at Utah Junction, Colo., and a chrome mine 23 miles southeast of Glenrock, Wyo., during 1918. The life of the Victor mines will apparently be short, and active search is being carried on for a new property. Five properties were thoroughly examined in 1918, but none was taken over. The Ferro Alloy plant is devoted solely to ferrochrome making, about 100 tons per month being produced. Net working capital increased from $136,811 at the close of 1917 to $542,204 at the close of 1918, but the statement of ore reserves as given above shows that this was at their expense.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Mineral Claims Offer Problems

No awards will be made by the War-Minerals Relief Commission until after the time limit for filing claims has passed. This is made necessary because of the limited appropriation available. As it is possible that the total claims may exceed $8,500,000, it is the opinion of the commissioners that it would be unfair to allow the first claims established, as others of equal merit, coming at a later time, could not be settled because of exhaustion of the appropriation.

A number of claims have been filed with the commission, but they will not be considered until the questionnaire has been filled out in accordance with the regulations which have been adopted. At this writing, no claims filed under the regulations have been presented.

It is expected that field men will have to make a personal examination of most of the claims coming within the purview of the act. An arrangement has been made with J. E. Spurr, the head of the War-Minerals Investigation Section of the U. S. Bureau of Mines, whereby his field force will make the necessary examinations. Field men already have been dispatched to investigate the claims of the Chestatee Pyrite and Chemical Corporation, in Georgia, and of the National Pyrite and Copper Co., in Alabama.

It is apparent that the difficult problem facing the commission is the securing of a business basis on which to distinguish between the claimants who made expenditures at the request of Government agencies and those who entered upon a mining venture for speculative purposes.

Steel Prices Lowered

To the surprise of most persons interested, the new Industrial Board of the Department of Commerce accomplished something distinctly tangible when an agreement was reached with the steel manufacturers which cut the price of steel fully 20% below the war prices and from 10 to 14% under the post-war prices which the steel industry voluntarily had placed in effect. The price of ore is to remain the same until the projected reduction in freight rates becomes effective. No negotiations with the producers of other metals are expected at this time, according to a statement given out at the offices of the Industrial Board.

One of the surprises of the meeting is that the prices are to be maintained for a year. This is contrary to precedent in the steel industry, where it has been the practice to revise prices quarterly. One of the most interesting aspects of the negotiations is the legal phase. There is every reason to believe that assurances have been obtained from the Department of Justice that agreements as to prices when the Government is a party are not regarded as violating the Sherman Law. The official statement regarding the steel prices, which was issued Mar. 21 by the Industrial Board, follows in essential particulars:

The board is asking industry to coöperate in taking the first step and voluntarily make temporary sacrifices in the interest of all, and has asked the iron and steel industry, because of its fundamental importance, to be the first to act, and the board is highly gratified with the spirit in which it has responded.

It is fully understood and expected that the present wage rates or agreements will not be interfered with, the approved prices having this in view.

The reduction in the price lists may involve the necessity of some high-cost plants either shutting down temporarily or running at a loss for a period, but it is expected that with an increased volume of business, soon to be developed, a reasonable return to the average and better than average producers will be afforded. In view of the higher costs developed throughout the world as a result of the war, a return to anything like pre-war prices is regarded as out of the question. It is expected that other industries, as well as the consuming public and labor, will recognize their obligations in the circumstances and coöperate in the same generous spirit as has the steel industry.

Judge E. H. Gary, of the U. S. Steel Corporation, in announcing the new prices, said in part:

The objects to be secured are a revival and stabilization of business by establishing a reasonably low basis of prices which would be satisfactory to the consuming public, and yet, so far as practicable, would yield a moderate and reasonable return to the investors where they are entitled to it in the application of sound business principles; and at the same time would not disturb wages rates or interfere with wage agreements; and, further, having determined upon prices which it is expected will not be reduced during this year, it is believed that the volume of business will be promptly increased and that furnaces and mills will be operating at a largely increased capacity, thus giving employment to a correspondingly increased number of employees.

It has been necessary to ascertain and scrutinize all the facts and figures in order to prevent any injustice, and this has been the occasion for considerable discussion and some differences, but as a final result of the conferences which have taken place during the last two days and before, the committee appointed to represent the entire iron and steel industries joined in the report which was made to the Industrial Board.

While in the opinion of some of the manufacturers the board has insisted upon some changes in the schedule submitted before approving the same, yet the iron and steel committee are convinced that the members of the board have been governed solely with the intention of protecting and promoting the best interests of the public, the investors of capital, and the employees, without discrimination, and that the action of the board has been wise and just.

The price list and reductions submitted and approved by the Industrial Board are in part as follows:

PRICE LIST OF IRON AND STEEL PRODUCTS APPROVED BY INDUSTRIAL BOARD

	Nov. 11 Price	Present Price	New Price	— Reductions — From Nov. 11	From Present
Pig iron, basic	$33 00 G.T.	$30.00	$25.75	$7 25	$4 25
Billets, 4-in	47 50 G.T.	43 50	38 50	9 00	5 00
Billets, 2-in	51 00 G.T.	47.00	42 00	9 00	5 00
Merchant bar, base	2 90 G.T.	2 70	2 35	11 00 N.T.	7 00 N.T.
Structural, base	3 00 G.T.	2 80	2 45	11 00 N.T.	7 00 N.T.
Light rails.	3 00 cwt.	2 70	2 45	11 00 N.T.	5 00 N.T.
Rails standard bessemer	55 00 G.T.	55 00	45 00	10 00	10 00 G.T.
Rails standard O.H.	57 00 G.T.	57 00	47 00	10 00	10 00 G.T.
Ore	No change				

Basing points and differentials unchanged. Prices effective at once.

Examination for Mineral Geographers

In an effort to secure several mineral geographers and mineral geographic aids for the U. S. Geological Survey, the Civil Service Commission will hold a competitive examination Apr. 9 and 10. The examination may be taken at the usual places throughout the United States. According to the commission's announcement, the duties of appointees will consist chiefly of the preparation of reports upon the mineral resources of the United States and other countries, including the studies of occurrence, production, consumption, and movement of mineral commodities in world trade. Appointees will be eligible for promotion to higher grades.

Competitors who pass the examination for appointment to the position of mineral geographic aid will receive salaries ranging from $1200 to $1440 a year; competitors eligible for appointment to the positions of mineral geographer, $2400 a year and higher; associate mineral geographer $1800 to $2340 a year; and assistant mineral geographer $1500 to $1740 a year. At present there is one vacancy in the position of mineral geographer, and there are several vacancies in each of the other positions.

For mineral geographic aid, applicants must have been graduated from a college, university, school of mines, or school of mining engineering of recognized standing, or be senior student in such an institution and furnish proof of actual graduation within three months from the date of the examination. For mineral geographer, in addition to the education above prescribed, applicants must have had at least one year's graduate work in geology or geography, or a year of practical experience in field or office studies relating to mineral deposits.

Statements as to training and experience are accepted subject to verification. Applicants must have reached their 20th but not their 45th birthday on the date of the examination. Applicants must submit to the examiner on the day of the examination their photographs, taken within two years, securely pasted in the space provided on the admission cards sent them after their applications are filed. Proofs or group photographs will not be accepted. The examination is open to all citizens of the United States who are able to meet the requirements.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C., or to the secretary of the U. S. Civil Service Board at any place listed thereon. Applications should be properly executed, excluding the medical certificate, and filed with the commission at Washington in time to arrange for the examination at such place as may be selected by the applicant.

Promotion of Industrial Research

Great Britain's action in setting aside £1,000,000 for the promotion of industrial research is expected to stimulate a movement in the same direction which has been under way for some time in this country. A proposal to that end is contained in a bill introduced in the recent session of Congress by Senator Hoke Smith and Representative William S. Howard. As the Smith-Howard bill contains certain objections, which are regarded as precluding its passage, the National Research Council is endeavoring to perfect a new one.

The salient features of the British plan have been communicated to the U. S. Bureau of Mines. Under it, representatives of an industry who are interested in obtaining the benefits of more extended research make application to the government council for a grant. If the application is approved, certain sums are set aside for specified purposes. There must be also certain proportionate contributions by the industry. The results of the work are to be available to all the companies that contributed to the research fund, but are not to be available to outsiders.

Business Training for Engineer Students

Convinced that insufficient attention is being given to business training in the engineering courses of the higher institutions of learning, the U. S. Commissioner of Education is conferring with representatives of these institutions. In these conferences, the commissioner is being represented by Dr. G. L. Swiggett, the specialist in charge of commercial education for the Bureau of Education. Dr. Swiggett was secretary in charge of the second Pan-American Scientific Conference, which was held in Washington in 1915.

The matter first was called to the attention of a small group of administrative professors of engineering and commerce from several of the institutions in the Middle West. There was such unanimity of opinion that the average engineer is leaving college with insufficient business training that it was decided to hold a large conference in Washington on Mar. 31. At this conference an effort is to be made to formulate plans as to curricula which it is hoped the various colleges and universities may consider worthy of adoption.

As it is expected that the United States will take a far more active interest in projects in other countries calling for engineering skill, it is the opinion of Dr. Swiggett that the requirements for that purpose alone would justify greater attention to the business side of engineering education.

The conference on Mar. 31 also will be attended by representatives of the four leading national engineering societies and of the Society for the Promotion of Engineering Education. The conference is to be of an executive nature

Against Protecting Potash Industry

Representatives in Washington of farmers' organizations are outspoken in their opposition to the Henderson potash bill, which died with the recent Congress. It is Senator Henderson's intention to reintroduce the bill as soon as the extra session is convened. The opposition to it is so strong, however, that it may be difficult to get a bill out of the committee which materially restricts the importation of foreign potash. If such a bill were reported, extended debate and deferment of consideration would ensue. For this reason, a plan is now being considered which would empower the War Trade Board, under certain restrictions, to prevent dumping of potash, dyestuffs, or other materials. This plan involves legislation to continue the life of the War Trade Board, which under present law automatically will cease to exist with the signing of the peace treaty.

Nitrate importers have agreed with the Government to sell the War Department's surplus of sodium nitrate on a basis of one pound of Government nitrate to each two pounds of their own. The disposition will be made by the same importers by whom it was purchased originally. The importers will be allowed to deduct the actual expense incurred in making the sales, but all the nitrate will be disposed of at the market price.

That the quality and extent of the potash deposits in upper Alsace has not been realized outside of Germany is the belief of officials in Washington. Information from German sources has just become available which leads to the conclusion the Alsace deposits are of far greater value than the potash monopoly cared to have known.

Norcross Commands Twenty-Seventh

Colonel Perry, who received his "eagles" just before leaving France, gave a farewell dinner to his officers at the Columbia Club on Mar. 24. On the following day he relinquished command of the Twenty-seventh, having been ordered to duty with the Chief of Engineers in Washington. Maj. F. S. Norcross succeeded to the command. The regiment is now being dispersed in squads among the camps nearest the several homes, headquarters going to Camp Grant, Illinois.

As announced in the last issue, the Comfort Fund for the mining regiment has reached its goal of $20,000.

Engineers Propose U. S. Department Of Public Works

The following communication has been sent to engineering organizations in the United States:

ENGINEERING COUNCIL
McLachlen Bldg., Washington, D. C.

March 11, 1919.

On Feb. 20, 1919, Engineering Council passed a resolution advocating the creation by Congress of a Department of Public Works and urging all members of the engineering profession in all branches to participate in an effort to acquaint the people of the country with the critical importance of this matter and to assist in the creation of such a department.

The principle underlying the foregoing has been urged during the last half century by many engineers, but no legislative result has ever been achieved. The need for a Department of Public Works has now become so urgent that the project is being advocated throughout the country. Immediate action by engineers is desirable, so that a well-considered plan, which will receive unanimous engineering support, may be laid before the 66th Congress.

Therefore by virtue of authority vested in me by Engineering Council, I hereby cordially invite each engineering organization to which this call is conveyed to appoint one delegate to meet with the National Service Committee of Engineering Council in joint session at Chicago, Ill., Apr. 23 to 25, for the purpose of taking such action as may be necessary to achieve the desired result.

It is hoped that each organization will act promptly and favorably on this invitation. Kindly send notice of acceptance to M. O. Leighton, Chairman, National Service Committee, Engineering Council, 502 McLachlen Bldg., Washington, D. C., giving the total number of members in your organization at date of notice. Advice concerning local arrangements and provisional program will be forwarded on receipt of acceptance notice.

J. PARKE CHANNING,
Chairman, Engineering Council.

The local arrangements at Chicago will be in charge of the general committee of Technical Societies of Chicago, which is a federation of all the local engineering organizations. The executive committee of the general committee will be in immediate charge, working with C. B. Burdick, member of the American Society of Civil Engineers, who is the Chicago member of the Engineering Council's committee on national service.

Details of the conference are being worked out by the national service committee, of which M. O. Leighton is chairman. This conference is the result of a large amount of agitation that has been going on for some years. It is expected that a resolution will be drafted which can be presented to Congress and which will receive the unanimous support of the engineers of the country.

Although the conference will determine upon some plan to be followed, informal discussions that have taken place among engineers seem to indicate that the plan which is receiving the greatest following will consist of a rearrangement of Federal engineering functions, rather than the creation of an additional Cabinet office.

Under such a rearrangement, the various engineer bureaus of the Government would be brought together under one department, instead of being distributed among several departments, as at present, which would result in a common administration of engineering work, a large saving of expenses to the Government, especially overhead expenses, and an increased efficiency arising from the combining of the several functions under one authority and the prevention of duplication which now occasionally occurs.

The project of organizing a Department of Public Works is not new. Many attempts have been made to induce Congress to enact the necessary legislation. All have failed, for one reason or another. Experience gained in connection with public works since the war started, and the obvious disadvantage of the chaotic system of public-works management, have convinced the engineers that a strong effort must be made to secure the obvious remedies.

Engineers in general do not expect that a successful result will surely follow the first attempt, although every effort will be made toward that end.

Government Will Sell Rail Stocks

The Government plans to sell at prevailing market prices the surplus stock of 80-lb. rail and 25-lb. rail ordered for the American Expeditionary Force overseas, but not required, owing to the signing of the armistice. There are about 50,000 tons of 80-lb. rail and about 7000 tons of 25-lb. rail; also large quantities of crossings, slip switches, and turn-outs. The bulk of this material is at port, readily accessible for loading. All sales are being conducted through the office of the Director General of Military Railways, Washington, D. C., where further information can be obtained.

Employment for Engineers

For the convenience of engineers returning from military service, a list of agencies is here given which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau: Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service: A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service: George W. Kirchwey, state director, 16 East 42d St., New York City.

To Encourage Unhampered Research

Speaking at a recent meeting of the Royal Institution in London, Sir J. Dewar said that a few years before the war Professor Haber had paid the institution a visit, with the object of studying the best means of establishing similar bodies in Germany, as there it was felt that many of the research workers were too much dominated by manufacturing and academic influences. Since then five or six Kaiser Wilhelm Institutes had been founded on the model of the Royal Institution. The latter had always been conducted on individualistic lines, being maintained by the members, and at an average cost of not more than $6000 per annum during the first 100 years. The speaker declared that he feared for its security, now that state interference was the order of the day.

Quebec Asbestos in 1918*

Asbestos mining in Quebec was active during 1918, and asbestos is one of the few substances on which the cessation of hostilities will have no effect for some time. Owing to the program of intensive construction of ships which has been laid out by various countries, the demand for asbestos will continue, as considerable quantities of this substance are used in shipbuilding.

Both the tonnage and the value show marked increase as compared with 1917, although it will be noticed in the accompanying tables that the amount of rock mined is less. The value of the asbestos recovered from the average ton of rock was $4.06 in 1918, $3.08 in 1917, and $2.13 in 1916.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC IN 1918

	Shipments and Sales		Average Value	Stock on Hand Dec. 31, 1918	
Designation of Grade	Tons	Value	per Ton	Tons	Value
Crude No. 1	1,808	$1,695,761	$937 92	1,104	$985,449
Crude No. 2	1,896	805,331	424 74	582	122,399
Mill Stock No. 1	13,559	2,221,954	163 87	2,993	586,850
Mill Stock No. 2	32,412	1,852,992	57 17	2,522	154,934
Mill Stock No. 3	92,700	2,443,861	26 36	7,033	234,890
Totals	142,375	9,019,899	63.35	14,234	2,084,522
Asbestic	16,850	34,046	2.02	375	873
Totals	159,225	$9,053,945	......	14,609	$2,085,395

Quantity of rock mined in 1918 was 2,445,745 tons.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC IN 1917

	Shipments and Sales		Average Value	Stock on Hand Dec. 31, 1917	
Designation of Grade	Tons	Value	per Ton	Tons	Value
Crude No. 1	1,761	$1,370,740	$778.38	580	$470,923
Crude No. 2	3,603	1,374,387	381 46	746	269,766
Mill Stock No. 1	13,197	1,318,387	99 90	1,089	206,124
Mill Stock No. 2	54,072	1,988,197	36.77	3,346	141,344
Mill Stock No. 3	64,609	1,146,847	17.75	7,447	124,735
Totals	137,242	7,198,558	52 45	13,208	1,212,892
Asbestic	17,210	42,139	2 45	263	805
Totals	154,452	$7,240,697	....	13,471	$1,213,697

Quantity of rock mined in 1917 was 2,634,410 tons.

Get the Worth of Your Money

It would be interesting if one could examine an authentic record of mining investments and compile three lists, one in which the investments had been profitable, a second showing a fair return for money invested, and a third list of investments in which the money had been lost without any compensation whatever. If it were possible to compile such a record it is probable that those in the latter class would foot up to a rather handsome total, particularly among American investors.

One besetting sin of the American people, recognized the world over, is that few of them make any effort to get the worth of their money. "Easy come and easy go" has been their motto for so long that Americans have established an international reputation as "easy marks." The war and the necessity for each citizen to play some part in it have taught many that if purchasing is done thoughtfully and an attempt is made to get the worth of the money expended, it is possible to have a few dollars at the end of the month with which to buy Liberty bonds.

More of these bonds must be taken, but, feeling that the danger point has been passed, many are inclined to relax all patriotic efforts and "let Jones walk the floor."

Perhaps the fighting is over and the death lists are closed, but the bills are not yet paid, and it is incumbent upon those who are still safe and sound to see that they are paid. Let no one stint himself—the necessity for this may have passed—but let all remember the lessons learned on careful buying, and get the worth of the money spent, whether it be in buying socks or stocks, wines or mines. The savings that may easily be made will amply pay each individual's share of the indebtedness that Uncle Sam has incurred on his behalf.

Proved Oil Territory in California

The proved area of California oil fields, according to the Standard Oil Co., aggregates 99,844 acres, equivalent to 141.94 square miles. In the determination, the lines were drawn 200 to 300 ft. outside of the field and in the instance of outlying single wells the field is credited with about 15 acres, thus representing the actual proved area, giving no consideration to territory generally regarded as proved but not fully drilled. Large areas in Buena Vista Hills, generally regarded as proved, are not included in the accompanying tabulation, which also shows the total production of oil in California to Dec. 31, 1918, and the total barrels per acre in the respective fields.

TOTAL PRODUCTION, AREA, AND PRODUCTION PER ACRE OF CALIFORNIA OIL FIELDS TO DEC. 31, 1918

Field	Proved Acreage	Total Production to Dec. 31, 1918 (Barrels)	Total Barrels per Acre to Dec. 31, 1918
Kern River	7,755	206,566,725	26,637
McKittrick	1,645	55,165,388	33,535
Midway-Sunset	40,582	325,871,087	8,030
Lost Hills-Belridge	4,675	33,846,134	7,240
Coalinga	14,916	213,155,797	14,290
Lompoc and Santa Maria	7,998	88,057,211	11,010
Ventura County and Newhall	4,904	21,311,263	4,346
Los Angeles and Salt Lake	2,700	54,300,112	20,111
Whittier-Fullerton	5,239	140,487,718	26,816
Summerland	230	2,234,947	9,717
Miscellaneous	(a) 200	992,102	4,961
Totals	90,844	1,141,988,484	12,571

(a) Estimated.

Bismuth in California*

Several bismuth minerals have been found in California, notably native bismuth and bismite (the ocher) in the tourmaline gem district in San Diego and Riverside counties, near Pala. Other occurrences of bismuth minerals, including the sulphide, bismuthinite, have been noted in Inyo, Fresno, Nevada, Tuolumne, and Mono counties, but in small quantities. The only commercial production recorded was 20 tons, valued at $2400, in 1904, and credited to Riverside County.

Recovery of bismuth from blister copper in the electrolytic refinery has been noted[1], ranging as high as 27.3 lb of metallic bismuth per 100 tons of blister copper from the Iron Mountain, Shasta County, ores.

The uses of bismuth are somewhat restricted, the metal being employed principally in the preparation of medicinal salts, and in low melting-point or cliché alloys. These alloys are utilized in automatic fire sprinkler systems, in electrical fuses, and in solders.

California Mineral Production in 1918 is estimated by the California State Mining Bureau as follows, it being understood that these are simply preliminary figures, the revised returns to be reported later: Tungsten concentrates, 2300 tons; lead, 7500 tons; zinc, 2250 tons; quicksilver, 22,000 flasks; petroleum, 100,000,000 bbl.; chromite, 52,000 tons; manganese ores, 25,000 tons; magnesite, 90,000 tons. The production of gold, silver and copper is not here stated, as estimates of these for California have already been made.

---

*Abstract from "Preliminary Statement on the Mineral Production in the Province of Quebec," Quebec Bureau of Mines.

*Abstracted from *Bull.* 83, "California Mineral Production for 1917," California State Mining Bureau.

[1] *Trans.* A. I. M. E., Vol. 47, pp. 217-218.

Editorials

The Return of the Twenty-Seventh

IT WAS the good fortune of representatives of the *Journal* to meet the incoming Twenty-seventh, and we can assure our readers that it was with a feeling of pride that we watched the great transport making its way slowly up the river, and in our mind's eye we visioned the return of the soul of a great industry. It was with confidence that we said good-bye to the mining regiment, with pride that we noted its accomplishments in the great struggle, and now its safe and victorious return is an occasion for thankfulness.

The mining industry deserves much credit for the part it has played in the fight—its response to the nation's call for materials, its contributions to the various funds and Liberty loans, and last, but by no means least, the individual effort of each man of the Twenty-seventh. Previously imbued with a spirit of coöperation, and appreciative of the value of working together, these men have exhibited a characteristic *esprit de corps* throughout their entire experiences "over there" that does them credit, and in the complete history that will be written will be chronicled many instances of bravery, steadfastness of purpose, and accomplishment that have been performed by our own mining regiment —the Twenty-seventh.

Following its organization at Camp Meade in October, 1917, the regiment was speedily filled by men recruited from various mining districts: engineers, artisans, miners, and others, all well equipped to undertake such work as was assigned by their respective commands. Their intensive training at Camp Meade and their previous experiences in practical work combined to make a splendid unit, and, although circumstances were such that they were not required to do actual military mining, their versatility proved of immense value, and the record made by the regiment in road and bridge building and other construction work is an enviable one. But not alone on these accomplishments do their laurels rest, for we know the Twenty-seventh to be fighters as well as builders, and the stories of hand-to-hand conflicts, spirited dashes in the night and all manner of reconnoissance work make up a history that rivals the brave pages to be written of other regiments.

Company A went to France in February, 1918, companies B and C followed in June, and D, E and F went on Sept. 1. They worked at Chateau-Thierry, St. Mihiel and the Argonne, and in the Argonne-Meuse sector alone built 55 bridges, spanning rivers with pontoons and foot-bridges. They return—44 officers and 1349 men, under the command of Col. Oscar B. Perry—with three regimental citations and the names of three great battles on their flag. During its service the regiment lost only six men, and 31 were wounded. This, in short, is the history of the Twenty-seventh—certainly an enviable record and one in which every man connected with the mining industry should have pride.

We are advised from many sections that the welcome home is to be a warm one. Realizing the sacrifices the men have made, it will indeed be most appropriate for the mining industry fittingly to express its appreciation of a service well rendered and successfully completed. The training and experiences have been such that the Twenty-seventh returns a bigger and keener industrial army, and the men will be anxious to again assume the responsibilities which they left. In districts where curtailment of mine operations has followed a lack of demand for the product mined, and in which high costs have made mining unprofitable, it has been necessary to reduce forces to some extent. But, with the return to normal conditions, the mining industry enters an era of prosperity that promises to be permanent. The situation demands the employment of big men; men whose opportunities well fit them to cope with the growing problems of operation. Of such are the Twenty-seventh.

Position of the Low-Grade Zinc Mines

THE need for efficient operation is felt at this time more acutely than at any other of which there is record. Bed-rock prices for zinc, increasing labor and supply cost, and a marked decrease in labor efficiency combine to make the position of the operator of a zinc mine in Wisconsin a far from comfortable one. Like conditions maintain in other kinds of metal mining also, and in other localities as well. W. F. Boericke, in another place in this issue, shows how the mining of zinc ores in Wisconsin has increased on a unit basis to 55.1% over the costs in 1914. To overcome this heavy increase there is the remote possibility of the decrease of wages and supply cost. Both of these may eventually take place, but the operator who desires to continue mining is almost compelled to look in other directions for a solution of the problem.

Mr. Boericke points out various ways of successfully increasing efficiency and promoting economy. He, however, states that the operators have been obliged to resort to the mining of richer ground, and, where this has been impossible, the usual policy is to close the mine rather than exhaust the ore reserves on an unprofitable market. It is a pleasure to note that the attitude of the miners and mill men has been generally good. Wholehearted coöperation on their part will lighten many an operator's difficulties, and make it possible to continue the operation of mines that are on the ragged edge.

About Spanish

LATE in January a facetious correspondent favored us with his opinions as to the advisability of promoting the study of Spanish in the United States. His letter, which we published, was written in lighter vein; and although not intended to be taken seriously *in toto*, it contained, nevertheless, a number of conclusions which could be considered logical and which might prove difficult to controvert. His main object was to emphasize the logic in the contention that the study of a particular foreign language at school or college is, more or less, an unprofitable investment. He cited an instance where a large class of students took Spanish, all of whom had no working knowledge of the language when they subsequently needed it in a Latin-American country.

The majority will admit that there is a lamentable waste of time learning languages that are subsequently forgotten. Knowledge so gained must be continually exercised and added to by daily practice. This is the prime factor to insure fluency. We are inclined to agree with our correspondent that the student who laboriously acquires a classroom knowledge of Spanish in an American town or city will probably find that he could have spent his time to better advantage. Of course, it depends largely on the man. An intelligent person can learn enough Spanish in a few weeks to make himself understood, and is then able to absorb local or technical phraseology with facility, and so expand his vocabulary to the desired degree.

In this issue we print a further contribution by another correspondent, in South America, who takes a view which on primary consideration appears to be diametrically opposite to that of our earlier contributor; but, on second thought, we are inclined to believe that both opinions may be right. There is nothing like a positive statement for eliciting facts. No amount of lukewarm theorizing ever achieved anything; and between the two somewhat extreme views presented we would endeavor to steer a middle course.

The fact is not sufficiently realized that a really workable knowledge of Spanish, including an ability to speak, read, and write the language in accordance with the niceties that local custom dictates in, say, Uruguay, Chile, Spain, and Mexico, might be considered impracticable because of the intensive study that would be needed for a considerable length of time. The idiomatic expression of a language in a particular country or district can be best left to natives; and, as our earlier correspondent pointed out, men to do clerical work of this kind can be hired for a nominal sum.

We appreciate the fact that an acquaintance with Spanish will undoubtedly be useful to an engineer going to one of the Spanish-speaking Latin-American countries; but, when it comes to the question of *habla*, we suspect that prospective employees' qualifications in this connection would be more favorably viewed if the language had been acquired in the field rather than in the classroom. The attainment of the necessary perfection in the latter case means a strenuous effort, and a considerable expenditure of time, if not money. A new language can best be studied after one reaches the country where it is spoken, and not before. It is then that ample opportunity occurs to concentrate on the imperative and the necessary, to the exclusion of the unessential; and it is only by practice that even a fair degree of perfection can be attained.

Languages to many men are anathema—they even multilate their own mother tongue in speech and script. Of them little can be said other than that the condition is often due to the neglect of fundamentals at school or college. Others—and an engineer to be worthy of the name should be in this category—attempt the acquiring of a language only when the labor is justified, and usually realize that the result will be achieved with the minimum of exertion and without waste of time by personal contact with natives speaking the language.

American mining companies in Chile and Peru doubtless like to engage men with a knowledge of Spanish, but they would probably prefer those who have acquired it in the field. Next to this class might be grouped the men with no knowledge of Spanish, or time to spare from professional work to study it from a "professor," but with more than enough initiative, energy, and intelligence to pick up a rudimentary knowledge of the new tongue on the voyage down, and sufficient interest in the prospect of advancement to make themselves proficient when they get there.

In the final category comes the man who has, perhaps, spent years studying Spanish at school, absorbing Castilian niceties of phraseology and mood, which are of no use to him in the field, even if he remembers them—which he probably does not. The whole problem must be faced boldly, and care taken that fundamental factors are not ignored. Let us avoid the pitiable error of insisting on the acquisition of Spanish by school children, to the detriment of their knowledge of and their ability to express themselves in English.

The root of success in connection with the acquisition of a new language, as in other branches of endeavor, is a determination to succeed; and the cheapest method of acquiring Spanish is to learn it from the natives of the new country where profession or trade takes one, recognizing the potentialities and intrinsic worth of that courtesy and civility which are the characteristic traits of our Southern neighbors.

The Licensing of Hoisting Engineers

IT SEEMS almost unnecessary to advocate the licensing of hoisting engineers, as is done in a late report by the Inspector of Mines of Nevada. Nevada may well draw from the experience of other mining states in this respect. To leave the selection of hoisting engineers entirely to operators is, in our opinion, inadvisable. Undoubtedly the majority of operators discriminate carefully in choosing men for this important service, but there is danger that inexperienced and unfit men may be selected in some instances. Requiring all hoisting engineers to take out licenses, either on the basis of considerable experience or on a rigorous examination, is strongly advisable; and mining codes that contain no provision for such licenses should be amended.

The Adjustment of Prices

THE resumption and the maintenance of industry in the largest practicable volume are much to be desired. Conditions are now such that industry unaided is likely to take a long time reasonably to approach anywhere near normality.

Some diseases require prompt surgical treatment. In the case of others nature may be allowed to take her course; but in almost all instances care and attention are factors that hasten recovery and complete a permanent cure. Rigorous surgical treatment has been accorded war contracts and many war activities that have formed temporarily a part of the industrial body. Many may question whether the treatment has not been too drastic. However that may be, the fact remains that industry as a whole is greatly in need of most careful handling. Experienced and broad-minded leaders are necessary to bring industry back to a healthy condition. Stabilization of industrial factors is essential to restore confidence.

The Industrial Board of the Department of Commerce has accomplished a beginning by the agreement that has been reached with the steel manufacturers. A cut has been made of fully 20% below war prices, and from 10 to 14% under post-war prices, in the basic steel commodities. The price of iron ore is to remain the same as it is at present until the projected reduction in freight rates that affect this commodity takes place. Steel prices are to be maintained for a year. This is contrary to precedent in the steel industry, where formerly prices have been revised quarterly.

The price of copper has dropped 42%, lead 35%, and zinc 24% from quotations that prevailed in November last. Compared with these reductions, which are based on a free market and sound economic practice, the cut of 20% from war prices in the case of steel is not sufficient. Greater sacrifices must be made, and the sooner they are made the sooner will industrial activity be resumed.

The careless adjustment, or in some cases the entire absence of adjustment, of steam engines provided with adjustable valve gear, results in waste that closely approaches "paying through the nose." The mechanical equipment of a mine should be examined at regular intervals for lack of adjustment, faulty bearings, imperfect lubrication and improper alignment. A good mechanical department and a system of monthly reports of the mechanical condition of equipment will pay for itself. S. A. Worcester, in his excellent paper on "Steam Economics in Simple Terms," draws attention to an insidious kind of waste that results partly from lack of knowledge and partly from carelessness. Such wastes are inexcusable at any time, but particularly at present, when continuation of operation in some instances is dependent upon rigid economy in every department.

In this issue we reproduce four photographs under the title "Mining Asbestos in Quebec," which show operations in the Thetford-Black Lake-East Broughton district. We also publish an abstract of a report, "Quebec Asbestos in 1918," by the Quebec Bureau of Mines, which shows that the industry enjoyed continuous and active operation during the last year. There is reason to believe that the demand for asbestos of the various grades will continue. It is our intention to reproduce in later issues of the *Journal* other photographs showing the Quebec asbestos operations, which we have received through the courtesy of the Asbestos and Mineral Corporation, Whitehall Bldg., New York.

BY THE WAY

Dr. A. B. McCallum, chairman of the Canadian Advisory Council for Scientific and Industrial Research, in the course of an address to the Canadian Mining Institute, made frequent use of the word "researcher," as a synonym, or substitute, for the term investigator. He stated that he had been criticized for doing so, but that it was etymologically correct and a needed addition to the language. "When you speak of an investigator," he said, "people immediately think of the probing of some unsavory political scandal." Apart from this objection, "researcher" seems to characterize the work undertaken under the auspices of the council better than "investigator."

The difficulties in obtaining a fair verdict in Washoe lawsuits, in a district where every one speculated in mining claims, are narrated by Eliot Lord in Monograph 4, U. S. Geological Survey. The bias in many instances was intentionally increased by direct bribing. A discreet observer wrote with simple irony to the *Territorial Enterprise* in 1865 to inquire "Whether the following transactions would disqualify a gentleman from serving as a juror in the future: 1. Throwing out of the court-house window a paper on which was written 'See me with $1000; I will then tell you tomorrow morning how the thing will go, and we can make money.' 2. Taking the wrapper from a cigar and having replaced it with a note on which my terms were written, leaving the enclosed cigar where my friend could get it. 3. Finding a note under the lining of my hat offering me '$5000 provided you go for us,' but giving my verdict only to be fooled by the company." The inquirer fortified his assumed position by quoting from Johnson's Life of Addison the saying: "It is not necessary to refuse benefit from a bad man when the acceptance implies no approbation of the crime."

Cap'n Dick was seriously regarding the sheave in the headframe as it turned, slowly at first, and then increased to a high speed and gradually slowed down as the skip came into view and finally emptied into the pocket. "M'son," said he, "didst thee ever realize tha turibble strainin' an' twistin' that one o' them there h'axles mus' stan'? Wonnerful, m'son, wonnerful! I never did tell thee tha story baout 'ow I figgered tha worl' 'ad come to a h'end, did I? Well, I'll 'ave to tell 'e. Years h'ago, back long we, schoolmaster 'e'd tell us baout these 'ere w'irlin's o' tha universe, an' 'ow tha h'earth wuz suspended a'tween two gert poles, an' gawin' raoun' an' raoun' tha 'ol bloody time. An', min' you, this 'ere h'impressed me; 'ardlike, I might say. H'any'ow, years followin', I wuz shif'boss to 'Arris mine, an' one day I wuz takin' five, 'avin' a bit o' Peerless an' wonderin' 'ow tha stope we figgered to blas' that night, w'en shif' went off, would come daown. Of a sudden, 'ere come two chaps runnin', an', dam-me, I wonnered w'ot wuz h'up. An', min' you, m'son, clean scared they wuz. Come from stope h'above, w'ere rock wuz 'ard an' needed naw timberin'; a gert h'open cavity, m'son. Never a bloody word could they say h'as to w'ot 'ad 'appened, but, h'any'ow, back we gaws to see w'ot's h'up. An', believe me or no, m'son, w'en we reached that stope 'ere wuz a noise an' commotion like tha 'osts o' 'ell, an' in tha middle o' tha stope wuz a gert revolvin' pole, w'irlin' raound like a bein' possessed, an' swingin' from side to side. Dam-me, m'son, I never naws w'ot to make on un, an' 'ere wuz they two chaps tremblin' from 'ead to foot, an' cryin' h'out that tha wrath o' tha h'Almighty wuz decendin' h'upon them. 'Baout tha h'only thing I could figger wuz tha 'ol bloody worl' 'ad slipped h'off these 'ere poles. Then, o' a sudden tha bloody beggar stopped, an' h'up I gaws, although min' you, m'son, it did take a 'eap o' courage to do un. An' w'ot dost thee think t'were, m'son? Nothin' but one o' these 'ere diamond drills that we 'ad put daown from surface, an' dam-me, she wouldn't stay w'ere she wuz to. Jus' started h'off followin' some bloody seam or h'other, an' h'out she come in this 'ere stope. But, min' you, m'son, 'appenin's like they do tax tha 'eart tremendus."

Personals

George C. Stone will investigate conditions affecting the zinc industry in Europe.

Fred W. Denton is vice-president of the Copper Range Co., 82 Devonshire St., Boston, Mass.

Alvin B. Carpenter has been elected a director of the Chamber of Mines and Oil of Los Angeles.

Rudolf Gahl has moved his office from 1213 First National Bank Bldg., to 804 Equitable Bldg., Denver, Colorado.

W. A. McGunagle, president of the Duluth, Misabe & Northern R. R., is in California convalescing from influenza.

M. F. Chase is in France to investigate the condition of the zinc metallurgical industry, particularly in regard to acid plants.

Lieut. Ralph Edmundson, Lieutenant Douglas Chapin, and **Lieutenant Howard King** returned with the 27th Engineers.

Mark Workman, president of the Dominion Steel Corporation, who has been in England for some weeks, has sailed for Canada.

Ralph Budd, vice-president of the Great Northern R.R., has been named trustee of the Great Northern Ore properties, succeeding **Walter J. Hill**, who resigned some time ago.

C. James Smith, mining engineer and geologist, has succeeded to the business of C. E. Anthony, assayer and chemist, 218 West F St., San Diego, Calif. Mr. Anthony died recently.

Harold E. Taylor will assume a position with the Aluminum Castings Co., Cleveland, in the metallurgical department, where he will classify the results of experiments made by the company.

C. A. Myers has resigned his position as superintendent of the Plymouth mine on the Gogebic Range, and on Apr. 1 will become manager of the Coates & Tweed properties on the Mesabi Range.

Lieut. Wilder Laby, Lieutenant C. J. Mampel and **Lieutenant Joseph R. Guiteras** returned with the 27th Engineers, having spent about eight months in France, engaged in bridge construction.

Capt. Edwin S. Berry was detached from the 27th Engineers to serve on a Peace Conference committee to determine the damage done to the coal and iron mines of Northern France and Belgium.

H. H. Morgan, formerly with the Chicago office of Robert W. Hunt & Co., for many years in charge of the physical laboratory, has been made assistant to D. W. McNaugher in the Pittsburgh office.

Donald C. Smith has resigned his position as metallurgist with the Penn. Mining Co. at Campo Seco, Calif., and has accepted a similar one with the Afterthought Copper Co. at Ingot, Shasta County, California.

Maj. F. S. Norcross, of Michigan, who was in command of the First Battalion, and **Maj. R. E. Franklin**, of California, who was in command of the Second Battalion, accompanied the 27th Engineers on their return.

Capt. Ward Royce, of the 27th Engineers, Co. B, with a detail of miners, was cited for bravery while building a highway bridge at Apremont. The work was completed in four days under fire of German sharpshooters.

H. H. Johnson, consulting engineer of the Kirkland Lake Proprietary, Ltd., an English company, is at Kirkland Lake in connection with the proposed consolidation of the Tough Oakes, Burnside, and Sylvanite properties.

F. M. Sylvester, managing director of the Granby Consolidated Mining and Smelting Co., has left on a business trip to New York. It is understood that no announcement will be made concerning resumption of work at Anyox smeltery until his return.

Col. Oscar B. Perry, who organized and commanded the famous 27th Engineers, which was cited three times for its work under fire, arrived from France on hoard the "Dakotan" on Mar. 20. Colonel Perry will reside at the Waldorf-Astoria, New York.

W. F. Slaughter, for many years chief mining engineer for the eastern Mesahi operations of Pickands, Mather & Co., has been appointed superintendent of that company's Rowe mine on the Cuyuna range and is now preparing the property for an active season.

Lieut. Robert Burrage, of the 27th Engineers, which arrived in New York on Mar. 20, was cited for reconnoissance work at Bilosnes on Nov. 1, when he entered the German trenches with a patrol and killed three of the enemy, having only one of his men wounded.

Lieutenant White, of the 27th Engineers, Co. A, returned to New York with his regiment. While in command of a detail of mining engineers, on Sept. 29, engaged in construction work in an advanced position, his men met a detachment of Germans, and in the fighting which ensued completely routed the enemy, losing one killed and two wounded.

C. F. Kelley, president of the Anaconda Copper Mining Co.; **J. C. Clendennin**, vice-president of the A. S. & R. Co.; **Walter Douglas**, president of the Phelps Dodge Corporation, and **R. L. Agassiz**, president of the Calumet & Hecla Mining Co., who have spent the last two months in Europe for the Copper Export Association, will soon return to New York on the "Aquitania," of the Cunard line.

Obituary

A. M. Elliot died in Denver on Mar. 14 of pneumonia. He had been engaged in mining in Victor and Central City for the last 15 years. He is survived by his widow.

S. B. Patterson, prominently identified with iron mining and smelting for many years, died recently in Philadelphia. He was formerly superintendent of the Andover Iron Co.'s furnace and mines at Andover, N. J., and afterward the manager of the Empire Steel and Iron Co. mining and furnace properties. For 12 years, prior to his retirement in 1916, Mr. Patterson was superintendent of the Robesonia Iron Co., Ltd., blast furnace at Robesonia, Penn. He was also engaged at various times in the manufacture of coke in West Virginia and charcoal iron in Michigan.

Societies

Society of Chemical Industry, New York Section, held a meeting on Mar. 21 at Rumford Hall, 50 East 41st Street.

American Society of Civil Engineers held a meeting on Mar. 19 in the Engineering Societies Bldg., when E. A. Byrne, chief engineer of the Department of Plant and Structures of New York City, and consulting engineer for the New York and New Jersey Tunnel Commission, discussed the proposed New York and New Jersey vehicular tunnel.

National Association of Corporation Schools, Irving Place at 15th St., New York, will stage an interesting exhibit for the benefit of employers and others interested in personnel work, to be shown on the third floor of the Engineering Societies Bldg., 29 West 39th St., on Apr. 1 to 12. The exhibit consists of a collection of wall charts, forms, photographs, and models showing how the Army finds out what men can do best and how it uses that information; how soldiers are trade-tested, and how officers are rated and fitted into place; the manner in which the work is checked and supervised, and its results in the war. The collection is being shown under the auspices of the National Association of Corporation Schools and the United Engineering Society, representing the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. It was on exhibition for several weeks at Washington, where it excited so much interest that, in response to many requests, the Adjutant General consented to its display in other cities. Two commissioned officers accompany the exhibit to explain its various features.

Industrial News

United States Chamber of Commerce will hold a convention in St. Louis on Apr. 28, 29, and 30. No definite program has been issued up to this time.

Capt. J. Neale, Civil Engineer-in-Chief's Department, Room 1004, Admiralty, London, S. W. 1, requests that all advertisers of the "Journal" forward to him at the above address copies of their latest catalogs for purposes of reference.

American Blower Co., Detroit, announces that F. R. Still, vice-president and secretary, has left on an extended trip for the Far East, where he will investigate trade conditions in connection with export work Mr. Still's itinerary includes Japan, China, Australia, and most of the European countries, and he expects to cover approximately 36,000 miles before returning home about Nov. 1st.

Lea-Courtenay Co., manufacturers of high-duty turbine pumping machinery, Newark, N. J., appointed A. C. Nell the Chicago district manager, with offices at 1466 Conway Bldg. He has been until recently a captain in the construction division, U. S. A., having charge of power and mechanical equipment, and was formerly connected with the Allis-Chalmers Manufacturing Co. Mr. Nell will also represent the Schutte & Koerting Company.

Westinghouse Electric and Manufacturing Co., of Pittsburgh, announces the awarding of a large contract to the Canadian branch by the Hydro-Electric Power Commission of Ontario for two 45,000 kva. vertical water-wheel generators of 12,000 volts, 3-phase, 25-cycles, for the Queenstown development. These will be the largest water-wheel generators ever constructed, and indicate that the commission has decided there is no time like the present for construction work.

National Foreign Trade Council will hold the sixth annual convention in Chicago on Apr. 24 to 26, at the Congress Hotel, where registration will take place. A registration fee of $10 will be required of each delegate, the proceeds to be used to defray in part the printing of the official proceedings in a bound volume, which will be sent to each delegate. A directory will be issued promptly, containing a list of the registered delegates and their business affiliations. The theme of the convention will be "Foreign Trade Essential to American Industry." James A. Farrell, chairman of the council and president of the U. S. Steel Corporation, will call the convention to order at 10 a.m. on Apr. 24 in Orchestra Hall. The topic of the session will be "America's Need of Foreign Trade" from the viewpoint of (1) Production; (2) Finance; (3) Labor; (4) Imports. The topics at other sessions will be as follows: "The American Merchant Marine," in which will be discussed American shipbuilding, provision of cargoes, establishment of trade routes and return cargoes and American maritime policy; "Foreign Credits"; "Direct Selling"; "Ocean Service"; "Financing Foreign Trade," and numerous other subjects. The Bureau for Foreign and Domestic Commerce, the Pan-American Union and the Consular Service of the State Department will be represented.

New Patents

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum. Purifying Aluminous material. Charles H. MacDowell and Paul R. Hershman, Chicago, Ill., assignors to Mineral Products Corporation, New York, N. Y. (U. S. No. 1,291,979, Jan. 21, 1919).

Briqueting Machine. Warren D. Alexander, Los Angeles, Calif. (U. S. No. 1,291,705; Jan. 21, 1919.)

Classifier. Alfred L. Blomfield, Denver, Colo., assignor to the Dorr Co. (U. S. No. 1,292,237; Jan. 21, 1919.)

Manganese Steel, Method of Recovering. Wesley G. Nichols, Chicago Heights, Ill., assignor to American Manganese Steel Company, Chicago, Ill. (U. S. No. 1,291,656, Jan. 14, 1919.)

Metal Scrap, Treatment of. Edgar Rouse Sutcliffe, Leigh, England. (U. S. No. 1,291,672, Jan. 14, 1919.)

Melting Points, Method of Determining. Lewis W. Schubb, Edgewood Park, and Robson De S. Brown, Wilkinsburg, Penn., assignors to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,291,409, Jan. 14, 1919.)

Nickel-Copper Matte, Process of Refining. Carl Langer and Otto Langer, Clydach, Wales. (U. S. No. 1,291,030, Jan. 14, 1919.)

Ore-Concentrating Table. Edward J. O'Connell, Fort Wayne, Ind., assignor to Deister Concentrator Company. (U. S. No. 1,291,616, Jan. 14, 1919.)

Storage-Battery Locomotive. Raymond Mancha, St. Louis, Mo., assignor to Mancha Storage Battery Locomotive Company, St. Louis, Mo. (U. S. No. 1,291,581, Jan. 14, 1919.)

Editorial Correspondence

BOSTON, MASS.—Mar. 21

An Injunction Against Iron Cap Copper Co. has been issued by Judge Braley, of the Massachusetts Supreme Court, restraining the company from paying a dividend or otherwise disposing of its assets until settlement of the litigation between it and Arizona Commercial Mining Co. A preliminary hearing of the two suits brought by the latter company against Iron Cap was held before Judge Braley, who also ordered that briefs of both parties be submitted to the full bench sitting in May, when the question of jurisdiction will be considered. Iron Cap was also ordered by the court to disclose the nature and value of its assets, such information, however, to be available to the plaintiff only, and not to be written into the record.

MORENCI, ARIZ.—Mar. 20

The Arizona Copper Co.'s Mines were placed on a basis of five days per week on Mar. 1, and wages in the district were put on an 18c. scale with a "high cost of living bonus" of $1 per day for underground men and 75c. per day for surface men. The Longfellow mine has been closed, the men being distributed among the other mines of the company in Morenci. The sensible manner in which the workmen of the Clifton-Morenci district have accepted the recent reduction in wages and working time is thought to augur well for the future of the labor situation in the district.

WALLACE, IDAHO—Mar. 20

The Reduction of Wages by the mining companies of the Coeur d'Alene district became effective on Mar. 16 and was accomplished without notable incident. Employees had generally expected the cut and appreciated the fact that Coeur d'Alene operators had retained the war rate long after reduction had been made in many other districts, and that it was a question of taking half a loaf or no bread. The notices posted at the various mines plainly stated that unless the reduction was accepted the mines would be forced to close. The mining companies had continued to run under the adverse conditions, hoping that there would be a substantial reduction in the cost of living which would lighten the burden imposed upon their employees by the cut. It was, therefore, a matter of regret that the reduction had to be made without this relief. A considerable number of men quit at all the mines, but not all of them on account of the cut in wages. The approach of spring is always a signal for miners to seek other districts, some to go prospecting and others simply yielding to the tendency that is characteristic of the craft to drift from one mining camp to another. All acted individually, and so far as can be learned there was no attempt to induce others to quit, and no picketing about the mines. Some of the companies were perfectly willing to have their forces reduced to the extent of those who drew their time, and those which desired to replace the employees who left had no difficulty in getting men. There was a total absence of agitation, and if there are those in the district who are inclined to make trouble, they are keeping in the background and carefully conceal their purposes. Most of those who quit on account of the cut went to Butte, where wages are 50c more per day than in the Coeur d'Alene district.

DULUTH, MINN.—Mar. 20

The Minnesota Geological Survey, of which William H. Emmons is director in conjunction with the U. S. Geological Survey has issued from the University of Minnesota Bulletin No. 15 entitled "Preliminary Report on the Geology of East Central Minnesota Including the Cuyuna Range." The bulletin is of 178 pages, and contains many suitable illustrations and maps.

The Minnesota Compensation Law is receiving considerable attention at the hands of the present Legislature and under the terms of legislation now pending will be amended almost beyond recognition. In its present form the law calls for a maximum payment of $12 a week over a period of 300 weeks for a fatal accident, with minor injuries graded accordingly, and the settlement of all claims in the hands of the district judges. In its amended form, if passed, the law will demand a maximum of $15 per week for 300 weeks in cases of fatal accident, and the district judges will be displaced by a board of control appointed by the Governor and consisting of one labor representative, one employers' representative, and a third member whose status shall be at the discretion of the Governor. A state insurance bill is also under consideration and is being powerfully supported. It provides that all employers who come under the terms of the compensation act shall prove to the satisfaction of the state authorities that they are capable of carrying any possible loss, failing which they will be forced to take out a policy with the state. The bill is designed to entirely destroy the business of the liability-insurance companies now operating in the state and is being strenuously fought by them for this reason.

PLATTEVILLE, WIS.—Mar. 20

The Net Shipment of Zinc Ore from the Wisconsin district during 1919 to date is 18% short of 1918 figures. The present rate of decline is considerably higher and is growing weekly under the demoralizing effect of high costs and low market for ore. At Highland, the Mineral Point Zinc Co. is shipping crude zinc carbonate, without milling, taken from the old mine shafts on the old-time Kennedy, Minter, and Wallace tracts, which have witnessed continuous mining for lead, zinc carbonate, and blende for the last 70 years. The Lampe-Highland property of the Saxe Brothers is the only other producer with mill equipment active. At Linden the last producer operating with mill was forced to close when the small plant of the Stoner Brothers was destroyed by fire six weeks ago.

Dodgeville, Potosi, and Mineral Point camps are inactive. At Shullsburg, the Oliver Iron Mining Co. is working a full crew at the Mulcahy mine, mill, and roaster; this company has proved up an orebody on the Johnnie Lyons lease. The Wisconsin Zinc Co. has temporarily closed the Copeland mine, a new producer. The Vinegar Hill has a few men at work on its Copeland lease, but is withholding the opening up of this prospect. The Rodham is producing as usual, sending its low-grade blende to the National roaster at Cuba City and carrying in bin a year's accumulation of higher-grade blende.

At the Mifflin-Livingston camp, the Coker, 40 years old, is the only mine working full force. This property of the Mineral Point Zinc Co., with double mill equipment, led the district in 1916 and 1915, with shipment records of 15,106 and 14,031 tons, respectively, of blende concentrates. The Vinegar Hill Zinc Co. has the new Dale Rundell mine equipped and opened, and ready to operate as soon as a better market is evidenced. Other properties recently closed are the Yewdall mine, of the Vinegar Hill Co., and the M. & A., an independent producer.

The Blockhouse is Platteville's only active producer. This mine is now worked to within 200 ft of the Cruson workings, which mine was abandoned 10 years ago as a "rich pocket," largely because it was erroneously judged to be a "north-and-south" run. The mine has since been driven over a half-mile in length, widening out at times to 230 ft, and making 10 to 20 ft high, carrying heavy sheet formation and doubling back on its course in S-shape curves but maintaining a general east-west direction. The property is now averaging 40 tons of 40% blende concentrates daily, with 2500 tons in bins.

Cuba City has one consistent producer in the Connecting Link; the company operating this mine is moving the Gilman mill to the Coulthard-White lease. The Little Dick was opened and equipped with mill last fall by the Zinc Hill Mining Co., but operation has been deferred. This company is just completing the erection of the Cleveland mill on the Harvey lease north of the Connecting Link, where a new shaft is being sunk, the new property to be known as the Big Dick. The Platteville-Dall Co. is prospecting east of the old Dall. The National Zinc ore-separating plant is operating at full capacity. The big Government-built acid plant, contiguous to the National roaster, the construction of which was discontinued in November when 80% completed, is still idle.

At Benton-New Diggings, the Wisconsin Zinc Co. is operating the Champion, Longhorn, and C. A. T. mines and the Skinner roaster at full capacity. The Champion, which was the second largest single mill producer in 1918, led the district in 1917, with 15,727 tons of blende concentrates. The Government-built acid plant, 50% completed, situated alongside of the Skinner roaster, is also idle. The Mineral Point Zinc Co.'s new Hoskins mine is turning out blende concentrates at the rate of 1600 tons per month. From the time it began shipments early in 1918 to the close of the year, 15,771 tons of blende was delivered to Mineral Point. This company's Penna-Benton mine is working a new run of ore developed during the last year. The Meloy and Martin mines of the Vinegar Hill Zinc Co., the Calvert and Middie mines, of the Frontier Co., and the Indian Mound mine, of the Lawrence Mines Co., are operating as usual. The Frontier company is prospecting at the Bull Moose and Bearcat and is carrying a big reserve stock of concentrates at the Bull Moose and Middie properties.

At Hazel Green, the Kennedy, Jefferson, and Monmouth mines are operating. At Galena, the Graham, North Unity, and Black Jack are running as usual. The Blewett is a new producer, equipped with the Burr mill. The history of the Black Jack mine dates back to 1854; the property has passed through the hands of many owners, among them the Illinois Zinc Co. and the Peru Zinc Co. The Kennedy mine, also a property of the Mineral Point Zinc Co., has been in continuous operation for the last 20 years and led the district in production in the years 1909, 1910; 1911 and several years prior thereto.

THETFORD, QUE.—Mar. 20

Labor Shortage in the Asbestos Industry no longer exists. Returned soldiers and excess labor from industries affected by the return to peace conditions afford a surplus of labor, though enforced idleness is not yet apparent. Wages still remain at the high level, and employers are keeping to their avowed intention to hold them up as long as the selling prices of asbestos will permit them to do so. Shipments are still going forward freely, though there is a marked decline from pre-armistice records. Optimism is still the keynote in the industry, and the various companies are planning additions and improvements. The Asbestos Corporation of Canada is increasing its ore-storage facilities by building a 20,000-ton storage bin at its B. C. Mines, at Black Lake. The Bell Asbestos Mines have installed an elaborate system to overcome the dust nuisance, and the Jacobs Asbestos Co. is extending and completing its milling system of underground mining. At East Broughton, where production is entirely a fiber proposition, improvements are being planned to double the output at least. Messrs. Poulin and Roy are erecting a fiber mill adjacent to the Fraser mine of the Asbestos Corporation. The Garcin interests, which are operating the Eastern Townships property, suspended operations for the winter and are employed in remodelling their fiber mill on up-to-date designs. H. H. Williams is in charge of the reconstruction. At the Quebec Asbestos Co., under the management of E. E. Spafford, extensive development has been accomplished with a view to putting the mining end on a basis for steam-shovel operation through a more extensive crushing system and improved conveyor facilities. A 500-ft vertical shaft is now being sunk on the foot-wall side of the asbestos lode, with the intention of opening up the orebody at depth and affording added ore reserves for increased production. In view of the improved labor situation and increased facilities, it is possible that production of asbestos in 1919 may exceed that of 1918 by 30 per cent.

The Mining News

ARIZONA

Cochise County

DENN-ARIZONA (Bisbee) — Since resuming work in 1917, shaft sunk to 1800 level, and is now bottomed temporarily in sump 1830 ft. from surface. For entire distance from 1100 level sinking has been in leached vein matter, occasionally showing bunches of commercial copper ore, in form of carbonates and oxides. Crosscutting done at various levels; on 1600 level width of this leached ore-bearing material is 315 ft.; on other levels similar condition to that on 1600 is shown for distance driven. On 1600, a promising body of oxidized ore was cut 90 ft. from station, which it is expected, will be cut again on 1700 when drift reaches proper point. Station now being opened on that level, and will soon be started on 1800. Denn extends 4500 ft. along Dividend fault, and leached material that has been opened from 1100 to 1830 ft. is supposed to lie along fault for entire length of contact Such a body of leached material under 1100 ft. of conglomerate considered unusual. Since resuming work Denn has spent over $1,000,000 in development.

HELEN DOME (Bowie)—New machinery being installed. Ore carries gold and silver and about 2% copper.

GREAT WESTERN (Courtland)—W. J. Young, principal owner, overseeing sinking of new shaft and other development. Power house being equipped with newer types of machinery. Electric power to he used throughout. Shipments of relatively high-grade copper ore being made to Douglas.

LEADVILLE (Gleeson)—Two carloads of ore a day to be shipped to Douglas. Property in charge of owner, William Holmes.

SHANNON (Gleeson)—Recently shut down Copper Belle property, dropping 60 miners.

Gila County

IRON CAP (Globe)—Plans made for 600-ton mill to handle large quantity of milling ore developed in stoping shipping grade.

SUPERIOR & BOSTON (Globe)—E. G. Deane, Mayor of Miami, made superintendent, succeeding A. L. Graham.

SULPHIDE COPPER (Miami)—Purchased 14 claims in Pinal Mountains. at head of Russell Gulch, from Mrs. Clara Kinney, of Globe.

VAN DYKE (Miami)—Sinking deep shaft to orebody developed by drilling and assumed to be extension of Miami company's deposit.

Mohave County

HACKBERRY (Hackberry)—New mill ready for operation. Bins filled with good ore from 600 level; body proved down to 800 feet.

RURAL (Mineral Park)—Taken over by M. B Dudley and others, of New York New hoist and pumps already in place.

GOLD DUST (Oatman)—Working two shifts. New equipment added for deeper development.

GOLD ORE (Oatman)—A. C. Werden, manager, states that company's troubles have been adjusted and that deeper development will be started from 700 level.

RECORD LODE (Oatman)—Crosscut on 500 level has passed through 20 ft. of vein matter.

Pima County

BEACH (Tucson)—Property in Baboquivari district to have new mill. Excavation started. Plant to be installed by James M. Douglas.

Santa Cruz County

EXPOSED REEF (Patagonia)—Main shaft being sunk, preparatory to drifting for vein at depth.

BACA FLOAT (Tubac)—Company incorporated by A. R. Grund, of St. Louis, to work old mines on Baca Float grant, lately purchased from James W. Bouldin and Weldon Bailey.

Yavapai County

CONGRESS CONSOLIDATED MINES (Congress Junction)—Sheriff's deed given to Attorney T. G. Norris, of Prescott, grantee, for 15 patented mines in Martinez district, five patented mines in Big Bug district, mining equipment in both sections and broad-gage railroad from Congress Junction. Judgment given last August. Congress mills now being junked.

ABE LINCOLN (Constellation)—Crosscutting on 660 level for known orebody, 180 ft. distant.

GADSDEN (Jerome)—At 1250 ft. from 1200 station is crosscutting through schist full of chalcopyrite stringers with 8-in. streak of high-grade.

JEROME VERDE (Jerome)—Maintop orebody proved to have 17 ft. of high-grade copper ore. Drifting north on this at rate of 5 ft. a day. U. V. Extension line only 30 ft. away in other direction.

UNITED VERDE EXTENSION (Jerome) About 200 ft. remains to be driven in haulage tunnel, where heading had been reduced to drift size to expedite work and the draining of mine water. Mine heading abandoned On making connection tunnel will be enlarged, much of it concreted and track laid. Lower 250 ft. of Audrey shaft being concreted. Will also concrete entire Edith shaft. Company employing 400 men. half of normal force. Announcement of renewal of strike apparently given no attention by district workmen employed.

CALIFORNIA

Calaveras County

CALAVERAS COPPER (Copperopolis)—Force reduced to essential operation and development on 1200 level. the deepest working, where good ore is being mined. Treatment plant being repaired. Physical condition of mine said to be best in history.

ROYAL (Hodson)—Frank Tower and Jack Maltos extracting good ore. Expect to place old mill in operation soon.

BLACK WONDER (Westpoint)—Sold to San Francisco men. Equipped with new machinery. Motor trucks to be installed to haul ore to railroad at Valley Springs.

SAWYER (Westpoint)—To be operated under bond by Easy Bird Mining Company.

Del Norte County

PRESTON PEAK DISTRICT attracting attention of Chicago men, said to have optioned 89 quartz-mining claims in extreme northern edge of Del Norte County and lands embracing townsite of Waldo, Ore. Much of this was held by Del Norte Claimholders' Association, which sold to Del Norte Mining Corporation, of which A. C. Ross is a principal. Railroad construction from Crescent City to tap district is considered.

OWL CHROME (Crescent City) — High-grade silver ore reported by Silas White, of French Hill district.

Eldorado County

BIG TUNNEL SLATE (Placerville)—Optioned by Albert Ball, who is planning to develop with force of 30 men.

GEORGIA HILL (Placerville)—Optioned by San Francisco men, who will deepen workings in extensive gravel deposit. Situated in Yankee Jim district. Large producer in early days.

Inyo County

SILVER REEF (Bishop)—Good-grade silver ore disclosed at 60-ft. depth in vein carrying shoots from 4 to 24 in. wide. Shipment of 300 sacks averaged $250 a ton.

Kern County

BLACK HAWK (Randsburg)—Considering erection of new mill.

Nevada County

CALIFORNIA PLACER (Nevada City) —Two hydraulic giants in operation in Missouri Canyon. Twenty men employed. Extensive area of rich placer ground developed. Tailings impounded back of barrier across canyon near Greenhorn River. Large producer in early days. J. C. Cortner, superintendent.

Placer County

LIBERTY HILL (Dutch Flat)—Hydaulic operation started. Late storms have provided abundance of water. Holdings include Maguire mine, one of largest gravel mines in county.

San Bernardino County

ATOLIA (Atolia)—Retimbering mine in parts. New concentrating tables being added to milling equipment.

Santa Clara County

MAGNESITE SHIPMENTS from Western Development Co.'s property on Red Mountain to be resumed upon completion of reorganization of company. Product will be hauled by motor truck to Livermore for rail shipment.

Shasta County

REID (Redding)—To deepen 1000-ft. shaft to 1200 ft. Ore shipped to Mammoth smeltery, at Kennett and used as flux. Series of winzes disclosed large low-grade orebodies below 1000 feet.

Sierra County

KIRKPATRICK (Downieville) — New gravel mill installed and ready for test run. Capacity, 150 tons in 24 hours. Large amount of cemented gravel blocked out.

Tuolumne County

DONDERO (Columbia) — To install dredge for working old placer ground at Yankee Hill.

DEL MONTE (Groveland) — To be reopened after long idleness. Shaft being retimbered and new machinery installed. H. M. Hanley, superintendent.

SHAWMUT (Shawmut)—Reported that mine will be reopened. Shut down owing to high costs.

IDAHO

Shoshone County

BUNKER HILL & SULLIVAN (Kellogg) —Remodeled Sweeney mill, formerly owned by Federal company, to treat large tailings dump, which averages 1⅜% lead. Handles 400 tons of tailings in 16 hours. Makes middling product assaying 10% lead, 4 oz. silver and 20% iron, which makes it desired by smeltery for fluxing. Second product is flotation concentrates, which assay 25% lead and 18 oz. silver.

NATIONAL (Mullan)—New orebody struck in raise from 800 level believed to be best in mine. Work suspended soon after strike was made, on account of repairs in mill, which will require probably 30 days.

HECLA (Wallace)—Leased mill, which has been handling ore from Oreornogo vein closed down. This ore carried large per cent. of zinc and was treated in another mill. Hecla mill not being equipped for its recovery. Zinc has practically disappeared from the ore and it will now be treated in company's mill at Gem.

SUCCESS (Wallace)—Company has leased all ground from 700 to 200 level and will receive 20% royalty on all lead shipments and 15% on zinc. Lessees take care of company's property and relieve it of all expense while shut down. Ground above 200 level remains under lease.

KANSAS

Joplin District

WACHUSETTS (P. O., Commerce, Okla.) —Will begin erection of second-hand mill soon at Treece, Kan. August Mayerhoff, manager, in charge.

COMMERCE M. AND R. (P. O., Miami, Okla.)—To begin erection soon of sludge mill near Blue Mound, Kan., to handle sand tailings at Webber mine. Capacity estimated 75 tons per shift. Will take about 30 days. John Newton, general superintendent, in charge. G. L. Coleman, general manager.

KING BRAND (P. O., Picher, Okla.) — Will start soon to open ground to erect new concentrator at Treece, Kan. Wesley Landrum, superintendent, in charge of work.

MICHIGAN

Copper District

ISLE ROYALE (Houghton)—Production will be down to 60,000 tons ore per month by Apr. 1, coming from three shafts. No. 7 shaft shut down recently, and hoisting to cease in other shafts, at which work will be confined to opening up new ground. Important economy effected by stopping shipments across Portage Lake to Point Mills stamp mill and running Isle Royale mill at full capacity.

COPPER RANGE (Painesdale)—Approximate ore tonnage from three mines in February was 77,950, Champion shipping 45,700, Baltic 20,250, and Trimountain 12,000 tons.

MINNESOTA

Cuyuna Range

PRELIMINARIES FOR STRIPPING in Section 19-46-29, near Riverton, completed. Winston-Deare Co., contractors, for John A Savage interests.

BONNIE BELL (Ironton)—This property of Liberty Mining Co. shipping 6000 tons monthly high-grade non-bessemer ore direct to Zenith Furnace Co., Duluth.

Mesabi Range

PICKANDS MATHER (Coleraine)—Installation of concentrating machinery at Danube mine between Coleraine and Bovey progressing. Will constitute one unit with capacity of 3500 tons in 24 hours. Allis Chalmers Manufacturing Co., builders.

BOWE-BURKE (Eveleth) — Operations suspended indefinitely.

BURNS (Eveleth)—Operations reduced to one shift.

FAULT AND JEAN MINES (Eveleth)—Closed owing to lack of stockpile room. Will resume with opening of navigation.

CLEVELAND-CLIFFS (Hibbing)—Preparing to install plant at new Bourne property at Hibbing, recently leased from Great Northern Iron Ore properties.

OLIVER IRON (Hibbing)—Concreting Carson Lake shaft. Concrete starts at depth of 165 feet.

UTICA (Hibbing)—Electric pumps to be installed.

BENNETT (Keewatin)—Electric pumps to be installed.

MISSOURI

Joplin District

TULSA-PITTSBURG (Waco)—Moving old Neosho-Granby mill from near Diamond, Mo., to Waco. Will take about two months. Mr. O'Connor, general manager in charge.

WOMMACK & CO. (Webb City)—Sinking shaft and erecting second-hand concentrator Edgar Wommack, manager, in charge.

MONTANA

Jefferson County

MONEY LODE (Clancey)—New equipment to be installed.

ANGELICA (Wickes)—Galena ore cut in breast of 4000-ft. tunnel, 900 ft. below surface; faulted and thrown 400 ft. to south.

LLOYD-CROSSLEY—(Wickes)—Ore cut by west drift from heading of 3000-ft. crosscut tunnel.

Lewis and Clark County

HELENA (Helena)—Drifting south on vein at 400 level and crosscutting west 60 ft. to contact.

TOWSLEY (Marysville)—Sinking shaft on vein.

Powell County

MONARCH (Elliston)—Building concentor Large body lead-silver ore developed Railway one mile long to be built from mine to mill.

Mineral County

TARBOX (Saltese)—Development warrants construction of mill, according to statement by manager. Large body milling ore developed on 800 and 1000 levels. Proposed to erect 150-ton mill if financing can be arranged.

BOSTON & MONTANA DEV. (Butte)—Work trains expected to be in operation soon over more than half of distance to Elkhorn mine on Montana Southern Ry. Passenger trains to Elkhorn by June 15. Installation of compressor plant at upper [illegible] tunnel progressing. Drifting will start on body of milling ore 15-20 ft. wide.

BUTTE & SUPERIOR (Butte)—Arguments heard, beginning Mar. 19 in Supreme Court, Washington, D. C., on appeals by Minerals Separation from Federal Court opinions denying injunctions to restrain Butte & Superior from infringing on flotation patents.

TUOLUMNE COPPER (Butte)—Controversy with metal trades resulted in engineers being called off jobs at Main Range mine Mar. 20 and suspension of mining operations. Seventy men rendered idle.

NEVADA

Lyon County

BLUESTONE M. AND S. (Yerington)—Mine shut down on Mar. 1 for six months, awaiting readjustment of copper situation. During shut-down mill capacity will be doubled to approximately 1000 tons per day. Flow sheet to remain unchanged, except for installation of K. & K. flotation machines. During last few months mill has made extraction of about 90%, with average ratio of concentration of 12 to 1 on 2% ore. Foregoing stated by Samuel W. Cohen, vice-president and general manager.

Mineral County

SIMON LEAD (Mina)—Large body of silver-lead ore being developed 23 miles east of Mina. On 300 level orebody has been developed on hanging wall for 270 ft. and a crosscut driven 76 ft. in ore. Zinc concentrated separately. Company planning 200-ton concentrator.

OKLAHOMA

Joplin District

BECK (Picher)—Moving old Melrose mill from Quapaw field to Picher. Erection expected to be complete within 60 days. Mr. Beck, general manager, in charge.

UTAH

Juab County

TINTIC SHIPMENTS week ended Mar. 15 were 157 cars.

COPPER LEAF (Eureka)—Suit filed by Arizona corporation against company to decide title to claims alleged to have been located in conflict with claims filed on at earlier date by complainant.

IRON KING (Eureka)—Large deposits of iron ore for fluxing to be more easily marketable with completion of Goshen Valley road to this property and Tintic Standard. Also seeking to develop extension of Tintic Standard ore zone.

TINTIC STANDARD (Eureka)—Shaft to 1450 level. Much new equipment installed and development maintained. Company largely interested in projected Goshen Valley R. R., which will furnish easier outlet to large tonnage blocked out.

Salt Lake County

GREATER CONSOLIDATED MINES (Alta)—Tunnel starting from Maxfield mine in Big Cottonwood proposed to cross under Cardiff over into Little Cottonwood canyon.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Narrow-gage line to Wasatch being put in condition for spring hauling after winter snows. Capacity increased by additional Shay engine, making total of three engines owned. Good shipments expected after winter of development work in mines.

SOUTH HECLA (Alta)—Week ended Mar. 15 seven cars, or 300 tons, of ore shipped. Important development work in progress in East Side workings.

OHIO COPPER (Bingham Canyon)—Operations at mine and mill suspended about Mar. 10, owing to market conditions.

Summit County

PARK CITY SHIPMENTS week ended Mar. 15 were 4,085,600 lb. of crude ore and concentrates.

SILVER KING COALITION (Park City)—Larger force being employed. Upper levels to be operated under leasing system.

SILVER KING CONSOLIDATED (Park City)—Better recoveries being made at new mill. Lead-silver concentrates only being shipped. Zinc held for better market.

Tooele County

WESTERN UTAH MINING (Wendover)—Silver-lead ore of good grade reported at this property in Silver Island district 16 miles from Wendover and about a mile from Gethin Le Roy, producer of limited tonnage of high-grade ore.

WASHINGTON

Ferry County

LONE PINE SURPRISE (Republic)—Deeds filed at Ferry County record office on Mar. 13 conveying Lone Pine Surprise group to Northport Smelting and Refining Co. Mine and smeltery both controlled by Day interests.

Okanogan County

ARKINS AND GRANT (Nighthawk)—Installing 50-ton mill on property, recently bonded. All machinery purchased for present. More probably required later, but not specified.

Stevens County

UNITED COPPER (Chewelah) — High-grade streak of silver ore recently cut continues strong in winze being sunk from 1300 level. Lidgerwood electric hoist, capable of operating to 1000 ft., purchased and will be installed as soon as cable is received. New 15-drill compressor to be added.

LOON LAKE COPPER (Loon Lake)—Twenty-five men employed in preparing for construction of concentrator. Will double this force when construction begins.

SPOKANE COPPER (Loon Lake)—Will resume operations soon.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—Body of lead-silver ore opened up in virgin territory from No. 2 tunnel level; lies west of original body, which was stoped to surface. Distance to surface on dip is 500 ft. Downward continuation cut on fifth level 360 ft. lower down on dip. Milling resumed on two-shift basis. Will put on third shift soon.

ROSEBERY - SURPRISE (Rosebery) — Rebuilding assay office recently burned, most of contents having been saved.

SALMON-BEAR RIVER (Salmon River) —Under development by R. K. Neill, of Spokane. Shipping gold-silver ore to smeltery.

SILVERSMITH (Sandon) — Tenth-level drift reported still in oreshoot. Another carload of high-grade, making thirteen in all, ready to ship to smeltery. Shipments running about 40% lead and 90 oz. silver per ton.

GRANBY CONSOLIDATED (Vancouver) —February production of copper was 2,610,737 lb. (January, 3,156,486). Anyox plant contributed 2,072,997 lb.; Grand Forks plant 537,740 pounds.

Ontario

BAILEY (Cobalt)—Provided shareholders ratify proposed amalgamation with Northern Customs concentrator, work of reopening mine will be started at once after shutdown resulting from years of litigation.

FOSTER (Cobalt)—A substantial tonnage of milling ore being opened up on first level and considerable cobalt ore taken from second level.

NATIONAL (Cobalt)—Will diamond drill copper property at Temagami.

OPHIR (Cobalt)—High-grade oreshoot recently discovered only 10 ft. long; indicates promising territory. Crosscut being run on 100 level to meet vein cut on 410 level.

RIGHT OF WAY (Cobalt)—At annual meeting held at Ottawa Mar. 24 shareholders were asked to authorize issue of treasury stock at 3c. a share, proceeds to be used for development. Profits last year only $2000.

BUFFALO-KIRKLAND (Kirkland Lake) —Capital stock increased from $1,500,000 to $2,000,000.

KIRKLAND LAKE GOLD (Kirkland Lake)—New mill will be started when supplies of chemicals are received.

TOUGH OAKES (Kirkland Lake)—Mining operations resumed. Plans being prepared for connecting underground workings with those of Burnside.

MURRAY MOGRIDGE (Larder Lake)—To be reopened. Property has considerable tonnage of low-grade ore developed above 200 level.

DAVIDSON (Porcupine)—New orebody recently opened up at 500 level has been crosscut for 30 ft. without reaching foot wall. Vein throughout stated to maintain gold content.

DOME (Porcupine)—Expects to be treating 500 tons a day in May. Announcement of start of milling operations comes as surprise.

IMPERIAL (Porcupine)—Plans reorganization. Proposed to give shareholders one new share for each two now held. New stock now being offered at 10c. a share.

SCHUMACHER (Porcupine)—To be reopened and shaft sunk to 1000 level.

NICU STEEL CORPORATION (Welland)—Considering erection of ore-smelting plant and steel plant. Site and capacity not yet decided upon. At present making "Nicu" steel in plant leased by company.

Belgian Congo

UNION MINIERE DE HAUT KATANGA (Elisabethville)—February production of copper was 3,877,891 lb., January, 3,306,900 pounds.

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
20	4 7000	101⅛	47¾	24	4 6200	101⅛	47¾
21	4 7100	101⅛	47¾	25	4.6250	101⅛	49 5/16
22	4.6400	101⅛	47¾	26	4.6150	101⅛	49 3/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Mar.	Electrolytic	Spot.†	N. Y.	St. L.	St. L.
20	14¾ @14⅞	68	5 15 @5.25	4.90 @4 95	6 12½ @6.17½
21	14¾ @14⅞	68	5 15 @5 25	4.90 @4.95	6.15 @6.20
22	14¾ @15	68	5.15 @5 25	4 90 @4 95	6.15 @6 20
24	15 @15.10	(*a*)	5.15 @5.25	4 87½ @4 92½	6.17½ @6.22½
25	.	.	. .	4.87½ @4.92½	6.17½ @6.22½
26	15 @15.10	(*a*)	5.15 @5 25	4 85 @4 90	6.17½ @6.22½

(*a*) No quotations.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
Mar.	Spot	3 M.		Spot	3 M	Spot	3 M.	Spot
20	77	74½	82	238¾	233¼	28	27	39
21	78	75	82	238	234½	28	27	39
22			.	.		.	.	
24	78	75	82½	238	234½	28	27	38½
25	79	76	83	238	234¾	28	27	38½
26	79	77	83	240	236	28	27	39

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Mar. 26, 1919

The chief feature in the market this week was the development of an active demand for copper from domestic consumers, which had the effect of advancing the price a little. Lead was very dull. Zinc held firmly on the transaction of moderate business from day to day.

There is much extensive reconstruction and repair work to be done in Great Britain and elsewhere in Europe, but everything is delayed pending settlement of the peace terms and advent of industrial quietude. In France, industry is absolutely at a standstill, owing to disorganization of transport and the general financial situation, but improvement should soon become noticeable. Imports into France are prohibited, and, according to latest mail advices, there was no intention of lifting the prohibition. Quotations in France in the early part of March were as follows: Copper, 270 francs; zinc, ordinary, 140 francs; zinc, refined, 153 francs; lead, 100 francs.

Copper—A considerable business with domestic consumers began to develop on Mar. 20, and on Mar. 21, 22, and 24 there was some rather large business done, brass makers being buyers, among others. Up to the end of Mar. 22 the business in the main was done at 15c., delivered, 10 days, which probably averaged about 14.85c., cash, New York. There was some shading of that price on orders for deliveries to nearby works, and some business was taken on the basis of 14.75c., cash, New York. On Mar. 24, business was still done at 15c., regular terms, after which 15⅛c., regular terms, was asked and received, and during the afternoon some smaller business was done at 15¼c., regular terms, equivalent to about 15.10c., cash, New York. On Mar. 26 business was done on the basis of 15@15.10c., cash, New York, but the amount was considerably less than during previous days.

We heard of only one sale for export during the week, and this was a belated acceptance. It appeared that the export business of last week was in anticipation of the decline in sterling exchange, and with the advent of that new feature orders from abroad ceased.

The domestic business of this week was largely done on the basis of new terms, formulated by one of the producers, to which the others are conforming. According to these terms, copper is sold at prices including delivery to the buyer, who is allowed 10 days from time of shipment in which to make payment if the delivery be in the territory east of Pittsburgh and Buffalo. Other times are allowed for other territories.

The arrangement between the producers and the Government for the liquidation of the stocks of copper of the latter are now practically consummated, the Government having made announcement to this effect. It remains only for the formal contract to be ratified by the producers. The arrangement will go into effect Apr. 1, after which the Government's copper will be liquidated in monthly installments spread over 15 months.

The War Department announces that an agreement has been reached for the sale of about 100,000,000 lb. of copper, in addition to copper scrap, the prices to be governed by the average published quotations in the "Engineering and Mining Journal." In a statement made public by the director of sales it is said:

"An agreement has been reached whereby the United Metal Selling Co., representing the copper producers, will sell for the War Department approximately 100,000,000 lb. of copper, and also whatever amount of copper scrap the War Department has to dispose of. Not less than 5,000,000 lb. of copper will be delivered by the United States to the copper producers each month for a period of 10 months and then 10,000,000 lb. of copper per month will be delivered for a period of 5 months.

"It was further agreed that the amounts delivered to the copper producers would be at least 10% of their total sales, and, in the event of good market conditions, the copper producers would take in excess of this amount. The copper will be sold by the copper producers at market prices as determined by the average published quotations. A small consideration will be allowed the copper producers in marketing copper for the Government to cover expenses of sales."

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17½c. per lb. f.o.b. mill, carload lots.

Tin—On Mar. 24 American smelters were notified by Mr. Armsby to cease selling tin in lots of less than five tons. Without questioning the authority for these instructions, the smelters deferred to them, and therefore the domestic market was interrupted on that day. The demand for tin in small lots had been increasing materially. It was understood, undoubtedly, that the prevention of the filling of such orders would promote the allocation of the tin held by the U. S. Steel Products Co. that remains to be distributed. Inasmuch as smelters thought that the sooner it is done, and the sooner we have a free market, the better it will be, there was no particular use in resistance.

Lead—This market was extremely dull, and the amount of business that was consummated was almost negligible. The principal producer maintains an unchanged price. Other producers talk about concessions, but have not effected sales. During the last week quotations have been merely nominal, except in St. Louis, where an actual decline was registered.

London expects that the price for pig lead will settle at some point between £20 and £24. However, it is possible that the situation may be affected by interference with the Spanish production, there being a good deal of unrest in Spain.

A typographical error occurred in the lead price for Mar. 17 in last week's market report. In place of 6.15c. the figure should have been 5.15c. and the price of lead for that day 5.15@5.25c.

Zinc—Small business was done from day to day at prices a little firmer that those of last week, but the noteworthy feature was the sale of two lots for export to Great Britain at prices a trifle higher than what could be realized in this market, the explanation of this being that some of the cheaper sellers have no means of doing export business.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—It is reported that the Government is soon going to sell 1250 tons of its stock of antimony. It was probably this threat that had a depressing effect on the market, which declined to 6⅜c. for spot on Mar. 21, and closes at that figure. March-April shipments are quoted at 6⅜@6½ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Sales were reported at $67. San Franscisco telegraphs $72, steady. Reports from the mines indicate that they are not going to force things by throwing their product on the market.

Silver and Platinum

Silver—The New York market remains steady at $1.01⅛ for commercial silver 999 fine, but owing to the decline of London exchange, the fixed price of silver in London has advanced so as to maintain the parity between the two markets. London therefore has advanced from 47¾d. to 49 3/16d. Exports from San Francisco during February were 27,000,000 ounces.

Mexican dollars at New York: Mar. 20, 77½; Mar. 21, 77½; Mar. 22, 77½; Mar. 24, 77½; Mar. 25, 77½; Mar. 26, 77½.

Platinum—Unchanged at $99@100 for refined ingot.

Palladium—We quote $115@125.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 22—Blende, per ton, high $45.70; basis 60% zinc, premium grade, $42.50@41.50; Prime Western, $41@40; sludge, $38@37; flotation, $35; calamine, basis 40% zinc, $26@25. Average selling prices: Blende, $42.47; calamine, $31.47; all zinc ores, $42.25.

Lead, high, $65.05; basis 80% lead, $60; average selling price, all grades of lead, $59.97 per ton.

Shipments the week: Blende, 10,583; calamine, 153; lead, 2299 tons. Value, all ores the week, $591,460.

Announcement that smelters generally would reduce wages 10% the first of April was received here. Wages have been reduced at all mines, it having been done gradually, with miners concurring.

Platteville, Wis., Mar. 22—Blende, basis 60%, zinc, $42.50 base for premium grade and $40 base for high-lead blende. No sales of lead ore are reported.

Shipments reported for the week are 1787 tons blende. For the year to date the totals are 21,388 tons blende, 979 tons galena and 73 tons sulphur ore. During the week 2412 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—A little more inquiry for chemical ore, particularly for Rhodesian and New Caledonian, is reported.

Molybdenum Ore—Business is very dull. The small lots that come up for sale by auction have an unsettling eeffct. An encouraging feature is that Great Britain is reported now to be making inquiries.

Tungsten Ore—The public auction that was to take place on Mar. 20 was postponed to Apr. 4. Some large lots of Chinese ore were sold at very low prices. The big holders of the stocks in this market, however, continue to stand aloof, and exhibit no nervousness.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Unchanged.

Iron Trade Review

PITTSBURGH—Mar. 25

The price reductions agreed upon last week between the Industrial Board and the general committee of the iron and steel industry are regarded as effective on the morning of Friday, Mar. 21, and such shipments under old orders as would by trade practice be subject to adjustment will be adjusted according to that date. Steel for specific jobs, which brings a flat price, will not be adjusted, this including ships at a flat contract rate.

The reductions are $4.25 on pig iron and $5 on unfinished steel, per gross ton, $5 per net ton on grooved steel skelp and wire products ,and $7 per net ton on bars, shapes, plates, tubular goods, sheets, and tin plates. Rails are set at $45 for bessemer and $47 for openhearth, per net ton, $10 under the prices recommended last September by the War Industries Board, but not accepted, even as a war-time price, by the Railroad Administration. Until 1916 openhearth rails were $30, there being two $5 advances in that year

The new prices are as follows: Bars, 2.35c.; shapes, 2.45c.; plates, 2.65c.; grooved skelp, 2.45c.; universal skelp, 2.55c.; sheared skelp, 2.65c.; steel pipe, 57½% basing discount; plain wire, 3c.; wire nails, $3.25 per keg, base; black sheets, 28 gage, 4.35c.; blue annealed sheets, 10 gage, 3.55c.; galvanized sheets, 28 gage, 5.70 cents.

Pig Iron—The reduction in pig iron is $4.25 per ton, and the understanding is that the War Industries Board differentials and basings are to obtain, but it is doubtful if they will in all cases. For instance, foundry iron was $1 above basic and malleable 50c. above foundry, but already there is found a furnace interest willing to sell malleable at 50c. above basic Some furnaces insist that they will not adjust contracts to the reduced prices. There is no buying to speak of We quote the market as follows: Bessemer, $27.95; basic, $25.75; No. 2 foundry, $26.75, malleable, $26.25; forge, $25.75, f.o.b. Valley furnaces, $1.40 freight to Pittsburgh.

Steel—The reduction on unfinished steel is uniformly $5 per gross ton, making prices as follows: Billets, $38.50, sheet bars and 2-inch billets, $42; slabs $41, rods, $52, rods being Pittsburgh and the other materials Pittsburgh or Youngstown The reduction has not brought out new buying, but has induced freer specifying on contracts, particularly in the case of sheet bars.

Ferromanganese — The ferromanganese market, which is made by resale material, has declined further with 80% available at $130 delivered, though makers' quotations, purely nominal, are $200 for 80% and $176 for 70%. Spiegeleisen is to be had at $42 for 18%, shipping point makers' quotations being $55 @ 60, furnace.

Coke—The Connellsville coke market is no easier and is perhaps a shade firmer, there being less demurrage and off-grade coke offered at under $4, which is the recognized price for good grades of furnace coke. Foundry coke is available at $4.50 in fair brands, a few producers of special brands still adhering to $6. Some of the byproduct operations attached to blast-furnace plants could spare some byproduct coke, but demand is so limited that it is not worth their while to attempt to make sales.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan	75 630	88.702	101.125	36.682	44 356	48 438
Feb..	77 585	85.716	101 125	37 742	42 792	48 027
Mar.....	73.861	88 082	......	36.410	43 620	......
April.	73 875	95.346	......	36 963	47 215	......
May. .	74.745	99.505	. .	37.940	48.980	
June	76 971	99 500	......	39.065	48 875	......
July.	79 010	99.625	......	40 110	48 813	......
Aug .	85 407	100 292	......	43.418	49.077	......
Sept....	100.740	101.125	.. ..	50 920	49.500	..
Oct....	87.332	101.125	....	44.324	49.500	...
Nov ...	85.891	101.125	.	43 584	48 969	...
Dec.	85 960	101.125	.	43.052	48 492	...
Year	81 417	96 772	......	40 851	47 516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan...	23.500	(a)	110 000	92 238	125.000	106 619
Feb...	23 500	16.763	110 000	78 700	125.000	95 700
Mar....	23 500		110 000	.	125.000	.
April..	23 500	......	110.000	.	125.000	..
May..	23.500	......	110.000	.	125.000	..
June..	23 500	......	110.000	. .	125.000	. .
July....	25.904	......	119.913	.	134.913	..
Aug...	26 000	......	122.000	.	137.000	. .
Sept...	26.000	.....	122.000	.	137.000	.
Oct...	26.000	.....	122.000	.	137.000	.
Nov....	26.000	......	122.000	.	137 000	..
Dec...	(a)	.....	118.447	....	133.167	
Year	24 628	.....	115.530	... .	130 507	

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January...	85 500	67.702	293.227	248.557
February..	92.000	66.801	311.525	223.963
March	(a)	.	318 875	. .
April	(a)	.	329.905	. .
May	(a)		364 217	...
June	(a)	.	331 925	. .
July	(a)		360.347	. .
August	(a)		380 900	. . .
September........	(a)	.... ..	343.905	....
October..	(a)	.... ..	335.543	....
November.	(a)	.... ..	323.550	....
December.	(a)	....	267 736	....
Av. year	(a)	... .	330.138	....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January . .	6.782	5 432	6 684	5 316	29 00	37 227
February.	6.973	5.057	6 899	4.784	29 00	28.675
March... .	7.201	.	7 091	.	29 00	.....
April	6.772	.	6.701		29 00	. .
May.... ..	6 818		6 704		29 00	. .
June... .	7 611		7.511		29 00	. . . .
July . ..	8 033		7 750		29 00	. . . .
August ..	8 050		7 750		29 00	. . . .
September .	8 050		7 750		29 00	. . . .
October .	8 050		7 750		29 00	. . . .
November	8 050		7 750		31 20	. .
December....	6 564		6.324		40 00	. .
Year	7 413		7 222		30 10	..

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January .	7 836	7 272	7 661	6 022	54 000	56 045
February	7 814	6.623	7 639	6 273	54 000	46 150
March .	7 461		7 286		54 000	
April	6 890		6 715		54 000	
May	7 314		7 114		54 000	
June	8 021		7 791		54 000	
July	8 688		8 338		54 000	
August	8 985		8 635		54 000	
September	9 442		9 092		54 000	
October	8 801		8 451		54 000	
November	8 491		8 141		54 100	
December .	8 163		7 813		56 050	
Year	8 159		7 890		54 190	

New York and St Louis quotations, cents per pound London, pounds sterling per long ton.

Pig Iron Pgh	Bessemer‡		Basic‡		No 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37 25	$33 60	$33 95	$31 40	$33 95	$32 40
February	37 25	33 60	33 95	31 40	33 95	32 40
March	37 25		33 95		33 95	
April	36 15		32 95		33 95	
May	36 20		33 00		34 00	.
June	36 36		33 16		34 16	.. .
July	36 60		33 40		34 40	.
August	36 60		33 40		34 40	..
September	36 60		33 40		34 40	..
October	36 60		34 40		35 40	
November	36 60		34 40		35 40	.
December	36 60		34 40		35 40	
Year	$36 67		$33 70		$34 45	

‡ As reported by W P Snyder & Co

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 24
Alaska Gold M	3½
Alaska Juneau	2¼
Am.Sm.&Ref.,com..	68½
Am.Sm. & Ref , pf ..	104½
Am.Sm Sec., pf., A	93
Am. Zinc	13
Am. Zinc, pf	42½
Anaconda	60¾
Batopilas Min ..	1½
Bethlehem Steel....	66½
Butte & Superior...	21
Butte Cop. & Zinc .	6½
Cerro de Pasco.....	33½
Chile Cop	19½
Chino	34¾
Colo. Fuel & Iron.	40½
Crucible Steel.	66
Crucible Steel, pf..	94
Dome Mines ...	12½
Federal M & S. .	10
Federal M. & S., pf.	36½
Great Nor., ore ctf.	41
Greene Cananea.	42½
Gulf States Steel..	53½
Homestake ..	98
Inspiration Con	46¾
International Nickel	25¾
Kennecott ...	31¾
Lackawanna Steel	69¾
Mexican Petrol..	180
Miami Copper	22¾
Nat'l Lead, com..	66½
National Lead, pf .	106½
Nev. Consol	16
Ontario Min	6½
Ray Con	20
Republic I &S.,com.	81¾
Republic I &S., pf .	103
Sloss-Sheffield. ..	53
Tennessee C & C..	12½
U. S. Steel, com...	97¾
U. S. Steel, pf.....	115
Utah Copper.......	72½
Va Iron C. & C..	56
Worthington Pump	62

BOSTON CURB*	Mar. 25
Alaska Mines Corp.	‡.12
Boston Ely.. ...	.99
Boston & Mont.....	.53
Butte & Lon'n Dev.	.11
Calaveras	1
Chief Con	3½
Contact . .	.05
Corbin. .	‡.25
Cortez	.12
Crown Reserve...	.50
Crystal Cop .	.27
Eagle & Blue Bell. .	2 1/16
First Nat Cop	1 1/16
Houghton Copper...	.15
Intermountain....	‡.05
Iron Blossom. ..	.40
Iron Cap . .	9½
Majestic	.16
Mexican Metals.	.23
Mines of America .	‡.05
Mojave Tungsten. .	.03
Nat. Zinc & Lead .	.08
Nevada-Douglas.	.15
New Baltic .	1
Oneco ..	.20
Pacific Mines..	‡.35
Rex Cons .	.05
Yukon Gold	.75

SAN FRAN.*	Mar. 18
Alta	01
Andes	07
Best & Belcher.	04
Caledonia .	05
Challenge Con.	‡ 03
Confidence	‡ 03
Con. Virginia	19
Gould & Curry	.02
Hale & Norcross	.19
Jacket-Cr. Pt	.04
Mexican .	.14
Occidental .	.40
Ophir	.27
Overman	.01
Savage	.09
Sierra Nevada .	.05
Union Con	.16
Utah Con	‡.02
Belmont	3.50
Jim Butler	.35
MacNamara	.49
Midway	.31
Mont.-Tonopah	.15
North Star	.07
Rescue Eula	.08
West End Con	1.05
Atlanta	.05
Booth	.14
Comb. Frac	‡ 02
Florence	.34
Jumbo Extension	.13
Kewanas	08
Nevada Hills	02
Nevada Packard	20
Round Mountain	43
Silver Pick	06
White Caps	15

COLO SPRINGS*	Mar. 18
Cresson Con	4 75
Doctor Jack Pot.	.04
Elkton Con ..	.06½
El Paso	15
Gold Sovereign.	‡ 02
Golden Cycle	‡ 79½
Granite	.14
Isabella	05½
Mary McKinney	09
Portland	78
United Gold M	14½
Vindicator	41

BOSTON EXCH.†	Mar 25
Adventure .. .	‡ 75
Ahmeek	64
Algomah......	‡.30
Allouez........	36
Ariz. Com.....	11¼
Arnold	‡ 20
Bingham Mines ..	‡8½
Bonanza	‡.10
Butte-Balaklava	‡ 22
Calumet & Ariz. ..	‡59½
Calumet & Hecla .	400
Centennial ..	12½
Copper Range....	41½
Daly West.	‡3
Davis-Daly........	5
East Butte........	8½
Franklin	‡3½
Granby	‡70
Hancock.	‡5½
Hedley	‡12
Helvetia	25
Indiana	‡ 75
Isle Royale......	24½
Keweenaw........	‡ 99
Lake	‡3½
La Salle	2½
Mason Valley......	‡2½
Mass	4
Mayflower	3½
Michigan. ...	‡2½
Mohawk ...	53
New Cornelia ..	‡11
New Arcadian ..	15½
New Idria	‡9½
North Butte.....	10
North Lake.......	‡ 50
Ojibway	‡1½
Old Dominion....	‡32
Osceola	45½
Quincy	52
St. Mary's M. L.....	40
Santa Fe	‡.25
Seneca	13½
Shannon .	2
Shattuck-Ariz.....	‡14½
So. Lake......	‡1
So. Utah	‡.14
Superior .	4½
Superior & Bost .	1½
Trinity. . .	2½
Tuolumne .	‡ 82
U. S. Smelting. .	48½
U. S. Smelting, pf	47½
Utah Apex. ...	2 1/16
Utah Con ...	8
Utah Metal....	1½
Victoria.......	1½
Winona.	‡ 90
Wolverine	16½

N. Y. CURB†	Mar 24
Big Ledge	50
Butte & N Y .	‡ 50
Butte Detroit.	‡ 05
Caledonia ..	.31
Calumet & Jerome.	1/16
Can. Cop. Corpn	1½
Carlisle	‡2
Cashboy	13
Con. Ariz. Sm .	1¼
Con. Coppermines	‡5
Goldfield Con	18
Goldfield Merger	06
Greenmonster.	‡1/16
Hecla Min .	‡4½
Howe Sound..	‡3½
Jerome Verde .	‡ 75
Louisiana...... .	25
Magma	‡27
Marsh	‡ 03
McKinley-Dar-Sa .	‡ 47
Milford . ..	‡ 75
Mother Lode ..	36
Nixon Nevada.. .	‡ 40
Ohio Cop . ..	‡1/16
Rawley	‡½
Ray Hercules	2½
Richmond	‡ 56
Rochester Mines	23
St. Joseph Lead..	11
Standard S. L....	½
Stewart ..	15
Success	‡ 05
Tonopah .	‡3½
Tonopah Ex .	2½
Tribullion	½
Troy Arizona . ..	‡ 10
United Eastern .	‡4½
United Verde Ext....	‡32½
United Zinc . . .	½
Utica Mines.....	‡ 08

TORONTO*	Mar 18
Adanac	20
Bailey	04
Beaver Con	41
Chambers Ferland	16
Coniagas	2 25
Hargraves	02
Kerr Lake	‡5 12½
La Rose	31½
Lake Shore	‡ 91
Min. Corp. of Can	2 00
Nipissing	‡8 75
Peterson Lake	08
Temiskaming	31
Wettlaufer-Lor	‡ 03
Davidson	63
Dome Exten.	27
Dome Lake	24
Hollinger .	5 12½
McIntyre	68½
Newray	08
Porcu. Crown	27
Teck-Hughes	25
Vipond	22
West Dome .	13

* Bid prices. † Closing prices. ‡ Closing quotations

Engineering and Mining Journal

April 5, 1919

Volume 107 *Number* 14

HAND JIGGING AT CATAVI, BOLIVIA

Wolfram Mining in Bolivia[*]

BY G. F. J. PREUMONT

AS A TIN-PRODUCING country Bolivia is second in importance to the Malay States, but it is only within recent years that wolfram mining has reached any magnitude. In view of the development of the industry, a few notes may be of interest, especially as it is under no form of control. It is not much more than ten years ago that wolfram first made its appearance in the customs list of Bolivia as an export. Through the courtesy of the Bolivian customs officials the following table has been compiled, showing the production of *barilla*, or concentrates, averaging probably not less than 60% wolfram:

PRODUCTION OF WOLFRAM IN BOLIVIA

Year	Tons (2240 lb.)	Value
1908	186	£6,255
1909	150	5,902
1910	207	8,556
1911	292	13,967
1912	468	31,398
1913	278	25,098
1914	272	26,768
1915	779	93,615
1916	2,986	425,677
1917	3,828	585,201

The exports of wolfram in 1916, given by the customs authorities, were distributed among six countries, as is shown by the table in the next column.

EXPORTS OF WOLFRAM FROM BOLIVIA IN 1916

Exported to	Tons	Value
United States	2,062.6	£294,046.5
Great Britain	873.0	124,448.5
France	25.5	3,643.0
Argentina	9.5	1,356.0
Peru	9.0	1,266.0
Chile	6.4	917.0
Totals	2,986.0	£425,677.0

The wolfram production in the various districts of Bolivia for 1916 was as follows:

WOLFRAM PRODUCTION IN BOLIVIA IN 1916

District	Tons	Value
La Paz	1,494.0	£212,983.5
Oruro	936.6	133,518.5
Potosi	332.6	47,414.0
Cochabamba	222.8	31,761.0
Totals	2,986.0	£425,677.0

From these figures it will be noted that La Paz is the first in importance, though some of the output credited to that district is probably produced in and exported through Oruro. The principal mines in La Paz are the fields of Palca or Yungas, Quime or Inquisivi, with others of less importance at Araca, and Colquiri. In the Oruro district are some important scheelite deposits at Conde Auque and elsewhere. In the Cochabamba district the principal mines are at Khami and Chicote, and the Uyuni district has produced, according to reports, moderate quantities of hübnerite of remarkable purity at Salasala and in other localities. The wolfram industry in Bolivia differs from the tin industry in that the latter now depends on two mines alone for the production of nearly 40% of its output, whereas the former obtains its product from a great number of mines.

---

[*] Abstracted from *Bull.* 173, I. M. M.

Wolfram is found mostly along the line of the Eastern Cordillera running from north to south, the occurrences extending far into Peru and the Argentine Republic at either end. This range of mountains consists chiefly of metamorphic schists and slates, strongly contorted and folded, probably Palæozoic, and described by d'Orbigny as Silurian. No fossils are found in these crystalline rocks, above which are series of unconformable quartzite, the whole being intruded at places by recent granite. Occasionally white mica is found in this rock.

Geology of the District

There are two outstanding massifs rising to great altitudes—Illimani, having a summit about 21,000 ft. high, and Mururata, slightly less, both, of course, covered with perpetual snow and practically inaccessible. Granite can be seen in the N.E. side of Illimani up to a height of about 13,000 ft., and rises possibly to a still greater altitude, and on Mururata granite is also prominent and forms the divide between La Paz and the Yungas Valley in places. In one or two regions detritic fragmental quartz overlies the granite or is in close proximity to it, and lower down schists and slates are encountered. The valleys are deep and for the most part have precipitous sides. Evidence of glacial action is less marked in this district than in the neighborhood of La Paz and down the watershed of the La Paz River.

The Cordillera Real, or main chain of mountains on which these deposits occur, is more imposing even than the eastern range described, but it is interrupted by a magnificent canyon between Taca and Saya, which forms a gorge at least 1000 yd. deep through which the Rio de la Paz flows. Granite appears more frequently on the Araca side *in situ;* glacial phenomena, such as moraines, are numerous and extensive, and many glaciers are still existent, and snowfields cover large tracts of country at heights of 16,000 ft. or more.

Occurrences of Wolfram Ore

Wolfram ore deposits and veins of quartz carrying wolframite occur in all constituent parts of the series mentioned, in granite, quartzite, or slate. In the Palca district, the San Francisco and Andina mines are both in granite; the vertical veins appear like gash veins and are much faulted, making mining difficult and slow. The wolframite occurs in bunches and spots, and is sorted easily by cobbing. The ground is extremely hard. The veins can be followed on the surface sometimes for as much as 200 yd., and have been mined from the surface in the most primitive manner. Both the mines mentioned are small producers, and others in the immediate neighborhood, such as Esmeralda, Dondavido, and El Inca, are even less important. Lower down, however, properties such as La Chojilla and Cerro Negro, which are in quartzite, are fair producers, but the most important properties are at Picho, with several veins in slate. This is at an altitude of about 10,000 ft. and is in a quasi-tropical climate. An abrupt contrast to this is afforded by the property called La Salvadora, which is situated at a height of more than 15,000 ft., in almost arctic surroundings, difficult of access and involving extremely arduous conditions of living.

Indians Are Wolfram Prospectors

An interesting property is La Nevada, situated on the eastern side of Mount Mururata and north of Illimani, on the trail to Lambate. Its altitude is about 14,750 ft., or slightly below the line of perpetual snow. The property was discovered by an Indian, who passed it on to some natives of Lambate, and it was subsequently purchased from them by its present owner, an American. Wolframite occurs here in quartz veins so nearly horizontal that they only dip 14° to the west, forming successive layers of quartz interstratified with quartzite, which are so near the surface that they can be mined economically as an open quarry and on a large scale. The occurrence is patchy, bunches of beautiful crystals often being found, but on the whole it is probably low grade. The property has the advantages of easy access, fairly endurable climatic conditions, available water power, and a good surrounding district from which to obtain supplies. It is at present on lease at a monthly rental to a buying agent for the French government, and produces about 250 quintals (10 tons) of 60% *barilla* concentrate per month. A drilling plant with compressors is in course of installation, and the only essentials required to make the venture successful are mining on a large scale and the maintenance of a good price for wolfram.

Some hope of obtaining alluvial wolframite thereabouts was at one time entertained, owing to the fact that the débris at the foot of the mine contained, in a number of places, considerable quantities of quartz spotted with metal. This expectation has not, however, been realized. Near by is the small equipment which forms all the ore-treatment plant for the mine, consisting of a couple of *quimbaletes* (rocking crushers made locally); two buddles and an ingenious hand-shaking table of small capacity. A roasting furnace to eliminate the pyritic contents of the *barilla* completes the outfit. The fuel employed is *taquia* (llama dung).

Tin Property Develops as Wolfram Producer

On the flank and southern side of the Illimani, a property (Cerro Negro) which was taken up a few years ago for the production of tin, has proved, instead, to be a producer of wolfram; it is, however, of small importance except in the sense that it draws attention to the possibilities in that district. The mine is at an altitude of about 14,000 ft., and is in quartzite which is considerably tilted, the veins being vertical and interbedded, but thin. Alluvial was expected below this deposit, but none was found of any appreciable value, owing, it was thought, to the presence of too much pyrites and some cassiterite. The property forms a connecting link with the fields toward Araca and thence to Quimsa-Cruz.

The *barilla* of wolfram produced in the district of Palca is of high grade, probably not below 66%, and very pure, and the associated minerals are mostly pyrites and pyrrhotite, with sometimes a little cassiterite. A little scheelite is also often found on the surface. The district is auriferous, and the old Spanish colonists appear to have had a fair number of gold mines in operation at one time. At present, the Olla de Oro mine is the only one producing that metal.

Strange to say, no wolfram has been found in its immediate vicinity. Most of the wolfram mines in Bolivia are situated at great altitudes, involving trying climatic conditions and extremely difficult means of access. Good roads are unknown, and transportation is solely by means of pack animals.

Araca District Has Many Small Producers

Araca is well known for its tin mines, which were for a long period held by German interests and are now controlled by a Chilean company. There are in that district perhaps a dozen small wolfram concerns run in primitive fashion, the production of which is not great. On the eastern fold of the Cordillera I noticed a peculiar instance of a vein of quartz carrying wolfram which outcropped into what must have been a glacial frontal moraine dating back to remote geologic times, as it was comparatively low ground. The lode is vertical and fairly rich, but it is almost unworkable, owing to the manner in which it had been crushed and broken by the action of the moraine, and so was a constant source of danger to the miners. The owner had made no effort to trace the vein at a lower level where it might be found in more solid condition, or, indeed, to follow it in any direction where it might have led out of the crushed zone. The production averages about one ton per month. The country toward Quime is so wild in character that little or no prospecting is done, and it remains for the native Indians to discover what they can, with the chance eventually of working the prospects on contract. Prospecting in these high altitudes is almost a physical impossibility to foreign-born miners.

Derelict Tin Companies Are Revived as Wolfram Producers

Quime itself is a small *pueblo* (village), around which are grouped many small wolfram and tin workings. In 1915, when the price of wolfram was at a high figure, it was the center of an extraordinary boom. The village is at a comparatively low altitude, and the mines are situated on the crests of the hills in the surrounding country. In the district of Quimsa-Cruz, behind Monte Blanco, which was formerly expected to prove an important tin district, half a dozen more or less derelict tin companies have taken a new lease of life as wolfram concerns. One of these, the Pacuni mine, has already attained considerable importance and produces 10 to 15 tons of *barilla* per month. There are not more than two or three veins, which occur in granite fairly wide for that class of mining—from 2 to 3 ft. wide—and which can be traced on the surface for a distance of a few hundred yards. At the time of my visit, the company was engaged in installing equipment for crushing and concentration, and no doubt the output will be increased.

On the road to Caluyo are several small prospects, mostly in quartzite and on thin but frequently rich stringers. These mines are, relatively, insignificant, and one has to go on toward Oruro and Cochabamba to find mines of importance, such as the Taborga group, which is the most important producer in Bolivia, and Chicote, the property of Fricke, a German, who has been in the wolfram-mining business for many years.

A large proportion of the wolfram industry in Bolivia is now controlled by American interests, but the French have tried to take a share in the industry through their government. British interests are almost non-existent, except for the fact that some fairly large contracts for the purchase of ore to be delivered in England are in force. German activities are now probably disguised to a great extent under Chilean colors, and are at present more or less somnolent, whereas before the war they were paramount. The Taborga group, which is the largest producer of all, with an output of probably at least 1000 quintals (50 tons) per month, is in Bolivian hands.

Cost of Producing Wolfram in Bolivia

The cost of production is almost an unknown quantity to everyone, owners included. A common rule-of-thumb method of computing returns in Bolivia is to consider the monthly output in terms of the number of hands employed. Two quintals (a quintal represents 100 lb. of *barilla*) per man employed is considered to be a fair average production per month. This system of reckoning serves to give the value of individual concerns in a country where there is no publication of returns or profits. In this respect there is a general air of secretiveness, which is, however, probably practiced to a greater extent by the foreign interests than by those under native control; in the latter case the lack of information is doubtless due to ignorance rather than to any desire to conceal results.

Mines Are Mostly Worked on Contract System

Almost every mine is worked on the contract system, the *perquinero*, or contractor, buying his explosives and all his supplies from the *pulperia* (store). The contract price per quintal has nearly doubled in the last 12 months, and 60 *bolivianos* per quintal (110s. per 100 lb.) has been quoted as the most recent figure. A considerable amount of pilfering is carried on without much possibility of prevention, because anyone can buy or sell without a license. On the other hand, the prices charged at the *pulperia* are often excessive.

Explosives and supplies in general have gone up steadily in cost since the beginning of the war. Dynamite (gelignite 55%), which has the lowest quotation, costs £8 10s. per case of 50 lb. at the magazine near La Paz, with an extra charge of 10s. for conveyance to the mine. Mining steel costs £8 per 100 lb. minimum, and hammers are sold at 1s. 5d. per lb. Fortunately, the process of mining wolfram is so simple in its requirements, and the price of the product is so satisfactory, that the high charges for supplies are not seriously felt.

Labor is neither particularly plentiful nor unduly scarce, so that there is no apparent difficulty experienced on that account. Wages have appreciated to some extent recently, and the majority of mines now pay their *barreteros*, or miners, about 3.50 *bolivianos* (6s. 7s.) per day. But as most of the work is done on contract, the scale of wages gives little concern to the owners. The style of living of the Bolivian miner is of necessity rather low, owing to the cost of requisite commodities. He is an intelligent and capable worker, but he has an unfortunate weakness for alcohol.

The industry, like wolfram mining elsewhere, is regarded as a precarious undertaking, depending largely upon the maintenance of prices after the war. The present method of working—if it can be called a method—consists of nothing more than scratching up the earth and surface-holing, with the aim of getting all the ore out with the least effort and as quickly as possible, regardless of the future. There is, moreover, no faith in the mining of wolfram in depth, which helps to account for the reluctance to do more than surface work. A few concerns will undoubtedly develop in time, but a large number must close and disappear, as some have already done, as soon as the surface deposits are exhausted. If the supply of the metal is to be maintained, there can be no doubt that the present primitive methods must give place to more scientific search and systems of production; and it may be remarked, in passing, that American interests show signs of preparing for future developments on more rational lines.

MINING LAWS OF BOLIVIA HAVE NOT BEEN MODIFIED

The mining laws of Bolivia, excellent on paper, have not been changed in any respect to meet the conditions of wolfram mining. The tenure or title is the same for wolfram as for tin, and any property of value yields a harvest to the legal fraternity in the shape of numerous *pleitos* or lawsuits. Regulations as to mining are so few as to be almost non-existent, and, in fact, the chief attention the industry attracts from the government consists in the collection of the export duty, now about 3.20 *bolivianos* per 100 kg. (about 2s. 6d. per 100 lb.), which the authorities consider to be much too low.

Other taxes are not heavy, and the duty on a mining *pertenencia* (claim) of one hectare (2.47 acres) is 4 *bolivianos* (7s.) per annum for all lode metals. The greatest advantage that wolfram mining offers in Bolivia is that little capital is necessary to start, provided that there is enough metal forthcoming to give quick returns, as there is practically no need for any plant except such as can be made on the spot at a comparatively trifling outlay. This conjunction of circumstances has been the basis of many fortunes amassed in that industry since the outbreak of the Great War. Practically all mines and prospects developed during that period started virtually without capital, supplying what was needed as time progressed from the proceeds of the output.

AVAILABLE MARKETS FOR BARILLA ARE NEW YORK AND LONDON

The *barilla* is mostly sold in La Paz to two or three firms dealing on their own account with New York principally, and London, or with one or two government buyers for the Allies. The price paid by these latter was until recently about 65s. per unit delivered for shipment at Mollendo, but for a number of months, corresponding with the entry of the United States into the war, the price has been regulated by New York, and stands higher than the figures formerly quoted by the Allies. A 66% *barilla* not containing any objectionable element can easily fetch today at La Paz 130 to 150 *bolivianos* (227s. 6d. to 262s. 6d.) per quintal. The price varies according to New York quotations.

On presenting this review of the wolfram industry in Bolivia I must be excused for the absence of many details relating to cost of production and values per ton, for the reasons already mentioned, namely, the impossibility of obtaining those figures. Bolivia is essentially an intensely individualistic country, where little information of a trustworthy character can be gleaned without a great expenditure of time, effort, and patience.

Life of Wooden Water Tanks[*]

The variation in figures submitted on the life of timber on various railroads shows that no accurate estimate may be made on the life of tank timber that will apply to all sections of the country. It is characteristic of timber that it is more durable when used in the region in which it is grown than when used elsewhere, for nature seems to have fortified the timber against decay to a certain extent when it is kept in its native climate.

The accompanying table shows the life of 184 tanks that are still in service. In preparing this tabulation consideration has been given to tanks in railroad service only.

AVERAGE LIFE OF WOODEN TANKS

No. of Tanks	Material	Average Life, Years
77	Redwood	32.6
29	Cypress	28.3
25	Cypress	25.0
3	Cypress	32.0
24	White pine	29.7
12	White pine	35.4
4	White pine	29.0
184 (total)		30.0

It will be noted in the table that the white-pine tanks show a higher average life than the cypress tanks, although the opposite was found to be true in a tabulation that was made of 126 tanks that have been relieved. This may be explained by the fact that cypress tanks were not used as extensively as white-pine tanks up to 20 years ago, and on the installations shown there are probably many white-pine tanks which were in use before cypress tanks were constructed, although there is apparently little difference in the durability of the two woods.

A yellow-pine tank, not mentioned in the table, showed a life of 29 years, though that of a yellow-pine tank as constructed today would probably not exceed 12 years. This difference can probably be explained as being due to the fact that the trees from which the tank mentioned was cut had not been bled of the rosin and preservative oils natural to the wood. A red-cedar tank shows a life of 28 years, but this does not represent the extreme life of the timber, for when the tank was taken down the best of the timber was used in the construction of a smaller tank, which is still in use. The original tank was constructed in 1870, which makes the timber in the smaller tank 48 years old.

Many records indicated a life of only 10 to 15 years for cypress, white-pine and red wood tanks. This was unfair to the timbers mentioned, as the short life obtained was undoubtedly attributable to poor selection of timber, poor construction, to the tank not being kept filled with water, or some one or more of a number of faults or conditions that would cause early decay.

Mine Pumps—In the General Electric Review of January, 1919, John Liston states that the pump equipment of the Randfontein Central Gold Mining Co., of South Africa, consists of four units for installation underground, each unit comprising a centrifugal pump in two sections driven by a d.c. 1750-hp., 1500-r.p.m., 2000-volt, slip-ring induction motor, a section of the pump being on each side of the motor. Each unit will have a capacity of 1200 gal. per min. against a total head of 2600 ft., which corresponds to approximately 7,000,000 gal. of water per 24-hr. day for the entire equipment.

---

[*] Abstracted from a paper presented by C. R. Knowles at the 1918 annual meeting of the American Railway Bridge and Building Association and reprinted in part in *Engineering and Contracting*.

Marketing the Mine Prospect

By E. S. BOALICH*

The seller of mine prospects is perforce optimistic. On the other hand, the prospective buyer or his "scout" is pessimistically inclined, and certain conditions and preliminary formalities are necessary that the two may meet on common ground. Primarily it is not essential that expert professional opinion of a property be obtained, for often a few well-chosen facts are sufficient to create interest and offer a basis for further investigation and business negotiations.

RECENTLY there has been a revival of interest in matters which concern the "development of the prospect." This is one of the vital questions that confront the mining world today, and not only does the subject require the thoughtful consideration of the mining public, but the intelligent solution of its various problems will have an important bearing on the nation's progress toward industrial independence.

During the last eight years I have been identified with three Federal and state "mining bureaus," and in that time my duties have brought me in constant touch with many seekers of mining information of every character. Among these there have been hundreds of prospectors and others who were in search of buyers for "properties," usually prospects and sometimes actual mines, as judged from the standpoint of development work already done. Alternating with every 50 or so of these "owners seeking to sell" has come one "prospective investor seeking to buy," or his "scout."

ATTITUDE OF "SCOUT" DISCOURAGING TO PROSPECTIVE SELLER OF "MINE"

A real "scout" is a born pessimist. He may admit that there might be a mine discovered, some day, in China or Peru, or even in Mexico, but "the cream has been skimmed" in this country. The scout is world weary. A twenty-dollar gold-piece will not cause him to flick an eyelash, and a thousand-dollar bill is probably counterfeit as far as he is concerned. Why he remains in the business of "scouting" is a mystery many have sought to unravel.

A closer acquaintance with the scout and with his work somewhat diminishes one's first impression that he does not want to find the thing for which he is ostensibly looking. As a matter of fact, he has covered thousands of weary miles running down prospects and reported strikes, only to find that almost without exception the facts as originally presented to him were overdrawn, distorted, or stated in such a manner that the reported conditions could not be substantiated by close investigation. He feels, and with real cause, that the cream is not only gone beyond recall, but that the cow has stepped into the milkpail.

IDEAS OF SELLER AND BUYER AT VARIANCE

The pity is that there seems to be no middle ground, no neutral territory, where the owner of the prospect and the investor, or his engineer, may get together. The vendor is usually so obsessed with the richness and great value of his "mine" that it is difficult, if not impossible, to winnow the wheat from the chaff of his general conversation. The buyer, secure in the knowledge gained by past experience, is prone to class every man who comes to him as a visionary, and to condemn every possibility, unheard—unless it comes backed by a well-known engineer's report. Whether or not the judgment be impartial or fair, it is a fact that practically any unknown man who seeks to sell or otherwise dispose of a prospect or mine is considered incompetent until he proves himself competent, and the opportunity to speak in his own defence may even be denied him if he makes a poor beginning.

To say to the busy capitalist, "I have a 15-ft. vein which has been traced 10,000 ft. on the surface and will assay $121.50 in gold and $43 in silver," is equivalent to asking the gentleman to ring for the police. Ask him to lend you his limousine, but do not ask him to take an option on your property unless your title to the same is clear. Don't make the statement that your ore exactly resembles that of the "Golden Treasure Consolidated," for perhaps he held his stock in that company too long, and the subject does not awaken pleasant memories.

PSYCHOLOGY OF MINE PROSPECT DISPOSAL

Be prepared, however, with definite facts, "key words" as the psychologist might call them, which are capable of detailed description and proof. If your capitalist or engineer is really looking for mines, these facts will arrest his attention. He will take it upon himself to do his own prophesying in respect to what may develop and as to the width the vein may attain at depth, after he has made the journey to your particular mountain top, and has found, or failed to find, your "main workings."

Before you start to the city, Mr. Miner, take some paper and write a "report" on your mine. Do not attempt to "expert" it, but write briefly and simply what you know to be true. You will be surprised to see with what respect you and your report will be treated. As a suggestion in this connection it will be well to cover the following points:

1. Name of property; number of claims.
2. Situation (Section, Township and Range; also direction and distance from nearest town. Trail or road. Distance to nearest railroad station).
3. Title (patented or how held, with proofs).
4. Improvements and development work. (a) Surface. (b) Underground.
5. Describe deposit (vein and geologic characteristics. Size at points, where this is known. Character of ore, and pertinent ascertainable data concerning it).
6. Topography of country. Climate (in winter).
7. Reason why property is offered for sale.
8. Definite terms under which property can be purchased or leased.
9. Brief mention of history of district and names of principal producing mines.

If you have maps, assay certificates (and can show where the corresponding samples came from, and what they represent), engineers' reports, or other similar data, attach them to your statement. The first eight items outlined above offer the best argument you could ordinarily present. You will probably stand or fall by those facts. But your chances of "standing" will be much better than if you had fortified yourself with a pocketful of "high-grade," and had been hazy as to the distance to the railroad or as to whether or not you were snowed in for five months in 1918!

---

*Mining engineer, California State Mining Bureau, San Francisco, California.

Liquid Oxygen Manufacture and Uses*

Speaking at a recent meeting of the Royal Institution in London, Sir. J. Dewar referred to the disappearance of the barium oxide process of manufacturing oxygen, and its replacement by that involving the fractionation of liquid air. For a time there was no demand for the nitrogen thus liberated, but soon it found extensive application in the manufacture of nitric acids and nitrates, of cyanamide, and of ammonia by the Haber process. The German dye manufacturers had exploited the electrical method of fixation and had invested about £3,000,000 in acquiring cheap water-power in Sweden. So much importance was attached to the Haber process in Germany that it had been made a national monopoly, and, in effect, it had been the principal means of enabling that country to satisfy its requirements of explosives during the war. For the Haber process the hydrogen was obtained electrolytically and by freeing water gas from admixed gases with the aid of low temperatures. In England the total output of the 12 factories manufacturing liquid oxygen was 1 million cu.ft., say 118 tons, per day, 85% of which was used for cutting and welding metals and 15% for medical purposes. In Germany one plant alone was producing 100 tons per day.

Liquid oxygen has been much used by airmen flying at high altitudes. For this purpose it is stored in vacuum vessels provided with a mechanism for controlling the evaporation, and with tubes leading to a mouthpiece through which the aviator may inhale. There are three types of mechanism. In the first, the liquid is heated electrically; in the second, the evaporation is promoted and controlled by thermal conduction through a rod of copper or aluminum in the liquefied gas; in the third the liquid is siphoned out into an evaporating chamber, from which the gas is conducted through tubes—to bring it to air-temperature—to the airman's mouth, the rate of evaporation being controlled by adjusting the conical stopcock through which the gas is passed.

Liquid air is stored in spherical metallic vacuum vessels holding from 5 to 30 gal., the high vacuum required being maintained by keeping absorbent charcoal, cooled to the temperature of the liquefied gas, in a chamber attached to the lowest part of the external wall of the inner vessel, whereby the annular space is highly exhausted. These vessels are durable, and the rate of loss from the largest does not exceed 5% per day.

The lecture was illustrated by numerous experiments, among the most remarkable of which were the demonstration of the magnetic property of liquid oxygen by placing an electro-magnet near drops of it falling from a pipette, these being drawn to the pole in the form of a thin stream; and the stopping of the motion of a radiometer wheel by creating a vacuum around it with liquid air and charcoal, the pressure being reduced to about 1/50 millionth of an atmosphere.

Shimer Case-Hardening Process*

Case-hardening by using a liquid bath of a mixture of easily fusible salts not possessing case-hardening qualities, into which is immersed fresh calcium cyanamide, which imparts case-hardening properties to the bath, is a substitute method invented by Porter W. Shimer, of Easton, Penn. This method is said to possess case-hardening properties equal to or greater than those of previously used baths, gives off no poisonous vapors, and costs but a fraction of what the cyanide costs in the baths formerly considered essential. The process has been in use in a large American works for more than a year.

The composition of the non-case-hardening salts appears rather immaterial. Good results have been obtained by using a mixture of sodium chloride, calcium chloride, and barium chloride in equal proportions by weight; also with a mixture of one part sodium chloride to one part calcium chloride. This mixture is melted in a suitable pot, and the calcium cyanamide is brought into contact with it by placing small lumps of the cyanamide in an iron basket, which is sunk to the bottom of the case-hardening pot. A lively evolution of gas then takes place, and the bath acquires case-hardening properties, which last as long as the evolution of gas continues. As soon as a lively evolution of gas occurs, the dipping in of articles can begin. If the gas evolution becomes too great, the cyanamide may be removed, and case-hardening can be done for some time after this removal.

The cyanamide is best used in lumps, which permit of better control of the evolution of the gas. It should be fresh and contain no moisture. The quantity used varies according to the size and shape of the bath and the character of the articles to be case-hardened.

The Use of Tamping-Bags in Blasting

Miners in general realize the importance of tight tamping and the advantage of having proper tamping materials, but these are not always available, so that it may be necessary to utilize whatever is at hand, with the result that there is a greater consumption of explosives than is necessary.

Miners and rock blasters are beginning to appreciate the utility of tamping bags made of heavy paper as containers for sand, clay, or loam to be used for tamping. The bags are particularly useful when loading holes that are pointed upward. A supply of these bags can be filled and taken into the mine at the beginning of the day's work, and in this way the blaster is sure of having a tamping material that will give him maximum breakage at least cost. Their use also saves time when loading bore holes. Tamping bags are of marked advantage when the blaster desires to make up charges of blasting powder in cartridge form, as is usual when loading uppers or in damp open work. They are more convenient than clumsily made funnels or cones, for which pieces of newspaper are generally used. The cost of the bags is slight, and their use should save many times their cost because of the saving in explosives or greater breakage from a given charge.

Magnesite Production of Quebec in 1918 was 28,564 tons of dead-burned material, valued at $1,016,764, according to the preliminary report of the Quebec Bureau of Mines.

---

*Abstracted from Journ. Soc. Chem. Ind., Jan. 31, 1919, p. 238

*Abstract of paper presented at New York meeting of the A. I. M. M. E., February, 1910, by Joseph W. Richards.

Mine Ventilation in the Cœur d'Alenes*

By ROBERT N. BELL†

Consideration of the subject of ventilation in mines involves certain inevitable natural obstacles. Within set limits good ventilation by means of natural gravity air-pressure circulation may be secured, but with increased depth and lateral extension of the workings it becomes necessary to employ artificial means. The account deals with ventilation conditions in the Coeur d'Alenes and with the methods now employed and those proposed to increase and perfect air circulation in the mines.

MINES of the Cœur d'Alene district have their vein apexes high on the mountain sides, and are developed by adit or crosscut tunnels to depths below 2000 ft., which give ample natural gravity air-pressure circulations that usually afford good ventilation and are easily controlled. The natural advantages of the district in this respect, and its deep sedimentary formations, are exceptional, but in recent years, in three particular cases, the ore penetration has been developed extensively below the lowest points of surface-drainage entry, involving crosscut tunnels, three of which are two miles long. These tunnels are of a minimum size of 7 x 8 ft. and are used for drainage, haulage, and ventilation.

ORE PERSISTENCE AT DEPTH PRESENTS NEW VENTILATION PROBLEM

Above these deep drainage levels, ventilation by natural gravity air currents was a simple matter, but each of these mines, and several others in less degree, have shown a persistence in their ore occurrence to great depth below these lowest drainage entries, and the sublevels thus developed have rapidly expanded in the last few years. This condition presents a new problem in ventilation. The long tunnel is depended upon for the main air supply by reason of the fact that the electric ore-trains used in these air courses act like a piston and offer resistance when in motion against the air, and materially retard its flow.

Sublevel ventilation by natural gravity air, even with the advantage of deep drainage and numerous higher outlets, has recently proved inadequate in volume and velocity fully to supply the normal working requirements of the men, and mechanical means for increasing the air supply have become imperative.

A ventilating system that will simply carry away the smoke and gases resulting from blasting, and the emanations from men and lights, is a mistaken economy in large mine operation, as the great harm resulting from an insufficient supply of good air is shown markedly in the behavior of the men employed in such a mine. "Surliness, discontent, inefficiency, and a general desire to cut work or taper" are often directly traceable to poor air, and no investment will pay a bigger return in resulting efficiency of the workers than good ventilation.

The long tunnels of the Morning and Bunker Hill & Sullivan mines, owing to the natural wall resistance and moving trains, are incapable of carrying sufficient air properly to ventilate the extensive and rapidly deepening sublevels of these properties without mechanical induction. Fortunately, both mines have several other outlets in addition to their long tunnels, which, though at a much higher level, can be used and are used as additional sources of fresh air, with the return or up-cast draft directed through still other outlets. To improve ventilation conditions at these properties it is necessary to drive several thousand feet of expensive straight-line raise connections, in addition to making the required mechanical installations, but scarcity of labor has decidedly retarded the improvements.

PROPOSED VENTILATION AT BUNKER HILL MINE

In carrying out the work of making the connection, over 900 ft. of raises have been driven at the west end of the Bunker Hill mine, and these are now being extended, to be used exclusively as an air course. A station has been cut for the installation of a recently ordered 60,000-ft. Sirocco fan to take fresh air not only from the Kellogg tunnel, but also from the adjacent Sweeney shaft and other west-end outlets. Present plans provide for, if it is found necessary, the installation of another large Sirocco fan near the head of the No. 2 east shaft, which is up-cast and will afford a permanent circuit through the east-end outlets, above the Kellogg tunnel. This is the deepest mine along the plane of the vein in the Cœur d'Alene district. Its orebodies are entirely in quartzite formation and vary in size up to 100 ft. in horizontal cross-section and 900 ft. in length. Stopes are timbered with square sets and filled with waste. Levels are 200 ft. apart vertically and 300 ft. on the dip of the vein, which is about 40°. The hottest stope in the mine is 1500 ft. above the bottom level at the apex of the Cameron stope at the No. 10 level crosscut connection. This is one of the largest stopes in the mine, and has been actively operated for the last 12 years. At this point the temperature is 80° and the humidity reaches 100%. This is largely due to local faulting, oxidizing timbers of the stope and the fact that the situation is a converging point of return air.

RANGE OF TEMPERATURE AT BUNKER HILL MINE

The highest bottom-level temperature in the mine at the new 15 level, which is 4800 ft. along the dip of the vein below its highest crest and 3400 ft. vertically under the mountain, registered only 70° F. The top of the stopes at 13 and 14 levels registered 75°, and the No. 2 shaft station main-return air course at the 13 level, 70°. These are comparatively low temperatures for such depths. The mine, however, is damp throughout, and the relative humidity is high in all the sublevels, causing men to perspire freely at work, and this gives the impression that the temperatures are higher than is actually the case. The only remedy for this humid condition is a greater volume and velocity of fresh-air currents.

At the Hercules mine, with a drainage crosscut tunnel at its lowest point from Canyon Creek only a few hundred feet short of two miles in length, the natural ventilation in its new sublevels is still good. The new vertical, four-compartment shaft from this level is 1400 ft. deep, but only three sublevels have yet been opened down to the 600 level. The underground hoist stations are completely sealed with air-tight doors, and the main shaft, which during the winter carried 30,000 cu.ft. per min. of fresh air, affords ample ventilation for the present levels. By way of the shaft, drifts, stopes, and through several rock raises to the No. 4 tunnel outlet, 600 ft. above No. 5, a natural return circuit is provided during the summer season. Stations are now being cut in the new shaft at the 800 and 1000 sublevels, where the natural temperatures are slightly under 70° and well ventilated by an exhaust fan at the 600-level station.

---

*Abstracted from "Twentieth Annual Report of the Mining Industry of Idaho."

†State inspector of mines, Boise, Idaho.

Deep Working Shaft at Hecla Mine Provides Natural Ventilation

The Hecla mine has a natural advantage in ventilation, owing to fact that its main working shaft starts at the surface and does not involve a long adit approach. It is ideally situated for natural gravity air ventilation, and the management has taken full advantage of this condition. The mine has a drainage level driven along the course of its ore zone several thousand feet, which strikes directly into the east side of the abrupt slope of Canyon Creek, near the main surface shaft collar. The main shaft now has a maximum vertical depth to its new bottom station of 2000 ft. The lowest operating level is at a depth of 1600 ft. and the lineal distribution of the orebodies is extended 3000 ft. in length and duplicated with several parallel courses of ore, with many raises, chutes, and manways at short intervals. Near the east end of the ore development a straight-line raise, nearly vertical and 1400 ft. high, was put through to the surface from the drain tunnel, for ventilation purposes, and the opening gives a maximum gravity vertical range to the 1600 level, through connecting raises, for a natural air quantity of 3000 cu.ft. per min., with several other outlets above the drain tunnel to relieve the main west stopes, and this theoretically presents almost ideal conditions for natural air circulation.

Heavily Timbered Drifts Offer Resistance to Ventilation

The main shaft has a large-sized compartment which is idle, and each station drift entry is provided with an air door. In December this shaft, acting as a natural down-cast, was distributing 28,000 cu.ft. of fresh air per min. at strong velocity through the lower levels, with return through numerous outlets to the surface. The recent rapid expansion and duplication of the operating avenues and ore courses of this mine, all heavily timbered, develop a heavy resistance to free air circulation, in spite of its extremely high-chimney draft value, and retard the flow of the return air, which is believed to be due, in part, to lack of proper splits in the west orebody, a condition that the company's engineers are now studying carefully with a view to remedying by additional doors and stoppings, and if this is not effective, a powerful Sirocco fan will be installed as an exhaust, probably at the head of the No. 3 tunnel 1400-ft. raise.

The temperature at the new 2000-level station in this mine in December was 70°, with relatively high humidity. In common with all the other sublevel properties, the maximum or warmest place tested in this mine, owing to the same cause of temperature localization as in the Bunker Hill & Sullivan and Morning mines, was at the top of an exhausted stope on the 600 level, 1000 ft. above the bottom working level, which gave a reading of 70° Fahrenheit.

It would seem from the foregoing that the temperatures in the deepest mines of the Cœur d'Alene district are comparatively low, and are approximately the ordinary normal summer heat at the surface. There is prevailingly, as previously stated, however, a general dampness of the ground and the resulting humidity or moisture in the air.

Air Conditions Improved by Blasting Schedule

At the Bunker Hill & Sullivan mine, the stoping is all done on day shift, and at the other mines the bulk of it is done on day shift. When two shifts are working in the stopes, the blasting is practically all done at the end of the second shift, which permits 8 to 16 hours' time for the mines to clear of smoke and gases resulting from the blasts. Exhaust fans are invariably used in dead ends, and there is now no point in the district where the air fairly can be considered bad, but in several of the properties, at the end of a shift with a big crew of men working, the air is poor, and it can be greatly improved by mechanical installations and new connections designed to facilitate the distribution of the currents.

Cost of Thawing Water Mains*

Data on the 1917-18 experiences of 96 cities with frozen water mains and services are included in the report of a special committee of the New England Water Works Association. The methods employed by these cities in thawing are summarized as follows:

ANALYSIS OF METHODS OF THAWING

	Mains No. Cities	Services No. Cities
Electricity	36	31
Steam	8	8
Hot water	4	11
Electricity, hot water	5	24
Electricity, steam	5	6
Electricity, hot water, steam	2	10

One city reported that the blow torch was employed in thawing services; another city employed fire. The cost of thawing with electricity per job varied from $20 to $1. A summary of the cost is as follows:

COSTS OF THAWING FROZEN WATER MAINS BY ELECTRICITY

No. Cities	Reported Cost	No. Cities	Reported Cost
3	$20	10	$10
1	18	3	$8 to $10
3	$15 to $16	21	5 to 8
3	12	6	3 to 5
2	11	5	Less than $3

The cost of thawing with steam ranged from $4.50 to $75, the later figure being reported by Stamford, Conn. One city reported a cost of $5, one a cost of $17.70, one $20, one $9.41, one $7.63, one $4.50, one $7.50, one $6.50, one $16.50, and one $14.

The reported cost of thawing with hot water ranged from $2 to $20. Four cities reported the cost as being $2; one a cost of $2.67; three a cost of $3; five a cost of $4 to $5; three a cost of $5 to $6; one a cost of $11.20; one $14, one $17 and one $20. One city reported the cost as being 5c. per ft. of pipe thawed.

Three cities reported on the cost of thawing by fire. In one case the cost was $11.16, in another $10.69 and in the third $10 to $30.

---

*Abstracted from the *Canadian Engineer*, Jan 23, p. 166.

The Radium Industry and Reconstruction*

By JOHN S. MacARTHUR

THE production of radium is one of the few industries that have been started under Government auspices. The Joachimsthal pitchblende deposits on which Mme. Curie experimented were worked by the Austrian government, which furnished material for the experiments. It may be objected that, as at this time all the available supplies of radium were being used for experimental purposes, no industry could, properly speaking, be said to center about it. In a short time, however, as the result of experimental work, the importance of radium as an article of commerce came to be realized, more especially in France and Germany, and its production acquired the status of an industry. A similar development had begun in Britain and in the United States when war broke out.

The production of radium, like that of almost every other commodity, has been profoundly affected by the conditions that have prevailed during the last four years. The Joachimsthal pitchblende, which had been the main European source of supply, ceased to be available. Ore had, therefore, to be obtained from overseas. The shipping problem was a dominant factor in the situation, and hence the importation of material from Australia and India was practically barred. There remained the carnotite ores of Utah and Colorado, and these have furnished Britain and her Allies with radium since 1914. These ores had previously interested British manufacturers, and, in consequence of the Allied blockade of Germany, supplies of ore and low-grade concentrates, which formerly went there, found their way to Great Britain in the early days of the war. Besides radium minerals for treatment in Great Britain, considerable quantities of highly concentrated radium compounds were imported to that country from the United States.

Much valuable shipping space might, however, have been saved had it been found possible to make use of considerable quantities of radioactive ores which are known to be in Cornwall. The records of pitchblende production in that county are admittedly imperfect, and this imperfection accounts partly for the failure to appreciate the importance of Cornwall as a producer. What it might do may be judged from the fact that one mine alone, to the records of which I had access, produced, in four years, ore which contained radium equal to 18,000 mg. of radium bromide, an amount comparable with the output of all the carnotite fields of America in the first four years of active production.

For the last four years practically all the radium produced in and imported into Great Britain has been for government purposes, and although radium was not actually "controlled" until August, 1918, the conditions for obtaining raw material and labor were such as to insure that the output went to the government. What, then, will be the effect, on the radium industry, of the cessation of hostilities? Unlike other industries, it cannot be said to have an established prewar position to which it can return. In my opinion it will have three main channels of development: In the first place there is radio-therapy; secondly, the manufacture of luminous paint; thirdly, the use of low-grade radium residues as fertilizers.

Not long after the discovery of radium, the similarity of its radiations to the X-rays suggested that it might be of use in medicine. Accordingly it was soon possible to obtain radium water, mud, or vapor baths at various Continental spas, which established "emanatoria." The treatment was used mainly for rheumatic subjects and neurotics. It is hardly remarkable that the multitude of adventitious aids to bodily and mental well-being which are to be found at such resorts tended to obscure the real nature of the curative powers of radium; but in other quarters radiotherapy was being taken much more seriously. It was discovered that radium is effective in arresting some forms of malignant disease, and much successful work was done in this connection, and a steady market had just been created for the radium producer when war broke out in 1914. A natural consequence of the war was that the progress of radio-therapeutics was much delayed, through lack of workers and shortage of material.

Less, therefore, has been done in defining the possibilities and limitations of radium as a curative agent than might reasonably have been expected five years ago. In war surgery, however, radium proved useful for preventing adhesions after wounds, and for rendering the scars pliable. In the case of facial wounds this has the effect of greatly lessening the disfigurement which they so often involve.

In the near future there will be a large demand on the part of the medical profession for radium, not only for the treatment of diseases where it is known to be of service, but also for doing experimental work, for here the time lost during the years of war must be made up. So important has this application of radium seemed. that medical men have advised the Government of the United States to see to it that the whole of the radium supply in that country is reserved for medical purposes alone. They regret that so much of the limited supply of radium should be dissipated in the manufacture of luminous paint for such things as watch dials, electric bell pushes and other like uses.

This brings one to the second great field of activity for the radium producer—namely, the manufacture of luminous paint. This substance is made by mixing a small quantity of a radium salt with hexagonal zinc sulphide. The luminosity of such a preparation is not conditional on previous exposure to light, and the activity of the radium is not lessened by its being mixed with the zinc sulphide. The cost of the mixture is not prohibitive, as 0.4 mg. of radium bromide to 1 to 2 gm. of zinc sulphide is sufficient to give good luminosity. The paint, however, is efficient for only about two years. By that time the zinc sulphide is worn out by the bombardment of the radium radiations. The latter is not exhausted, but may be isolated and used again with fresh zinc sulphide.

Though it is desirable that as much radium as possible should be available for the medical profession, and that it should not be wasted on articles of luxury, the legitimacy of its use for illuminating ships' compass cards is rather a different question. It has been suggested that mesothorium might profitably take the place of radium in the manufacture of luminous compounds.

---

*Abstracted from the *Mining Journal*, January 18, 1919, p. 39.

The radioactivity of this element is for practical purposes comparable with that of radium, but its life is measured by years, not centuries, and it could not with advantage be isolated more than once or twice.

There remains the use of low-grade radium residues as fertilizer. These residues, still containing a small quantity of radium, have been found to exert a stimulating influence on plant growth. The precise nature of the stimulus is not absolutely known, and has been hotly disputed. Some have denied the beneficial influence of radium altogether, but the weight of experimental evidence appears to be against them, and it is found that there is a steady demand for radium residues on the part of agriculturists and horticulturists. Radium fertilizer must not be thought of as a food; it will not take the place of essentials such as phosphate or potassium, but will aid in their assimilation. It also seems to assist in the fixation of nitrogen. The production of radium fertilizer remains of course the same, whether the concentrates are used for medical purposes or for preparing luminous paint.

Whether or not the production of radium is a key industry is a question which the mere scientist may think it presumptuous to answer; but it certainly ought to receive the attention of those who are devoting themselves to the solution of the problems of reconstruction. The position with regard to ore may be summed up as follows: The Joachimsthal pitchblende supplies, which showed signs of failing before the war, are now almost exhausted, and the United States Government has placed an embargo on the export of radioactive ores. The British manufacturer of radium must therefore seek his raw material elsewhere. Cornish supplies are extensive, but require re-development. Promising reports of radium minerals come from India, South Australia, and East Africa. It is of immediate importance that these supplies be developed to their fullest capacity.

Anything like a full description of radium extraction would be far beyond the limits of this paper, especially as methods must vary according to the nature of the ore that is being treated. All methods take advantage of the fact that barium and radium are chemically homologous. If barium is not already present in the ore, it is added in an insoluble form—1 kg. of barium to 1 mg. of radium—that is, 1,000,000 to 1. If the ore is then treated for barium, the radium will also be recovered. How far the power of barium to entrain radium is due to absorption has not yet been definitely ascertained.

When the radium and barium have been recovered together in solution as chlorides, the whole is evaporated to saturation point. The crystals which settle out are found to be much richer in radium than the radium-barium chloride left in solution. By repeated crystallizations an almost pure radium salt can be obtained.

American Smelting and Refining Co.

The earnings of the American Smelting and Refining Co. and its subsidiary companies for the fiscal year ended Dec. 31, 1918, after deducting general expenses ($1,305,934.39), corporate taxes ($1,252,356), and fixed charges ($1,616,109.44), aggregated $14,137,167.65, or $10,898,770.79 less than the preceding year. Corporate taxes were $2,597,614.73 less than in 1917. From these earnings, $5,439,631.20 was further deducted for depreciation and depletion, $250,000 for safety and welfare reserve, and $740,038.22 for miscellaneous charges, leaving $7,707,498.23 as total earnings applicable to dividends.

The company's income was derived as follows: Net earnings of smelting and refining plants and dependent industries, $13,234,710.85; net earnings from mining properties, $2,686,839.73; interest, rents, dividends and commissions, $2,390,016.90; total gross income, $18,311,567.48. Economic conditions that had maintained throughout the previous two years continued during 1918 and were accentuated in the last half of the year by constantly increasing wages and cost of fuel, materials, and freights. There was also a still further decrease in the efficiency of labor, due to the influenza.

Of the $7,707,498.23 applicable to dividends, the amount declared on preferred stocks for the year 1918 totalled $4,247,773.75, leaving $3,459,724.48 applicable to dividends on common stock. For the first three-quarters of the year dividends were paid on the common stock at the rate of 6% per annum and for the last quarter at the rate of 4%; the total paid being $3,354,890. The balance of $104,834.48, together with the surplus on Dec. 31, 1917 ($26,955,394.40), brought the total surplus to $27,060,228.88.

During 1918 there was expended $4,916,971.92, which was charged to property account. This included about $1,300,000 which was invested in Mexico and Chile, and $340,000 for the purchase of a mining property in this country.

The following statistics relate to plant operation during 1917 and 1918.

OPERATING STATISTICS: AMERICAN SMELTING AND REFINING COMPANY

	1917	1918
Number of men employees, excluding Mexico..	24,698	21,765
Total wages and salaries, excluding Mexico...	$24,497,836	$25,516,467
Average wages per 8-hour day..............	$3.31	$3.91
Tons charge smelted........................	5,918,924	5,658,232
Tons bullion refined........................	706,875	680,099
Tons coal used..............................	787,890	765,124
Tons coke used..............................	592,765	545,063
Barrels fuel oil used........................	1,560,535	1,659,337
Cubic feet gas used.........................	3,032,908,373	2,372,000,103
Tons ore mined..............................	2,318,925	2,525,280
Tons coke produced.........................	186,107	171,245
Production:		
Gold, oz....................................	2,496,693	1,994,015
Silver, oz..................................	69,841,061	72,572,506
Platinum and palladium, oz...............	1,597	1,516
Lead, tons..................................	275,266	260,192
Copper, lb..................................	916,974,000	868,540,000
Spelter, lb..................................	52,522,000	41,238,000
Nickel, lb...................................	682,715	626,085
Tin, lb......................................	12,130,000	19,868,000
Sulphuric acid, lb........................	66,174,000	87,338,000
Arsenic, lb..................................	9,132,000	7,837,063
Copper sulphate, lb........................	7,598,000	5,164,000
Byproduct metals, lb......................	4,131,709	1,870,662

Negligent Ladder System in Shaft

By A. L. H. Street*

A North Carolina mine owner has been held by the Supreme Court of the state to be liable for the death of a miner, who was killed while descending a ladder in a 550-ft. shaft, through being struck by other miners who fell upon him, where it was found that no platform was maintained on the last 95 ft. of the lower end of the shaft where the accident occurred.

Witnesses testified to a general mining practice of constructing platforms at least every 25 ft. in such manner that any person or substance falling along the ladders would lodge on a platform. Absence of such platforms on the lower 95 ft. having permitted decedent to fall about 75 ft. to the bottom of the shaft, it is held that the jury properly found that defendant operator was guilty of actionable negligence. (Parrish vs. Richardson, *97 Southeastern Reporter, 225.*)

---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Operations at the Zinc Camp, Arkansas

BY TOM SHIRAS*

Few mining districts can boast the distinction of paying their way from "the grass roots." The Zinc camp is one of these, and, moreover, owes its success and activity to the removal of the lumber industry, which formerly supplied local labor with a means of support. The ore deposits are not complex, mining may be carried on economically, and the returns are in good proportion. Operations are mostly in the hands of small concerns.

THE Zinc camp, which covers a territory approximately 10 miles square in North Boone County, Ark., including the upper watershed of Sugar Orchard Creek and a part of Crooked Creek, is interesting from the fact that practically all of the development work, which has resulted in the opening of many small mines, has been paid for from production, and there has been little investment of capital. The village of Zinc, situated in the Sugar Orchard Valley between two timber-clad ridges, is the headquarters for the mining men of the camp and the shipping point for the ore.

OPPORTUNITIES FOR THE SMALL OPERATOR

The camp occupies the same position in its relation to zinc mining as the old placer camps of the West did to gold. No one person or corporation owns all of the land; no company commissary exacts high profits for supplies, and any man with a strong pair of shoulders, a few pieces of hand steel, a striking hammer, picks and shovels and a wheelbarrow can nail a lease at a reasonable royalty and throw his hat into the ring. Considering the camp as a unit, it is ultra democratic and warm hearted; it welcomes a real miner spontaneously and enthusiastically, and it will fold a "busted tenderfoot" to its breast; but the stockjobber receives a cold welcome. Like other camps, it has its "monuments," but most of these are due to incompetency or the lack of practical knowledge of mining. Local men who follow mining as a business, and others who have come into the camp, have made a success, and this is particularly true of the small operator—so much so that the district has gained the sobriquet of "a poor man's camp."

GEOLOGY OF SUGAR ORCHARD DISTRICT

John C. Branner, former State Geologist of Arkansas, in his report of the Sugar Orchard district, chronicles its geology as follows: "In its main features the geology of the Sugar Orchard district is quite simple; the horizontal calciferous rocks which yield the zinc are overlain by the St. Joe marble bed, and, above the St. Joe, the Boone chert caps the hills on both sides of the streams. There appear to be local variations in the beds, at places the structure being obscured by deep decomposition."

MINING CONFINED TO REMOVAL OF SILICEOUS ORES

Practically all of the ore mined in the camp is silicate of zinc carrying from 40 to 45% metallic zinc, with no lead, sulphur, or other objectionable substances. It is found disseminated in the gangue and in nugget form, the former requiring crushing and concentration, whereas the latter is ready for the market as it comes from the ground. Associated with the siliceous ores are large bodies of tallow clay, which carry from 20 to 35% metallic zinc, for which no market has yet been found. Sphalerite, or jack, has been discovered at lower levels by deep drilling in the valleys; but the presence of large bodies of silicate ore at the grass roots above the water level has discouraged the development of the sulphide mineral, and it is likely that it will receive little attention until the silicate ores are exhausted.

McCURRY CUSTOM MILL AT ZINC, ARKANSAS

GLORIA MINE AND MILL AT ZINC, ARKANSAS

Silicate ore, being a secondary formation, is more frequently encountered along the sides of old underground water channels, breaks, and faults. When once the ore is found, the miner follows it up or down to the right or left until the mineral pinches out. Until two years ago, a popular theory in the camp was that the ore rimmed the hills for a depth of about 70 ft.

---

*Mountain Home, Arkansas.

and that it was useless to cut deeper than that, as limestone bars were encountered at that depth and cut off the ore. However, this theory has been disproved, for some of the richest tunnels in the camp are now back as far as 500 feet.

Increased Mining Activity the Result of Lack of Work

Though prospecting has been carried on in the camp for the last 30 years, and a little production was made during that period, the camp did not come into its own until 1913, when it was literally forced into production by reason of circumstances that made it absolutely necessary for the male part of the community to mine. Previous to 1913, promoters would appear periodically, lease or buy a property and promote it. Invariably thousands of dollars were spent, and there were no returns. The industry was so spasmodic that it could not be depended upon as a means of furnishing local labor with steady work, and most of the men in the community were employed by a number of sawmills in the vicinity of Zinc. Late in 1912 these mills completed operations and moved away, leaving local labor idle and stranded. The men were without sufficient money to provide the necessaries of life, and possessed no funds with which to move away, and socialism became a popular topic of conversation. One night early in January, 1913, Lon Brown, a local prospector, walked into a store where the male population of the village had gathered and were bewailing their lack of luck, and offered every man $1.50 a day to mine silicate on a lease he had lately taken at the mouth of Coon Hollow. The only strings tied to the job were that the men would have to bring their own picks and shovels, and look to the ore pile for their wages. Most of them laughed at his proposition, believing that mining could not be carried on without a big initial investment, but four or five met him at his prospect the next morning, scraped the snow out of the cut, and started to work. In two weeks' time they produced a carload of hand-cobbed silicate that brought $700 in spot cash, which was more real money than had been in the village for months. Immediately silicate mining became popular, and the community has lived and thrived from the industry ever since.

Shafts have been sunk at a few properties in the camp, but most of the mining has been done by driving tunnels into the mountain sides on the ore-bearing level, the tunnel sites being determined by the ore outcrops.

Development of Milling Facilities

For the first few years hand-cobbed ore was the only grade produced. However, in taking out this free ore large quantities of milling ore were removed, which could not be treated, because of lack of proper facilities. This condition was overcome in 1915, at which time the McCurry custom mill was constructed, and later the Brown mill, which is now owned by the Boo-Gra-Loo Mining Co. Other properties in the camp which are now equipped with mills are the Madison, Resin Jack, Coker Hollow, Tar Kiln, Red Mill, and Gloria. The first four run spasmodically and the latter two, together with the custom mills, are in steady operation.

The Gloria mine, operated by the Gloria Mining Co. under the management of George Miller, is the largest producer in the camp, and was the largest producer in the field last year. It represents the type of mine into which many of the smaller properties will develop under proper management. The work has been carried on through a series of tunnels, of which there are nineteen. The mine proper lies on the east side of Sugar Orchard Creek about ¾ mile north of Zinc, and consists of approximately 1000 ft. of tunnel and crosscuts. The main tunnel, which is 15 ft. wide, has been cut under the mountain for about 500 ft. The last 200 ft. extends through a body of silicate ore 36 ft. high and of undetermined width. After hand picking the free ore, the "dirt" shows a mill recovery of 25%. Headings in a number of crosscuts are also in good orebodies, but these do not compare with the extent or richness of the body cut by the heading in the main tunnel. Owing to the price of ore, the owners of the property have made no effort to produce a maximum tonnage, but have confined their operations to blocking out their ore, and have milled and sold only such output as was produced by the blocking-out of ore. Production has been from 20 to 40 tons a week.

The property is equipped with a small but modern concentrating plant. The machinery consists of one 10-in. crusher; one set of 24-in. rolls; 2 sets of 18-in. rolls; one 4-cell rougher jig; one 5-cell cleaner jig; and 2 Wilfley tables, with the necessary screens, belting, elevators and other equipment. The mill was operated for a number of years without a set of cleaner jigs or the tables, the cleaning being done with hand jigs, but under this method a considerable part of the valuable minerals was lost. Since the installation of the new cleaning equipment, the chats made by the old method have been re-run, and a profitable recovery has been made.

Measuring Gas Temperature in Boilers*

Accurate measurement of the temperatures of the gases as they pass through a boiler setting is extremely difficult, especially where the temperature of the gases differs greatly from that of the surrounding surfaces. Under such conditions the results obtained by ordinary methods of measurement are seldom correct within less than 10%, and are frequently off 25%. The errors in the measurements are due chiefly to three causes, as follows:

1. Radiation from the instruments with which the temperatures are measured. This error usually makes the observations too low.
2. Variation of the temperature of the gases at different points in a cross-section of the path of the gases. This error may make the readings too low or too high; more often, too low.
3. Fluctuation of temperature at any one point may cause the reading to be too low or too high.

Iron Works in the Donetz Basin of Russia are practically intact, and with some repairs would be able to resume operations immediately if the conditions permitted, according to the *Ironmonger*. Last August the blast furnaces of Krivoi Rog at Gdanzevski, were undamaged, but only 400 men remained at work. At the Briansk works 2500 men out of 6000 and at the Druzhkovka works 3000 men are employed. The Dnieproviénne Co. has kept on its men at the Kamenskoi furnaces, and it is possible that work may soon be resumed there.

---

*Abstracted from *Bull.* 115, "Measuring the Temperature of Gases in Boiler Settings," by Henry Kreisinger and J. F. Barkley, Bureau of Mines, Department of Interior.

The Guamoco District of the Republic Of Colombia—II*

BY S. FORD EATON†

CONDITIONS are extremely trying in the early stages of development in a locality such as the Guamoco district of Colombia, although, with time and organization, difficulties can be greatly modified. Transportation, obviously, is the principal problem. Distances from the two main rivers are great, and the country is rough. By looking at the map one would, perhaps, think that some shorter and more feasible routes must exist, but none has been found. Inasmuch as the mountain ranges run north and south, trails for freight trains must, for the most part, go in the same direction to avoid numerous heavy climbs. Favorable passes to the east or west are not plentiful. These trails are expensive to build and maintain. They must be cleared, graded, and banked on the hills, not only to make the long climbs easier but to drain off the water from the continuous rains. Pastures for stock must be cleared, sown, and fenced at regular intervals of a day's travel for pack trains. A train will make about 10 miles a day, and a rest house must be built at each station. Pastures and trail must be gone over at least twice a year to keep down the rank tropical vegetation. The constant rains and mule travel cut the roadbed rapidly, so that repairs are always needed, and fences and houses must be kept in proper condition.

Supplies, machinery, and repair parts must all be packed in anticipation of mule-back transportation. A mule load or *carga* cannot be over 250 lb. in two parcels, Pieces heavier than this, up to 500 lb., can be brought in by *turega*, i.e., lashed on two parallel poles, and supported by one mule in front and another behind. Still heavier pieces can be brought in on poles by men, but this mode is extremely slow and expensive.

The number of mules for hauling freight should be such that there is always at least one extra train or *partidua*, thus allowing a resting period for shoeing and treatment of sores and cuts. A good pack mule can be bought for about $100. Oxen can be used, but they are not as good as mules. The purchase price is less than half that of the mule, but they travel more slowly, require more pasture, are harder on the trail and will not stand up as well under constant work. Oxen will, however, travel with a heavy load over a swampy, boggy trail on which a mule will experience difficulty even without a pack.

THE LIBERTAD MILL, REPUBLIC OF COLOMBIA

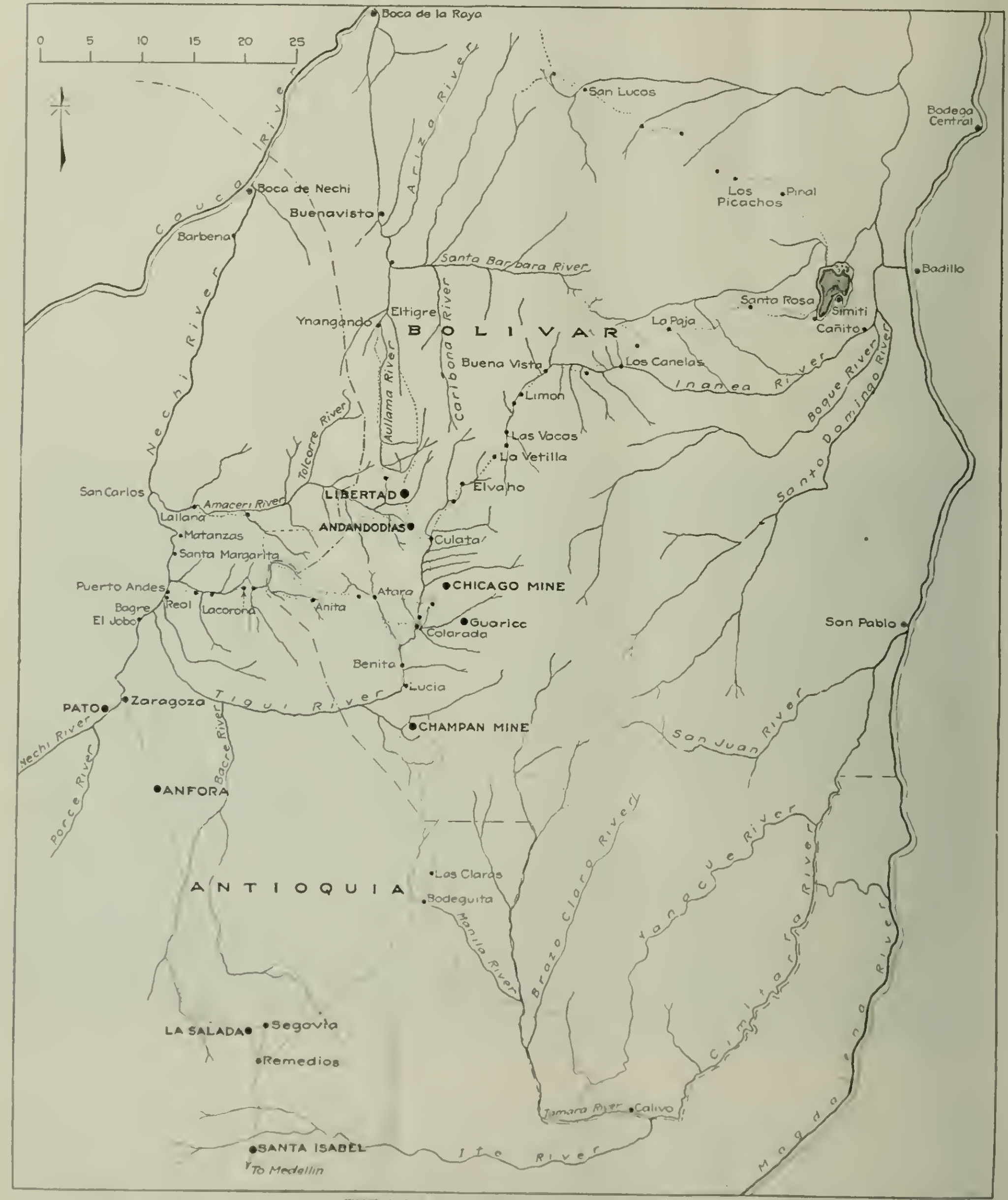
Supplies must be ordered long in advance, because, in normal times, it takes from three to six months to get them from the United States. From Colombian centers the time required is from six weeks to four months. This is not a serious drawback after the preliminary installation, as regular needs can be anticipated, but at the start and in emergencies many aggravating delays are experienced.

---

*The concluding installment of an article that appeared in the Mar. 22 issue of the *Journal*.

†Consulting mining engineer, Rocky Mountain Club, 65 West Forty-fourth St., New York.

Water power is available everywhere, and can usually be applied direct. Most of the mills have used water in this manner with turbines or the huge native type of overshot wooden wheel. A small hydro-electric plant supplies the needs of the Guamoco Mining Co. The available horsepower is almost unlimited.

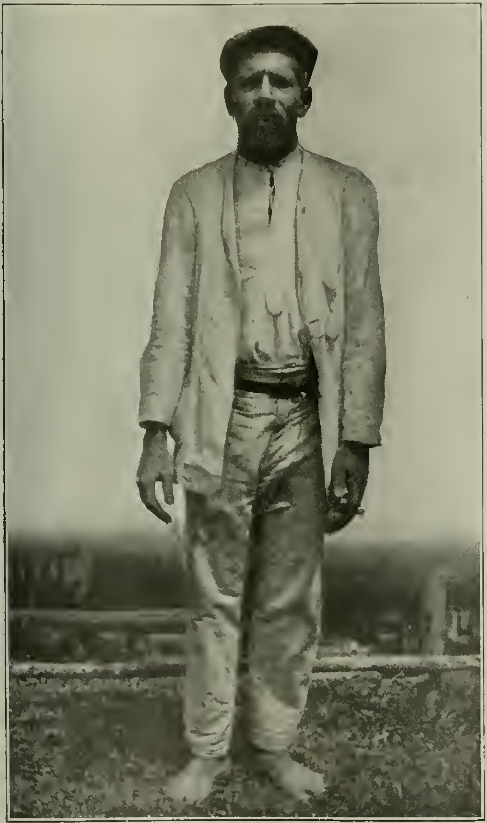


THE GUAMOCO DISTRICT OF COLOMBIA (By Courtesy of W. C. Burdett)

Native labor, such as it is, is plentiful. In this particular district there are two classes or factions. One comes from Simiti, the lowlands, and the other from Antioquia, the highlands. The Simitenian is a riverman, fisherman, and farmer of sorts. He is ignorant and somewhat stupid, but, to a certain extent, conscientious and trustworthy about his work. His knowledge of quartz mining has been gained in the mines of Guamoco during recent years. On the trail, and in carrying out clearing and general jungle work and at packing over hard trails he is a good workman.

The Antioquian comes from a district where considerable quartz mining is carried on; consequently his knowledge of the work is greater. He is a more intelligent and enterprising worker, but wiser, and inclined toward trickiness and shirking. He is more energetic and efficient than the Simitenian, and consequently makes a better boss.

The Guamoco population is composed of the lowest class of these two factions. Enmity exists, but by maintaining an equal balance of numbers, and by treating them impartially, serious trouble can be avoided. They have no morals. Petty deceit and dishonesty are the rule rather than the exception, and the majority are heavy drinkers. Nearly all live for the day only; and thought for the future is conspicuous by its absence. Patience is the basic requirement for successfully handling these natives, and they must be treated as grown-up children. Brutal, domineering tactics do not produce the best results; but, on the other hand, the fact must not be overlooked that they are always ready to take advantage of slack supervision.



A MINE BOSS FROM ANTIOQUIA

Liquor causes the greatest trouble. The natives insist on having it, in spite of all precautions and regulations to the contrary. Experience has shown that it is better to have it available on the property and to regulate the sale as seems best for all concerned.

Generally speaking, some system of task, bonus or contract work will produce the best results, because on day's pay there is a tendency to loaf. Carelessness and shirking can best be overcome by imposing fines. Deducting some of his pay will impress a native far more than a reprimand or even a jail sentence. In this connection it is wise to make the administering of fines a public matter. Posting them on a bulletin board helps to impress the culprit and causes his fellow workmen to avoid making the same mistake.

Guamoco wages are higher than in other districts. This condition is due to the fact that, in the early days, it was necessary to offer a bonus to the natives to induce them to come to the district; and the scale has never been reduced. Of their wages, 45c. per day is deducted and is issued in food as a ration. The rates of pay are as follows:

TABLE I. WAGES PAID IN GUAMOCO DISTRICT OF COLOMBIA

Surface laborer, per day	$1.00 to $1.20
Surface boss, per month	45.00
Carpenter, per month	60.00
Mechanic, per month	60.00
Blacksmith (general), per day	1.50
Millman, per day	1.20
Helper, per day	1.00
Electrician, per month	50.00 to 60.00
Helper, per day	1.20
Mine foreman, per month	70.00
Assiatant foreman, per month	60.00
Timberman, per day	1.30 to 1.50
Miner, per day	1.00 to 1.30
Mucker and carman, per day	.90 to 1.20
Tool sharpener, per day	1.20
Nipper, per day	.80 to .90
Storekeeper, per month	50.00
Mule skinner, per month	40.00
Helper, per month	30.00

FOOD

Owing to the fact that settlements or supply points are few and far between, the traveler, prospector, or miner must supply everything required by himself and natives. The native "on his own" can subsist on very little, and his wants are few, but when he goes to work for a company which provides all food he quickly develops a finicky streak.

COMPANIES ENCOURAGE LOCAL PRODUCTION OF FOODSTUFFS

The companies have encouraged responsible natives, with agricultural experience, to clear and plant farms where the conditions were favorable. Guamoco now produces nearly enough corn, plantains and *yuca* for local needs, as well as considerable sugar cane. The other essentials are rice, beans, coffee, lard, cheese, salt, beef, and tobacco. *Panela* (brown cane sugar) is consumed in large quantities, and for the most part is brought in from Simiti. Usually there is a shortage of corn during the months of April and May. At such times the grain must be brought in from the river districts, and the cost is high. Rice comes from the lowlands, and is scarce and costly during April, May, and June. Beans are brought in from Simiti. Coffee, lard, salt, cheese, and tobacco come from the larger river towns. Steers are driven in from the Nechi river to supply beef. The average normal costs at the company stores are shown in Table II.

TABLE II. RETAIL COSTS OF FOODSTUFFS AT GUAMOCO CO.'S STORE

	Per Lb.		Per Lb.
Corn	5c.	Coffee	16c.
Rice	10c.	Sugar (white)	15c.
Beans	14c.	Cheese	30c.
Panela	10c.	Butter	55c.
Lard	30c.	Onions	25c.
Flour	20c.	Potatoes	30c.
Salt	14c.	Beef	18c.

Duty on imported foods is high, and their final cost is from 200 to 400% above New York wholesale prices. Everything required by the natives must be brought in by the companies, and handled in their stores. Once a community of moderate size has been established, independent merchants will come in and open stores if allowed to do so, when they always charge exorbitant prices, particularly on articles not carried in the company store. On occasions there will be a temporary shortage of an essential commodity in the commissiary. At such times these dealers will reap a harvest. Because of this it is wise for the company to exercise care and supervision in connection with outside stores.

Timber and Buildings

A newcomer to Guamoco will receive the impression that there is an unlimited supply of timber to be had from the jungle-covered hills. Timber is abundant, but of many kinds and grades, and probably 40% of the trees supply a poor quality of wood, no part of which is suitable for lumber, and little will serve as mine timber or firewood. Of the remaining, one-half will furnish ordinary lumber and mine timber, and one-half will provide excellent material, some species being very hard and lasting many years. Trees such as *quimola*, *canelo*, *aceite* and *roble* should be used in all heavy and permanent construction.

There are many varieties of palm, and many are useful in housebuilding. Chief among these are the *macana*, *palmachica* and *rabo-gallo*. The first named has a hollow trunk which, when split in four or five sections, provides suitable strips for making house walls, floors, and beds. The *palma chica* and *rabo-gallo* furnish the best material for thatch roofing.

For the most part, houses for the natives are constructed of poles and *macana* strips, with palm thatch roof. Mother earth does for the floor. For mine, mill, store and office buildings, galvanized-iron roofing is preferable and more economical in the long run. Palm thatch must be renewed every two years, and repaired in the meantime.

In the construction of the more elaborate buildings, such as store, office, and staff living quarters, sawed lumber can be used. Neat and fairly durable walls can be made with poles or *macana* strips, plastered with mud or *adobe*, then whitewashed. All buildings should be designed to provide ample ventilation, as the climate is mild. There are no extremes of heat or cold, and insects are not numerous. There are no flies and few mosquitoes. On account of the heavy rainfall, good roof and ample drainage facilities are necessary. Altitude varies from 3000 to 6000 ft. above sea level, which accounts for the absence of the more trying tropical conditions encountered at lower levels.

Lumber is whipsawed by the natives, and an average cost is $45 per 1000 ft. delivered at the mine. This applies to material in 10- and 12-ft. lengths. Longer pieces will cost more. The sawyers, as a rule, are good workmen, and the material is well turned out.

Mining Methods in the District

Underground work as carried on in Guamoco suggests no comment except, perhaps, as regards crudeness. Owing to the handicap of transportation and the low tonnages handled, no mechanical equipment for this class of work has been brought in. Drilling is all done by hand with the 4-lb. "single jack." Only a few of the natives become what might be termed experts. It appears to be impossible for them to learn to strike an "upper."

The veins are narrow, so no particular timbering problems arise. As a rule the walls are held by stulls; and, when the ground is bad, posts are set on the stulls and pole lagging is placed behind. Some caving for fill has been done, and the usual practice is to drive raises every 25 ft. from adit level to adit level, 100 ft. apart. Intermediate drift levels are also driven. Chutes are built at the bottoms of these raises, then underhand and overhand stoping is carried on until the pocket is exhausted. Cappings 6 or 8 ft. thick are left above and below levels. When a part of the mine is worked out, these cappings are removed. Development work is usually done in the country rock on the foot wall, as better time can be made here than in the hard quartz.

Water has so far caused practically no trouble, the reason for this being that all the mines have been worked by adits and no great amount of sinking has been done below the lowest levels. Should extensive sinking operations be carried on, this would be an important factor.

Daily tonnages are low, and only comparatively high-grade ore can be mined; for under present conditions it does not pay to handle ore containing less than $15 per ton. Production per man-shift for all labor directly connected with mining will average less than one-half ton. This includes a reasonable amount of development work. In the average ground, raises 5 ft. by 6 ft. are driven from 40 to 60 ft. a month; drifts 5 ft. by 6 ft. 6 in. are advanced 35 to 45 ft. in the same length of time. Hard rock may be encountered, and progress is then much slower.

Costs of Operation

A compilation of typical labor costs in normal times is given in Table III. In 1915, total costs per ton of ore treated averaged about $10. That the cost of producing gold in Guamoco has increased considerably can be seen by comparing this amount with the totals in Table IV (general costs in 1917). To the cost per ton in this table should be added about $1 for administration, making the average for the year about $14.51.

TABLE III. LABOR COSTS IN 1915 AT GUAMOCO

	Mine	Mill	Power	Surface	Total	Tons	Per Ton
January	$1948 95	$259 75	$183 20	$449 24	$2841 14	567	$5 01
February	2087 54	233 65	171 35	586 82	3079 36	587	5 24
March	2114 81	276 57	142 06	604 44	3137 88	695	4 52
April	1701 58	244 55	197 55	310 75	2454 43	530	4 63
May	1711 20	287 82	173 40	280 00	2452 42	561	4 39
June	1797 64	261 95	143 75	277 49	2480 83	574	4 32
July	1767 37	267 60	175 20	627 65	2837 82	540	5 25
August	1873 40	270 60	128 52	347 30	2619 82	462	5 67
September	1185 87	338 95	187 32	451 41	2863 55	490	5 84
October	1550 16	358 30	142 20	450 10	2500 76	520	4 80
November	1095 15	294 55	158 60	518 85	2067 15	490	4 21
December	961 56	259 70	190 05	364 75	1776 06	496	3 59
Per ton average	3 039	0 515	0 306	0 809	4 77		

The cost of hauling one ton of freight, in pieces suitable for mule-back transportation, from the coast to central Guamoco, is $160. This sum is apportioned as follows: River boats, $60; canoe, $20; mule-back, $80. Mule-back transportation costs approximately $2 per ton mile, including upkeep of trail and pastures. Natives will contract the hauling only at about the same figure.

Mining and milling supplies are imported under minimum customs duty. Generally speaking, on parcels which can be brought in on the mules, the cost, landed at the mine, is the New York price plus 12c. per lb., gross weight. The costs of blasting materials at the mines in 1917 were: Powder, $70 per 100 lb.; fuse, $11 per 1000 ft.; caps, $46 per 1000. Local candles, of which three will last a shift, are about 5c. each.

TAXES AND ASSESSMENTS

Taxes and assessments are reasonable. Discovery and denouncement costs are moderate, as is also the annual tax per claim. By paying a certain lump sum, which is not exorbitant, title can be held in perpetuity. An operating company pays a flat annual real estate tax, called the *catastro*, of $100. There is also a monthly importation state tax of $30. Each foreign employee pays a yearly road tax of $10. A butchering tax of $2 per steer killed is charged. In all matters the government officials, who occasionally visit the district, are courteous and obliging, and display no inclination to levy petty graft.

TABLE IV. GENERAL COSTS IN 1917 AT GUAMOCO

	January	February	March	April	May	June	July	August	September	October	November	December
Native labor	$2411.65	$2818 28	$2517.82	$2660 62	$2491.56	$2847.65	$2172 10	$2339 03	$2503.54	$3837 37	$2612.42	$2917.41
Food	812 64	1998 14	1731 47	1084 30	1681 15	1917 29	1803 61	1213 66	1071.74	1125 67	777.37	1211 44
Supplies	1640 99	508 04	3327 29	355 62	1004.10	2132 88	1444 29	1126 77	2521 71	1984 40	1342 86	703 67
Transportation	224.66	939 65	526 56	575 30	460 91	606 73	894.37	510 11	646 23	242 25	332.81	422 45
Commission	57 81	65 33	37 44	108 51	17.09	91 41	71 84	47 15	159 58	39 46	43 59	50 87
Customs duties	17.32	10 09	125 20	166 84	7 97	64.31	27.02	75 67	10.01	.	129.51	54.29
Taxes	150 00	25 00	85 00	.	50.50	21.00	128 00	189 00	23 75	52 02	56 06	. . ..
Exp. sale gold	387 31	501.90	673 90	486.81	503 45	458.31	406 63	435 71	363 60	405 48	622.79	542 52
Miscellaneous	820.00	. ...	830.22	458 07	120 70	250 00	255 35	485 23	313.15	319.53	291.65	340 04
Totals	$6522 38	$6866 43	$9827 90	$5896.07	$6337 43	$8389 58	$7203 21	$6422 30	$7623 31	$8006.18	$6209 06	$6242 69
Tons milled	502	473	500	478	512	477	479	500	548	600	610	575
Cost per ton	12.992	14 517	19.655	12 334	12.377	17 588	15.038	12 844	13 911	13 343	10.178	10.856

LA MINA LIBERTAD

La Mina Libertad has been and is the most consistent producer of the district. It has been operated for eight years on a series of rich pockets in a quartz vein varying in thickness from 2 to 12 ft. Considerable work had been done on the surface by the Spaniards, and the original equipment consisted of a 500-lb. 5-stamp California-type mill. Water, by means of a Pelton wheel, supplied power direct to the stamps. In 1913 a new mill was built, a 50-h.p. hydro-electric plant installed and five more stamps were added. Later, a Wilfley table was put in and produced high-grade sulphide concentrates. A simple cyanide process is being used to treat these concentrates. The ore is free-milling and the gold amalgamates readily, recovery on the plates being about 90 per cent.

LA MINA CHICAGO

The Chicago Mine furnishes a direct contrast to Libertad, and is the exception of the district, it being the only property operated on base ore. The ore milled is a heavy iron sulphide, with some lead and zinc. No free gold is in evidence, yet the gold content averages from $30 to $40 per ton. Cyanide treatment only is used, the counter-current decantation process being employed. Ore is ground by crusher, Hardinge and pebble mill. Water power is used direct. It is claimed that the best ore has been encountered in the lowest adit, and it is expected that sinking operations will provide ore for some time.

SUMMARY

The foregoing will give the reader an idea of the conditions existing in the hills of Guamoco. Mining operations in Colombia at large are at present hampered by the unsettled commercial relations with other countries. Lack of shipping facilities has curtailed trade with the United States, so that the rate of exchange is very high. At times the American dollar has been worth as low as 79c. in Colombian money. This fact alone has increased the operating costs of American companies considerably. With the resumption of normal trade conditions this handicap will be automatically removed.

That Guamoco will some day be the scene of much more mining activity would seem to be one of the inevitable results of the world's constant search for new sources of gold supply. Many of the untouched quartz veins carry gold valued at $5 and $6 per ton, but present high costs have discouraged development. Although considerable prospecting has been done, there is need of much more, but it is obvious that projects of this nature must be properly financed. The fact that gold has been found so consistently throughout the district would indicate that all the mother pockets have not been uncovered, and the recognized pockety characteristics serve to encourage the belief that some day another Libertad will be found.

Transportation is, of course, the keynote of the problem. Until the mule and canoe are replaced by more rapid and economical agents, possibly the aëroplane, conditions cannot be materially improved. If and when this is brought about, Guamoco will come into its own.

Coal Consumption in Electric Stations

The Hydro-Electric Commission of Ontario recently issued a report entitled "The Rate of Coal Consumption in Various Electro Generating Stations and Industrial Establishments in Canada and the United States." The report emphasizes the influence exerted by plant capacity and plant load factor upon coal consumption, and the data included were obtained from replies received to inquiries made of 73 stations. Half of these were representative stations, ranging in capacity from 150 kw. to 150,000 kw., and most of the figures tabulated are averages for the last five years.

A summation of the data shows the following average rate of coal consumption for various sizes of electric-generating stations using coal-fired boilers.

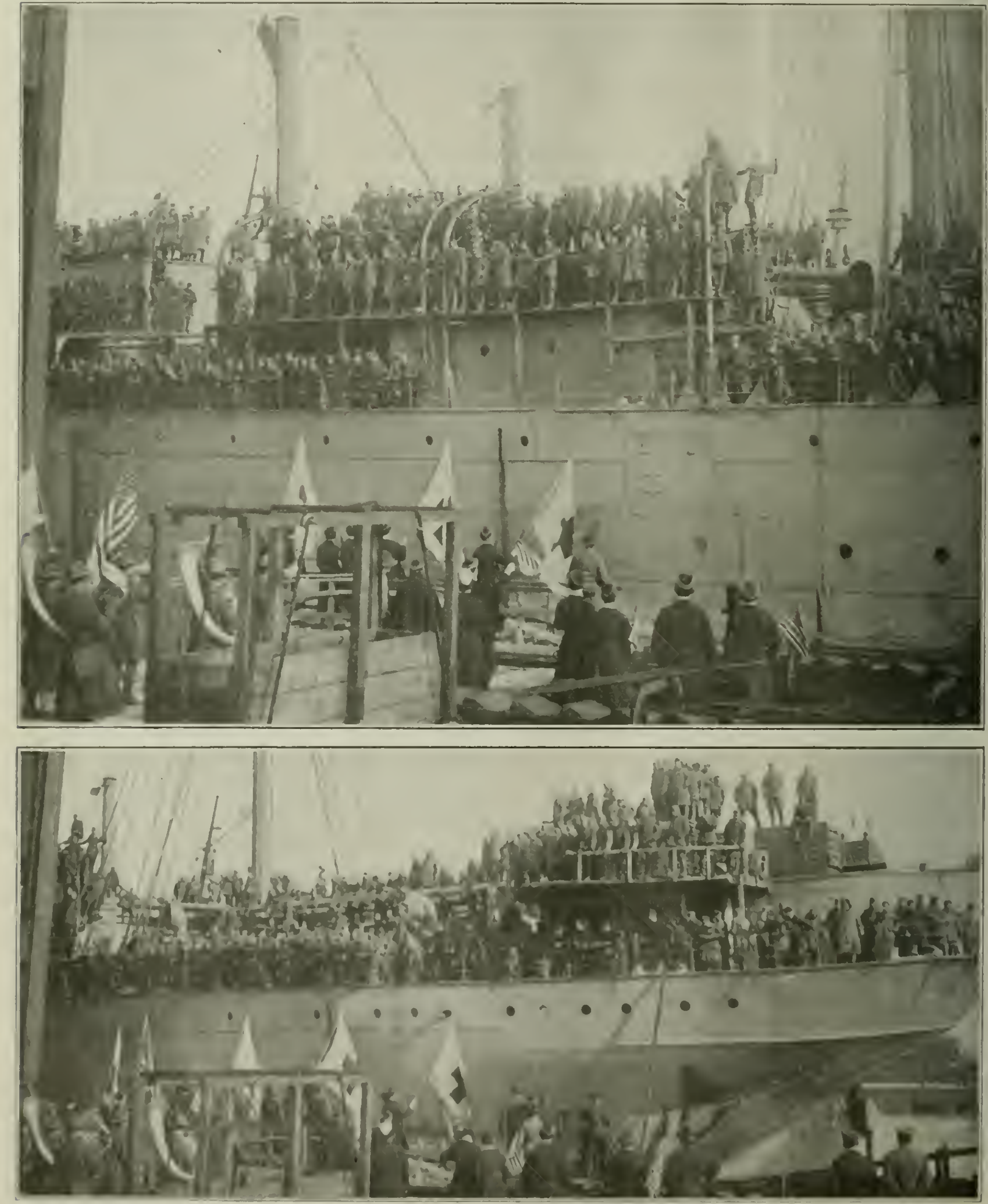
AVERAGE RATES OF COAL CONSUMPTION

(Kilowatts) Station Capacity	Rate of Coal Consumption (Tons per hp.-year)
Below 1,000	25.10
1,000 to 5,000	14.00
5,000 to 10,000	13.30
10,000 to 50,000	9.32
50,000 to 100,000	6.57
Above 100,000	6.25

Under favorable conditions, and in the largest plants, the rate of coal consumption may be as low as 6.25 tons per horsepower-year, but considering average conditions for electric generating stations in Canada, the average rate of coal consumption is not less than 30 tons per horsepower-year.

Thrift Is Shorthand for "Waste not, want not." Buy W. S. S.

The Return of the Mining Regiment



THE "DAKOTAN," CARRYING THE RETURNING 27TH ENGINEERS, DOCKING AT HOBOKEN, NEW JERSEY

COLONEL OSCAR B. PERRY, OF THE 27TH ENGINEERS

PRIVATE WILLIAM H. HALL AND "PUMPKINS"

MAJOR FRED S. NORCROSS

MAJOR R. E. FRANKLIN

The Engineer's Relation to Public Opinion

BY SPENCER MILLER*

The following address, the topic of which was the "Engineer as a Citizen," was delivered at the Engineers' Symposium, held on Mar. 26 in the Engineering Societies Building, New York, under the general auspices of the local sections of the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the Society of Automotive Engineers. A number of notable addresses were made on related subjects, which have been referred to in recent issues of the "Journal." The tenor of all the speakers' views during the evening was the need of organization to voice engineering opinion on public questions.

PUBLIC opinion is not always right, but it is always autocratic. By a right opinion, I mean one in harmony with the Golden Rule. Public opinion in the United States when Belgium was invaded by Germany was recognized as that of an outraged civilization; but public opinion did not call for immediate armed intervention. There were two opposing opinions in this country—one for war, the other for neutrality. It was not until the late Theodore Roosevelt, Eliot, of Harvard, and other great leaders appealed to our best instincts and awakened our spirits, that public opinion united for war. It was left to President Wilson to translate the awakened spirit of America in his inspiring address before Congress, Apr. 6, 1917. This address expressed America's public opinion and it demanded war with Germany. Who does not remember the thrills we enjoyed when reading that great message? Engineers all over the United States were among the first to declare that our duty resided in aiding France in its heroic fight for life and liberty as freely as Lafayette had aided us, a century and a quarter before.

Public opinion is affected by persistent propaganda, either for good or for evil. The most efficient vehicles to carry propaganda are the public press, the printing press, and the moving pictures.

The engineer is assuming an ever larger position in public life, and in spite of himself he is at the very center of life. The more we realize this great truth, the more seriously do we contemplate our responsibilities. This thought fills some with pride and others with humility. Eliminate the engineer from the world, and civilization would soon pass through other "Dark Ages" comparable with savagery and barbarism.

Even today the engineer stands, with all law-abiding citizens, facing the dark cloud of Bolshevism—not timidly, not indifferently, but in full strength, courage and faith that Bolshevism cannot survive in America. Look at Engineer Hoover, shooting at Bolshevism with bread—excellent ammunition to employ against incipient Bolshevism. The United States will stand firmly against Bolshevism with bullets and bayonets if necessary, because Bolshevism stands squarely against the code of morals upon which our civilization was founded.

Is it not clear, therefore, that we individually and collectively should make every possible effort to mold public opinion in the right direction, and, especially at present, to counteract the propaganda of those stirring up class hatred?

Thousands of engineers occupied public posts of responsibility during the Great War, and many of these will be invited to accept larger responsibilities as public servants. To analyze the qualities of the successful engineer in public life we find, in addition to his training as an engineer, a long list of homely virtues: Honesty—Even careful to avoid appearances of gain. Integrity—So clearly evident that none could question it. Unselfishness—Serving the nation for perhaps a fraction of his income in private life Self-control—Especially of one's temper, frequently sorely tried. Patience and courtesy to thousands of strangers, few of whom can be taken seriously. Willingness to coöperate with others. Courage to stand firm for right against selfish political influence. And, last of all, a spirit willing to renounce all for the good of the nation.

These homely virtues are things of the spirit, and therefore belong to the spiritual part of man. I use the term "spiritual" in its largest sense, and I trust you will not confuse it with "religious." Our greatest and most successful engineers, in and out of public life, are those in whom these homely virtues stand out conspicuously, and are usually referred to as men of "upright character."

THE ENGINEER IN PUBLIC LIFE

Thus we observe the engineer is successful in public life because of his *engineer training* and his *upright character*. But who may say that a well-trained lawyer with upright character to his credit would not make an equally good public servant? Is it not evident that both engineer and lawyer are needed in public and political life, and is any comparison advantageous?

A Congress half lawyer and half engineer surely would be superior to one all lawyer or all engineer. Do we not also recognize that experienced business men, manufacturers, and farmers of upright character are also required to serve the nation in Senate and Congress?

What is the relative importance of the training of an engineer as one element and his upright character as the remaining element? Can we look for an answer in the recent struggle in Europe? What is that element which President Wilson so aptly called "The very stuff of victory"?

The United States declared war in April, 1917. The morale of the French army had reached its lowest ebb, although greatly revived when the French heard of our entrance into the war. Marshal Joffre came to America pleading for *men*, trained or untrained, to support the morale of the French soldier. On the fourth of July, 1917, France was electrified by a parade of a small number of American soldiers through the streets of Paris. The knowledge that America was in the war, that American soldiers were coming fast, was the great sustaining element that prevented the French army from breaking.

The program for the United States involved billions upon billions of money. Ships by the thousands, airplanes by the thousands, guns by the hundreds of thousands, rifles by the millions, shells by the millions, tanks in hundred-thousand lots, and several million men besides.

---

*Vice president, American Society of Mechanical Engineers.

Only a small fraction of these materials of war ever arrived in France, and yet both France and England frankly acknowledged that our troops turned the scales against Germany. What, then, is the answer? Who won the war? What won the war? Surely it was not material things, for the war was going against us with the same amount of material. The answer to the riddle is the same that Napoleon announced one hundred years ago: "The relation of morale to materials of war is as three to one." Morale won the war, and morale is a thing of the spirit. Marshal Foch said only last week that "Faith won the war," and faith is a thing of the spirit.

If the stuff of victory at arms is largely a thing of the spirit, is it not also true of any victory in engineering. Don't you all know that your greatest engineering victories are more traceable to perseverance, industriousness, good habits, courage, pluck, steadfastness, than to simple engineering training as such? Is it not the spirit, after all, that wins all victories?

MORALE AND A GREATLY SIMPLIFIED CODE OF ETHICS DESIRED

If the engineer finds that in the complete fulfillment of his life work about one-quarter is material and the remainder spiritual, should not engineering societies make adequate recognition of this important fact? Is not morale as important to the engineer as to the soldier? Is not morale as important to an engineering association as it is to a military division? If these facts are conceded, then can we refuse to give the fullest and most complete consideration to the development of these traits among engineers? Could there be any better beginning than to adopt a thoroughly considered code of ethics to become the moral foundation of all engineering associations, a moral platform that all engineers may stand upon? Several of the societies have codes of ethics now, but codes of ethics, like modern religions, are usually too complicated. We want a simple code of ethics, a standardized code of ethics for engineers and architects.

The Ten Commandments of Moses were really a code of ethics and were inspired in the mountain tops. Our societies might well appoint men whose spirit dwells in mountain tops to come together and compose a code that shall be the Ten Commandments for the engineering profession. When such code has been officially adopted it should appear on the front pages of every year-book, printed in illuminated type. Furthermore, the constitution and bylaws should provide machinery for the enforcement of the code and for punishment for members who violate the code.

CHARACTER SHOULD BE TEST OF ELIGIBILITY

This code of ethics should be printed on every application blank for membership in every engineering society, and applicants for membership should accept the code and agree to abide by it before they are taken into membership.

After all, my friends, character stands supreme in the life work of any engineer, and anything which will aid in developing character will not fail in creating a good public opinion.

Flotation Litigation

The flotation patent (No. 835,120) of Minerals Separation Co. reached, for the second time, a hearing before the Supreme Court on Wednesday, Mar. 19, in the Butte & Superior case.

The contention of Minerals Separation counsel was that the defendant company had used the critical amount of pine oil during two years previous to the decision of the Supreme Court which sustained the patent, but that immediately thereafter the company added a sufficient quantity of petroleum oil to bring the total amount of oil used to over 1% for part of the time, and over ½% at other times. The contention of counsel was that the petroleum so added is not an oil of the patent, because it is absolutely inert as a frothing agent, and not only performs no function, but is detrimental. The amount of pine oil was continued at about the same quantity, only a very slight increase being made.

The attorney for the defendant, the Butte & Superior Co., explained to the court that he was in accord with the Supreme Court's finding as to the validity of the patent, and, to assist the court in interpreting its decision, he would recount the evidence which was before the court when it rendered its decision. He quoted fully from the Hyde record, emphasizing the insistence placed at all times upon minute, microscopic or critical quantities of oil. He quoted from the patent that the quantity was from 0.05 to 0.5%, and from witnesses for the plaintiff to the effect that upon all ores the world over and with all oils the limit was between 0.05 and 0.2 per cent.

As to the question of the use of petroleum, he argued that plaintiff's witnesses had testified in many places as to the use of petroleum oils, and that the licensees of Minerals Separation used oil mixtures of absolutely the same composition as that used by the defendant. He quoted from the first written descriptions of the process, in which petroleum was stated by the discoverers as an efficient oil for the process, and, moreover, showed that in the original British patent, of which the patent in suit was the American issue, in every place where oleic acid is mentioned, petrol is also mentioned as an equivalent.

Counsel for the defence contended that the disclaimer which was sent to the Patent Office was, in fact, no disclaimer whatsoever; and that, rather than eliminating the broad features of the three claims which were not sustained by the Supreme Court, the disclaimer actually broadened the claims by language which made the result of the process the limit as to the quantity of oil.

In closing, attorney for the plaintiff again emphasized the claim that petroleum had absolutely no frothing effect on defendant's ore, and was, therefore, not, in that case, an oil of the process, and should not be considered in computing the amount of oil of the process.

Reference was also made to the disclaimer, and the position was taken that the three claims differed from all the other claims of the patent in that they did not relate to a process dependent upon the oil coating of the particles.

Better Than Money, because they earn added money—War Savings Stamps.

Preliminary Report on the Mineral Production Of Canada for 1918

THE preliminary report on the mineral production of Canada for 1918, by John McLeish, chief of the division of Mineral Resources and Statistics, has been issued by the Canadian Department of Mines, Eugene Haanel, director. The total value of the metal and mineral production in 1918 was $210,204,970, the valuation being given as far as possible on the basis of the quantities of the metals recovered in smelteries, and the total quantities in each case are valued at the average market price of the refined metal in a recognized market. During the last three years increased prices of metals and mineral products have contributed toward the increasing of the total value of the mineral production. However, in the report it is stated that out of about 45 items, or products, included in the mineral records, no less than 18 products have reached their highest production in actual quantity during 1918 or 1917. The metal production in 1918 was valued at $113,563,111, an increase of 6.7% over 1917. Cobalt, lead, molybdenum, nickel, silver, and zinc all show increases in production. Gold and silver were less in quantities than in 1917 by small percentages, and in total value gold and copper also showed a decline.

MINERAL PRODUCTION OF CANADA IN 1917 AND 1918

	Quantity	
Metallic:	1917 (a)	1918 (b)
Antimony ore (exports), tons	(c) 361	(c) 26
Cobalt, metallic contained in oxide, etc., lb	1,079,572	1,347,544
Copper, lb	109,227,332	118,415,829
Gold, oz	738,831	710,526
Iron, pig from Canadian ore, tons	46,022	47,444
Iron ore sold for export, tons	169,252	112,886
Lead, lb	32,576,281	43,846,260
Molybdenite, lb	288,705	377,850
Nickel, lb	82,330,280	92,076,034
Platinum, oz	57	39
Silver, oz	22,221,274	21,284,607
Zinc, lb	29,668,764	33,663,690
Non-Metallic		
Actinolite, tons	120	228
Arsenic, white and arsenic in ore, tons	2,936	3,498
Asbestos, tons	135,502	141,462
Asbestic, tons	18,279	16,734
Chromite, tons	36,725	21,994
Coal, tons	14,046,759	14,979,213
Corundum, tons	188	137
Feldspar, tons	19,462	20,232
Fluorspar, tons	4,249	7,362
Graphite, tons	3,714	3,051
Grindstones, tons	2,523	3,072
Gypsum, tons	336,332	152 287
Magnesite, tons	58,090	58,090
Manganese, tons	158	(d)
Mica, tons	1,166	(d)
Petroleum, bbl	213,832	304,741
Pyrites, tons	416,649	413,698
Quartz, tons	216,288	224,116
Salt, tons	138,909	138,909
Talc, tons	15,803	18,190

(a) Revised figures. (b) Subject to revision. (c) Tons of 2,000 pounds. (d) Figures not available.

Copper production in 1918 exceeded the high mark of 1916 and was 118,415,829 lb., valued at $29,163,415. Of the total, 92,769,167 lb. was contained in blister copper and in matte produced in Canada, and 25,626,662 lb. estimated as being recovered from ores exported. Quebec production from pyritic ores was 5,869,649 lb., and Ontario production amounted to 47,047,801 lb., derived chiefly from the metal-copper ores of the Sudbury district and the Alexo mine in Temiskaming. Manitoba production was over 2,000,000 lb. and was derived from the ore deposits at Schist Lake. British Columbia produced 62,858,628 lb., and output from the Yukon is estimated at 300,000 pounds.

Total gold production in 1918 was 710,526 oz., and was valued at $14,687,875. Of this production, 16.4% was derived from placer or alluvial mining, 61.8% was in the form of bullion and refined gold, and 21.8% was contained in matte, blister copper, residues, and ores exported. Production by provinces was as follows: Nova Scotia, 1195 oz.; Quebec, 1855 oz.; Ontario, 411,217 oz.; Manitoba, 6755 oz.; British Columbia, 187,069 oz.; and 102,382 oz. was derived from the Yukon Territory. Exports as recorded by the Customs Department were valued at $10,040,813.

The lead production in 1918, estimated at 43,846,260 lb., represents the quantity of refined lead and lead bullion produced in Canada from Canadian ores, together with the lead estimated as recoverable from ores exported. Total mine shipments of lead ores and concentrate were about 76,057 tons, containing 47,673,853 pounds of lead. Exports of lead during the year amounted to 22,684,100 pounds.

Molybdenum production during 1918 was 377,815 lb., and represents the molybdenite contents of the ores and concentrates shipped. Total shipments of ores and concentrates amounted to 430.3 tons, valued by the operators at $428,704. Of this amount, Quebec produced about 88% of the total, the balance being derived from Ontario, including a small production from British Columbia.

Total nickel production was 92,076,034 lb., and was derived from the ores of the Sudbury district. The production of nickel-copper matte at the smelteries of the International Nickel Co. and the Mond Nickel Co. was 86,773 tons. Metal was recovered as a byproduct at the smelteries of the Coniagas Reduction Co., Thorold, Ontario; the Deloro Smelting and Refining Co., Deloro, Ontario, and the Metals Chemical Co., Welland, Ontario.

Production of platinum in 1918 was 39 oz., valued at $2560, and it was all obtained from the placer gravels of the Similkameen district, B. C. Platinum exports in 1918 included: platinum in ore and concentrates, 12 oz., and gold and scrap platinum, 185 ounces.

Canadian silver production in 1918 is estimated at 21,284,607 oz., valued at $20,597,540. Ontario production was 17,109,389 oz., or 80.4% of the total Canadian production. Quebec produced 147,316 oz.; Manitoba, 14,033 oz.; British Columbia, 3,965,828 oz., and the Yukon production was 48,041 ounces.

There was a small production of tungsten from Canadian sources in 1918. Ore received for treatment at the testing laboratory at the Mines Branch, Department of Mines, Ottawa, included about two tons from the Yukon district, four tons from Manitoba, and a small shipment from Nova Scotia.

Production of refined zinc in Canada was 12,278 tons in 1918. Total production of zinc from Canadian ores, including, in addition to the above refined production, the estimated recovery from ores exported, amounted to 33,663,690 lb. Quebec production was 2,652,526 lb., and that of British Columbia was 31,011,164 lb. Total zinc shipments in 1918 were 121,363 tons.

Total iron-ore shipments from Canadian mines in 1918 were 206,820 short tons, and included 8153 tons from Quebec; 197,637 tons from mines in Ontario and about 900 tons mined in British Columbia. Principal operations were, as usual, in Ontario, at the Holland and Magpie mines of the Algoma Steel Corp., Ltd. Pig iron production during 1918 is estimated at 1,194,000 tons. Production of ferroalloys, including spiegeleisen, ferromolybdenum, and ferrophosphorus, reached a total of 44,700 tons in 1918. Estimated production of steel ingots and direct steel castings was 1,893,000 tons in the year under review.

Asbestos production in Canada was, as usual, derived from the districts in Quebec. The total value of shipments of asbestos and asbestic in 1918 was $8,970,779. The average number of men employed in mining was 1674, in milling 1400, and the total wages paid were $2,871,643. The total shipments of chromite ores and concentrates from Canadian sources during 1918 were 21,994 short tons.

Duties of Engineers as Citizens

The local sections of eighteen engineering societies representing different phases of the engineering profession in Greater New York met on Wednesday evening, Mar. 26, under the chairmanship of Gano Dunn, formerly president of the American Institute of Electrical Engineers, to discuss the relation of the engineer to public activities beyond the limits of his technical horizon. Different angles for discussion were assigned to the five leading speakers. They indicated why engineers should accept civic responsibility and should influence legislation, and how the engineer can be used to advantage in governmental administration.

"We have emerged from the war with a political unrest in which the voice of reason is drowned between the clamor of labor and the sentimental appeal of visionary reformers," said Philip N. Moore, a former president of the American Institute of Mining Engineers, in his address on the "Civic Responsibility of the Engineer." "Now, as never before, we need the trained mind of the engineer to think clearly with unflinching logic from cause to effect."

Calvert Townley, past vice-president of the American Institute of Electrical Engineers, said in the course of his talk on "The Relation of the Engineer to Legislation," that, "An engineering training fits a man to arrive at logical conclusions regardless of outside influences, and he is therefore qualified to express opinions on legislative and other subjects outside his field."

That the trained engineer is the logical man for the management of undertakings involving the planning and execution of engineering, was the conclusion of Nelson P. Lewis, vice-president of the American Society of Civil Engineers, in his paper entitled "The Relation of the Engineer to Administration."

The address of Spencer Miller, vice-president of the American Society of Mechanical Engineers, who spoke on "The Relation of the Engineer to Public Opinion," is given in another part of this issue of the *Journal.*

Comfort A. Adams, president of the American Institute of Electrical Engineers, in his paper on the "Relations of the Engineer to Distribution and Production," pointed out that if engineers could so improve methods and machinery that the productivity of labor would be increased until it is possible to pay labor a real living wage and still have a fair return for capital, then they will have the remedy for the present undercurrent of industrial unrest.

Dr. Doremus S. N. Cassell, Daniel Turner, Frank Skinner, J. G. Johnson, H. A. Pratt, Lieutenant Van Gelder, Farley Osgood, C. F. Scott, J. K. Thompson, Louis C. Marburg, and L. G. Graton were among those who contributed to the discussion.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for February, 1919, and the figures for February, 1918, as finally revised, are as follows:

IMPORTS, FEBRUARY, 1918 AND 1919

(In Pounds, Unless Otherwise Stated)

Metal and Ore	Feb., 1918	Feb., 1919
Antimony ore, contents	140,841	3,008
Antimony matte, regulus, or metal	671,675	1,142,280
Copper:		
Ore, contents	10,371,481	5,071,159
Concentrates, contents	3,349,400	3,777,599
Matte, regulus, etc., contents	1,275,562	4,975,442
Imported from (in part):		
Canada	3,080,998	2,705,031
Mexico	3,109,071	5,079,659
Cuba	5,083,201	2,542,393
Chile	3,104,506	1,963,018
Peru	45,289	6,637
Venezuela	2,500	436,907
Unrefined, black, blister, etc	46,638,512	33,369,626
Refined, in bars, plates, etc	763,461	202,375
Old, etc., for remanufacture	82,249	512,866
Composition metal, copper chief value	56	3,701
Lead:		
Ore, contents	2,361,267	520,011
Bullion, contents	7,208,437	13,226,678
Imported from (in part):		
Canada	1,205,828	329,802
Mexico	8,363,876	13,397,628
Pigs, bars, and old	2,479,999	20,755
Pyrites, long tons	55,346	1,053
Imported from:		
Spain, long tons	50,795	....
Canada, long tons	2,592	1,053
Tin ore, long tons	3,560	1,451
Tin bars, blocks, pigs, etc	7,584,403	6,271,977
Imported from (in part):		
Straits Settlements	2,272,699	6,092,721
Dutch East Indies	615,170	....
United Kingdom	2,150,959	56,000
Australia	712,582	67,200
Hong Kong	896,566	56,056
Zinc:		
Ore, contents	9,629,293	4,627,863
Imported from:		
Canada	1,092,000	430,166
Mexico	6,239,977	4,197,697
Other Countries	2,297,316	....
Blocks or pigs, and old	6.141	18
Manganese ore, long tons	56,289	21,819
Imported from (in part):		
Cuba, long tons	209	11,619
Brazil, long tons	51,163	5,450
British India, long tons	2,550	....
Tungsten ore, long tons	482	1,535

EXPORTS OF COPPER, LEAD AND ZINC

(In Pounds)

	Feb., 1918	Feb., 1919
Copper:		
Ore, contents	151,470	4,200
Concentrates, contents	32,200	....
Unrefined, black blister, etc	1,431,009	108
Refined, in ingots, bars, etc	59,033,853	30,454,013
Exported to (in part):		
France	28,295,980	2,549,667
Italy	7,288,696	8,426,646
United Kingdom	22,123,748	15,234,685
Canada	1,108,348	629,845
Composition metal, copper chief value	2,884	79,645
Old and scrap	...	...
Pipes and tubes	237,030	490,979
Plates and sheets	760,597	3,812,266
Wire, except insulated	1,834,948	5,914,617
Lead:		
Pigs, bars, etc., produced from domestic ore	10,436,237	5,454,105
Pigs, bars, etc., produced from foreign ore	10,200,170	8,260,586
Exported to (in part):		
Denmark	...	1,015,811
Canada	1,672,016	189,444
United Kingdom	15,859,492	10,089,395
Argentina	456,956	171,102
Japan	1,344,000	...
France	604,787	1,682,777
Brazil	340,831	243,688
Zinc:		
Dross	1,508,883	4,692,685
Spelter:		
Produced from domestic ore	5,320,616	17,372,468
Produced from foreign ore	1,421,741	4,259,622
Exported to (in part):		
France	1,478,588	12,225,634
Italy	884,800	2,617,620
United Kingdom	3,622,477	5,077,749
Canada	543,918	273,712
Mexico	4,200	422
Japan	....	1,328,792
Norway	....	22,409
In sheets, strips, etc	1,130,287	9,320,666

Details of Practical Mining

The Brunton compass has been recognized in mine work as an effective instrument for determining directions, bearings, and similar functions concerning which a fairly accurate knowledge is desired. By means of the method explained, another valuable use is added to the many ways in which the Brunton may be utilized.

The discomfort and danger of wet shaft work and the various operations incident to shaft sinking are subjects of continual study. The method described in "Spitting Fuse in a Wet Shaft" is one solution of the difficulty where water is a menace to blasting.

Utilization of a worn-out washtub for one of the necessary parts of a prospector's outfit, or for the equipment of any mine in the early stages of development, suggests the idea that many cast-off articles may be used in other ways than those for which they were originally intended.

"A Movable Collaring Machine" excludes a crowded condition that may prevail in a small shop. Frequently it is found that such places are cluttered up with all manner of equipment, and this state of affairs will always result in decreased efficiency in the mine operation.

Any engineer who has attempted to get information from frayed or partially obliterated blueprints or maps will welcome the suggestion of any expedient that may assure their preservation in neat and usable condition.

Pocket Transit Sights and Lines

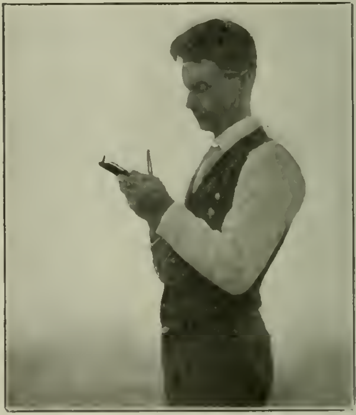
By C. L. Tice*

A method of using a Brunton pocket transit that is of value in finding the direction or bearing of inclined raises or other workings is depicted in the accompanying photograph. As far as I know it is not only original, but the results can be quickly checked.

By setting the sight as shown, holding the transit reversed, looking through the sight and inclining the mirror with one finger, a position is found which will allow the desired object to be bisected by the line in the mirror by reflection. At the same time the needle and bubble may be easily observed. The photograph shows the observer in the position of taking a sight at a point about 60° above the horizontal. It is also possible by manipulating the mirror to sight a point directly above or even behind the point of observation.

The same method of sighting may be used in setting lines at high or inaccessible points by placing the Brunton on a piece of timber stood upon end, or on one of the telescopic tripods. In this manner it is easy to set a couple of points on any line overhead without waiting for a long plumb line to come to rest. The method is quicker than setting one line, plumbing down to the instrument and then using a plumb line to set the other point. If it is necessary to set lines near iron or steel, which would deflect the needle if sufficiently close, this method will be found useful and can be applied a short distance away regardless of the height of the back.

The accuracy of work done in this manner may be judged by the fact that, to my knowledge, several parallel drifts averaging 75 ft. in length have been driven, after being lined up with a Brunton, with no more variation than could be expected with the use of a magnetic needle. In instances where the drifts have been driven from opposite ends, the point of juncture cannot be distinguished.



METHOD OF USING BRUNTON POCKET TRANSIT IN TAKING INCLINED SIGHTS

In setting lines, the use of No. 7 horseshoe nails, with the heads flattened and notched, will be found convenient. The nails may be driven almost anywhere in the rock in this district, although it is sometimes necessary to hunt for a seam. After a few days the nails will be found to be firmly rusted in place, and they will hold any strain that would be expected of a wooden plug.

Spitting Fuse in a Wet Shaft

By Frank B. Bryant*

In sinking the Leesburg shaft near Salmon City, Idaho, considerable difficulty was experienced in lighting the fuses for blasting, owing to the water that was encountered. The trouble was overcome in the following manner: A 6-in. length of 2-in. shafting was drawn to a chisel edge at one end, the planes of the bit making an angle of about 60° with each other. The other end was drilled and tapped to ⅝ in., and a piece of ⅝-in. rod, threaded at one end, was screwed in for a handle. When all was in readiness in the shaft for the shooting, the top man heated the "shooting iron" to a bright red heat at a small forge, and the iron was lowered to the bottom. The water raised in the shaft at about a foot per minute, so that it was necessary to float the fuses with wedges and blocks. One man held the fuses on a small block while the other spit them by stabbing each with the heated iron. No delay was experienced, and two men were able to light as many as 22 holes at one time.

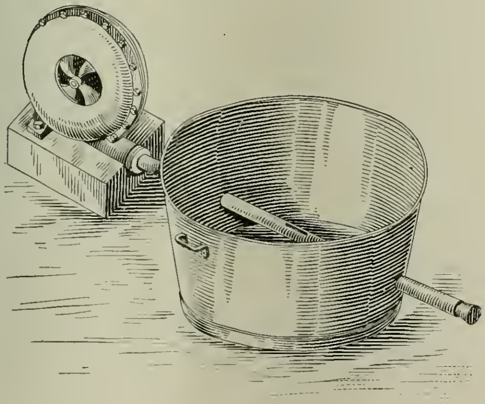
---

*Miami Copper Co., Miami, Arizona

*Mining engineer, Kendall, Montana

A Prospector's Washtub Forge

A handy forge frame is made out of an old galvanized-iron washtub. A 2-in. pipe, with a slot ¼ x 2 in. cut in the upper side, is placed horizontally, as shown, and connected with the bellows or blower. The other end of the pipe is plugged with a piece of wood. The tub is then filled to the level of the pipe with dirt or ashes, and the rest of the way with coal. If the pipe gets stopped up, the wood plug can be drawn, and the fine coke and ashes blown out. This washtub forge is much more simple for the prospector to put together than one constructed of lumber or rocks, and is fireproof.



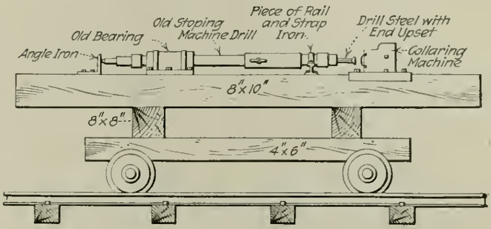
PROSPECTOR'S FORGE MADE FROM WASHTUB

Furthermore, lumber is not always obtainable "forty miles from nowhere." The tub is wide enough to support conveniently the usual lengths of steel used in such work. If long pieces of hand steel are to be sharpened, a bent-rod support is easily attached to the tub. When the prospector moves, the tub is not necessarily an inconvenience, for it can be used as a packing case.

A Movable Collaring Machine

A movable collaring machine which is particularly adapted to the small shop that would be crowded if the machine were mounted in a stationary manner is shown in the accompanying illustration. By means of a single track through the shop, the machine can be moved out of the way when not in use, and so make room on the track for cars to be repaired or for work of similar nature.

The mounting consists of a simple truck, with axles about five feet apart, two cross-pieces of 8 x 8-in. timber or larger, and one 8 x 10-in. timber, 8 or 10 ft. long, placed lengthwise with the truck. To this frame is bolted a small Denver rock drill collaring machine and an old stoping drill. The drill may be held in place by means of an old bearing near the bottom or in a similar manner, and a piece of rail or block of iron with an iron strap across the top of it can be placed near the chuck end. A small angle iron bolted to the long timber serves as a brace for the air feed piston to work against.


Piece of Rail and Strap Iron
Old Stoping Machine Drill
Drill Steel with End Upset
Old Bearing
Angle Iron
Collaring Machine
8"x10"
8"x8"
4"x6"

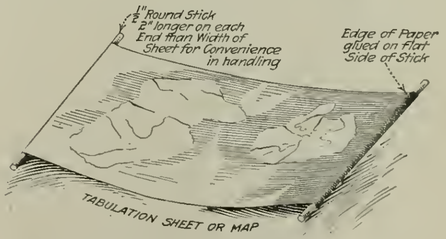
DETAIL OF MOVABLE COLLARING MACHINE

The holding pieces must be snug to keep the drill from vibrating, but not too tight to prevent the drill from sliding forward when the air is turned on. A short piece of drill steel is placed in the drill chuck with the end upset to strike against the anvil block of the collaring machine. In using this machine, a hammer drill gives much better result than can be secured with a piston machine. By substituting other dollies, bolt heads may be made.

Wooden Edge Protector for Maps

By Roy H. Poston*

Long maps, blueprints, and charts which require handling soon become frayed or torn unless the edges are protected. Frequently only one copy or set is available, and the destruction or obliteration of it would cause much inconvenience. One method of insuring proper protection against such possibilities is to glue pieces of half-round wooden stick to the two opposite edges of the print, after the manner shown in the accompanying sketch. This permits the print to be rolled from either end, and thus avoids creases caused by folding, in addition to allowing greater convenience in showing any desired portion of the print.


½" Round Stick 2" longer on each End than Width of Sheet for Convenience in handling
Edge of Paper glued on Flat Side of Stick
TABULATION SHEET OR MAP

WOODEN EDGE PROTECTORS FOR LONG MAPS

---

*St. Francois, Missouri.

Company Reports

Alaska Gastineau Mining Co.

The following summary of results of mining and milling of the Alaska Gastineau Mining Co. for the fourth quarter of the fiscal and calendar year 1918, together with comparisons of the principal items for the previous quarters, is given in a recent report:

OPERATIONS OF ALASKA GASTINEAU MINING CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Tons milled	287,571	218,930	309,249	469,695	1,285,445
Gross value of content, per ton	$0.986	$1.323	$1.164	$0.986	$1.089
Yield, per ton	.791	1.093	.954	.79	.883
Tailings, per ton	.195	.230	.210	.196	.206
Extraction, per cent	80.22	82.39	81.96	79.92	81.08
Value of products recovered	$0.79	$1.09	$0.95	$0.78	$0.88
Operating expenses, less miscellaneous income	1.06	1.14	.99	.80	.96
Loss, per ton	$0.27	$0.05	$0.04	$0.02	$0.08

During the fourth quarter, the mine produced about 3126 tons per working day, as against 2400 tons for the third quarter, an increase of 726 tons per day. A total of 173,138 tons of ore was broken in the mine, and 287,875 tons of ore was trammed to the oreways, leaving an estimated total of 1,718,173 tons of broken ore remaining in the stopes, according to the re-survey of broken ore made as of Dec. 31, 1917. A re-survey of the broken ore in the stopes was made at Dec. 31, 1918, and the total figures, not yet completed, will be shown in the annual report. Stoping was continued both east and west on No. 11 level, and the grade of ore broken still remains good and should improve before the stopes reach the No. 10 level. One new stope is being prepared on the No. 10 level and three new stopes are being prepared on the No. 11 level. No development or prospecting work was done during the quarter. The transportation division operated satisfactorily.

During the first two months of the fourth quarter the mill was run on an eight-hour shift per day basis, with overtime when necessary, and during the last month on the basis of two eight-hour shifts per day. The operations were satisfactory throughout the period, although affected by the lack of skilled operators. All the company's generating stations and transmission lines were kept in good conditon, and little trouble was experienced on account of breakdowns. A large amount of rain fell during the latter part of the year, and the two reservoirs are practically full, insuring an ample supply of power for the remainder of the winter and a surplus for sale should the market develop.

The gross value of gold in mill heads for the quarter was $0.986 per ton, as compared with $1.323 for the third quarter, a decrease of $0.337, this decrease being due to the large percentage of ore drawn from the caved stopes. The operating costs amounted to $1.0638, as compared with $1.1480 for the third quarter, a decrease of $0.0842. The "miscellaneous income" account showed a loss of $8226.79, mainly attributable to the operation of the company's boarding houses. The labor supply continued to decrease in October, but for the remainder of the year a considerable number of men applied for work. As most of these applicants were common laborers, the situation was not greatly improved, the urgent demand being for miners, powder men, and skilled mine workers.

The following tabulation shows an operating loss for the quarter of $78,381.20, as compared with the loss of $11,984.13 for the third quarter:

FINANCIAL RESULTS OF OPERATIONS OF ALASKA GASTINEAU MINING CO., 1918

Revenue	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Gross value of bullion and concentrate produced	$227,541.74	$239,351.98	$294,690.86	$371,044.32	$1,134,523.47
Expenses					
Ore production and transportation	$164,856.28	$125,456.94	$160,692.13	$212,116.73	$663,122.08
Milling	100,662.02	87,264.82	106,158.51	126,336.16	420,421.51
Shipping and smelting charges	10,460.73	11,098.12	12,594.65	14,217.97	45,539.15
Administration and general expenses	21,717.12	25,309.24	23,828.24	22,714.09	92,954.25
Total operating expense	$297,696.15	$249,129.12	$303,273.53	$375,384.95	$1,225,036.99
	$70,154.41	$9,777.14	$8,582.67	$4,340.63	$90,513.52
Miscellaneous income	8,226.79(a)	2,206.99(a)	5,665.29(a)	3,677.64(a)	19,776.71 (a)
Operating loss	$78,381.20	$11,984.13	$14,247.96	$8,018.27	$110,290.23(b)

(a) Loss. (b) The total column includes adjustments of published quarterly figures.

St. Joseph Lead Co.

The annual report of the St. Joseph Lead Co., covering the year 1918, shows that dividends amounting to $2,818,992 were disbursed during the period. The company's mills and concentrators produced 133,099 tons of lead concentrate, 125,320 tons of which was shipped to the company's smeltery and 7779 tons was sold to other concerns. The mines produced 2,299,490 tons of ore, and the total smelting output was 79,620 tons of pig lead.

With the signing of the armistice in November and the subsequent cancellation of Government munition contracts, the purchase of nearly 25,000 tons of lead per month which had been going into direct or indirect Government war uses was discontinued in the month of December; so that from the position of being entirely unable to meet the demand, the lead industry faced the prospect of a serious over-supply. No one expected that the full 25,000 tons a month could quickly be diverted to peace uses, this amount representing more than half the normal production. Most of the companies saw the necessity of at once curtailing output, but none of them desired to make the curtailment sufficiently drastic to throw out of employment large numbers of their employees at the beginning of the winter. The companies in St. Francois County, Mo., where the St. Joseph Lead Co.'s mines are situated, in early December went to a five-day week; but as lead continued to pile up, a still further cut in production was made. The company is now operating at about 60% of normal.

Portland Gold Mining Co.

The president of the Portland Gold Mining Co., Frank G. Peck, in the 25th annual report of the company says:

The Colorado Springs mill ceased operations on Mar. 31, 1918, so far as the treatment of ores was concerned. The production of high-grade ores in the Cripple Creek district had fallen off to such an extent by reason of war conditions that it was impossible to operate at a profit both of the reduction plants in Colorado Springs; and, our mill being the smaller of the two, it was decided to discontinue its operation, and to have our high-grade ores treated at the Golden Cycle plant, under a temporary and fairly satisfactory arrangement made at that time. If there should be a material increase in the output of the Cripple Creek district, or if changed conditions should later make it desirable to discontinue the present arrangement, we can either resume operations at our Colorado Springs plant, or treat these ores at our Independence mill, as may be deemed most advisable.

Important experimental work was carried on at our Colorado Springs plant during the last nine months of the year, by representatives of the U. S. Government, in an endeavor to develop a process for extracting potash from our tailings dumps. It has been discovered that these tailings contain 7% of potash, or about 140 pounds to the ton. There are about two million tons of tailings in the Colorado Springs mill dumps, and important progress was made toward devising a method of extraction.

The Victor mill was closed on July 30, 1918, on account of the impossibility of securing labor sufficient to supply the tonnage of low-grade ore necessary for economical operation of both it and the Independence mill. Much of the machinery from the Victor mill has already been moved to the Independence plant, and eventually all of it will be transferred, thus carrying out a part of the plan decided upon by the board several years ago, of ultimately combining all ore-reduction operations at the Independence plant. The Independence mill treated a considerable tonnage of low-grade ore during the year, and although the percentage of extraction was good, the profits realized were disappointing, largely owing to war conditions. Almost without exception, every improvement devised to reduce costs, and every economy instituted during the year, was immediately offset by some increase in the cost of labor, or of some chemical or commodity entering into the extraction of gold. However, now that the war is over, the trend of costs undoubtedly will be in the other direction. In other words, the purchasing power of gold, instead of decreasing, as during the last two or three years, should slowly increase, and the plant should earn a good profit during the coming year.

The most important event during 1918 was the completion of a branch tunnel from the Roosevelt drainage tunnel to a connection with Portland shaft No. 2 at a depth of 2131 ft. from the surface. The main drainage tunnel, work on which was begun 11 years ago, is 24,255 ft. long from its portal to its heading, which is about the middle of the northerly portion of the company's property.

On Dec. 29 our main shaft was sunk to the 21st or drainage-tunnel level. The work of timbering the shaft and cutting out a station of sufficient size to install pumps and to allow room for the work of opening up the high-grade orebodies there will soon be accomplished. We will then begin driving on our No. 1 vein, which contains the largest and best orebody we have. This will enable us to materially increase our high-grade production. Our Lee No. 5 orebody was cut by the drainage tunnel crosscut.

At the beginning of 1918 we had a good cash balance in our treasury, but the excessive cost of supplies, the heavy draft on our skilled labor by the Government, and the shortage of experienced miners, which compelled us to fill our vacancies with unskilled men, increased our operating expense so much that we carefully considered the situation thus brought about and acted accordingly. In July, on account of the small profits earned during the first half of 1918, we reduced our quarterly dividend from 3c. to 2c. per share, as it was evident that a considerable part of our dividend for the year would have to be paid out of our accumulated surplus earnings.

Taking everything into consideration, the outlook for the future is promising. The profits from our Independence mill should be sufficient to pay dividends at the present rate during the coming year. The labor situation is improving, and if the orebodies on the 21st level and below it, which are made accessible by the branch tunnel, prove to be measurably near to the production that we anticipate, the net earnings from the mine for the year should be sufficient to build up the treasury cash balance to satisfactory dimensions.

Much to our regret, F. L. Smale, the manager of the mining department, severed his connection with the company last October, after many years of valuable service. After Mr. Smale's resignation, we decided to place the mining and the milling departments under one head, and George M. Taylor was put in charge of both departments as general manager of the company. This arrangement has proved satisfactory, and great credit is due Mr. Taylor and his assistants, Fred Jones, superintendent of the mine; Thomas B. Crowe, superintendent of the mill; and Luther Lennox, assistant superintendent of the mill, for the success that has followed from the consolidation of the two departments under one head. The financial report shows that the gross value of ore mined and shipped during 1918 was $1,120,851.25, products recovered by the Victor mill realized $942,791.77, and revenue from all other sources, $14,066.31. The net cost of mining and milling was $1,881,113.10, leaving a net profit from operation of mines and mills of $196,596.23. Dividends were paid during the period amounting to $300,000, making a total of dividends paid to Jan. 1, 1919, of $11,257,080.

Rambler-Cariboo Mines, Ltd.

The Rambler-Cariboo Mines, Ltd., reports that for the eight months ended Dec. 31, 1918, 5400 tons of material was mined and milled, producing 400 tons of lead concentrates and 310 tons of zinc concentrates. The concentrator was in operation six months, the remaining time being spent in repairs made necessary by snowslides during the spring. Owing to high costs and scarcity of labor, little development work was done. No shipments of crude lead were made.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief Commission

The regulations governing the filing of claims under the War-Minerals Relief Act have been amended so as to allow claimants to file a brief with the questionnaire. It has been decided that hearings will be conducted by the War-Minerals Relief Commission when good reason for such action can be shown. When justified, the commission will conduct the hearing at a point easy of access from the mining district concerned.

Applications for relief are beginning to reach the commission in considerable volume. Thirty claims have been presented in such a condition that they have been formally filed with the commission. Many others have been returned with instructions as to the precise information required and the precedure to be followed. In addition, a large number of inquiries have been received. The following clauses have been added to the questionnaire:

Attach copies of all contracts: (1) For the financing of the enterprise; (2) by which money was raised; (3) for the sales of the minerals produced. Give name and amount of stock owned by each stockholder holding more than 5% of the stock of the company. Did the high price of the minerals influence claimant in determining to make production? At the time claimant determined to produce any of said minerals, did claimant contemplate presenting a claim against the Government in case losses were incurred? If so, did claimant inform any of said Government agencies or their officers, agents, or employees of that intention? Did claimant consult with any of said Government agencies or their officers, agents, or employees as to the machinery to be bought, the land to be leased or purchased, or the buildings to be constructed? Did claimant pay to any employees any damages for personal injuries sustained in the work of producing any of said minerals?

A determined effort was made to induce the Secretary of the Interior to open a Pacific Coast branch office of the War-Minerals Relief Commission. Secretary Lane, however, declined to do so, as he regarded it as impracticable to divide the work.

Sale of Surplus Motor Vehicles

Many rumors have been circulated as to the disposition of the surplus motor-driven vehicles now owned by the War Department. The following outline of the proposed method of handling this matter is given by the Director of Sales, War Department:

1. The different branches of the Government will be consulted to see whether the surplus of automobiles and motor trucks in the War Department can be used to fill their requirements.

2. Various manufacturers of vehicles will then be approached to see if they will take over the vehicles of their own make to market them with their own machines, thus giving the Government a fair market price and at the same time disturbing the market conditions as little as possible.

3. The net surplus remaining after the above methods have been adopted will be disposed of to the public, either through auction or by sealed bids. Full publicity will be given these sales, in order that the Government may realize the best results.

Reducing Clay and Gypsum Prices

Producers of gypsum and clay have held preliminary conferences with the Industrial Board with regard to a further reduction in prices. No conclusion has been attained, but it is believed that an agreement providing for slight reductions will be reached. J. E. Spurr, of the Bureau of Mines, is the member of the Industrial Board Advisory Committee, and he will act in an advisory capacity on mineral matters.

Economic Liaison Commission

An economic liaison commission has been formed by the State Department. It is made up of representatives from the departments in which the work has a bearing on foreign trade. The mining industry is represented by E. S. Bastin, of the Geological Survey, and H. C. Morris, of the Bureau of Mines. They will advise on problems relating to the minerals both with regard to import and export. The committee will meet every week. It is under the direction of Julius G. Lay, the foreign-trade adviser of the State Department. Members of the committee, other than those mentioned, are: Wesley Frost, Economic Intelligence Section, State Department; Karl Delaittre, Bureau of Research, War Trade Board; Col. John M. Dunn, General Staff; C. E. McGuire, Treasury Department; Roland D. Mahoney, Labor Department; Clarence W. Moomaw, Department of Agriculture; William Notz, Federal Trade Commission; Commander F. F. Rogers, Navy Department; W. M. Steuart, Tariff Commission; Walter S. Tower, Shipping Board.

Preparations are being made by the War Department to conduct research work on nitrates at the American University, near Washington. This is being done to take advantage of the equipment and facilities which are being abandoned by the Chemical Warfare Service.

C. B. Holmes has been retained as chief accountant for the War-Minerals Relief Commission. For many years Mr. Holmes was in the employ of the Chile Exploration Co., the Braden Copper Co., and other Guggenheim concerns.

Questionable stock promotion schemes are to receive the active attention of the Federal Trade Commission. Searching questionnaires have been sent out to a large number of companies and individuals now engaged in the sale of stocks, with the purpose of securing more complete information as to the extent and nature of their operations.

27th Engineers' Fund Is Still Growing

In the *Journal* of Mar. 29 it was announced that the fund of the Association of the 27th Engineers had reached its goal of $20,000. Since then additional contributions and receipts have been as follows:

H. C. Hyer	$25.00
Oscar Lachmund and Van H. Smith	20.00
Christmas donations from employees of Braden Copper Co. at Rancagua, Chile	450.00
Interest on bank deposit	14.73
Total	$20,509.73

The association is going to publish a memoir, giving a history of the 27th Engineers, a complete roster of the officers and men, and all other details of interest. A copy will be sent to each member of the regiment and to each subscriber to the fund.

Members of the regiment will receive also a bronze medal made according to a design which was adopted by the regiment while in France. If any of the men have a different address from the one on the roster, they should notify W. R. Ingalls, secretary-treasurer of the Association of the 27th Engineers.

Sale of Ordnance Scrap

WASHINGTON CORRESPONDENCE

Ordnance scrap is being placed on the market at current prices, and is being taken rapidly. It is predicted that all of the existing stocks will be disposed of within two months. Stocks as of Feb. 28, the last figures available, were as follows:

	Pounds
Brass scrap, all kinds	5,162,405
Cupro nickel, all kinds	700,540
Aluminum scrap, all kinds	62,893
Copper scrap, all kinds	1,219,218
Machine shop borings and turnings	4,640,989
Heavy melting steel scrap	1,685,097
Low-phosphorus steel scrap	6,838,539
Nickel-steel borings and turnings	2,887,779
Nickel-steel scrap (heavy)	5,692,345
Cast and malleable iron scrap	1,042,097
High-speed steel scrap, borings and turnings	148,453
Babbitt	228,428
Mixed and miscellaneous iron and steel scrap	1,119,260
Brass sweepings, ashes, etc.	265,119
Lead scrap, all kinds	94,005
Chemicals, acids, etc	3,594,795
Miscellaneous scrap (rags, paper, wood, etc.)	535,949
Burlap	33,098
Total	35,948,009

Compensation to War-Mineral Producers

WASHINGTON CORRESPONDENCE

The conditions governing the presentation of claims for loss incurred in the production and exploitation of manganese, chrome, tungsten, and pyrite ores are as follows:

1. All claims must be in writing, contain a statement of the facts upon which losses are based, subscribed and sworn to before a notary public or clerk of a court of record.

2. All claims must be filed in the office of the Secretary of the Interior, Washington, D. C., within three (3) months from and after the approval of said act, i.e., on or before June 2, 1919.

3. Claims for losses cannot be considered which relate to any other minerals.

4. There can be adjusted, liquidated and paid only such net losses as have been suffered by any person, firm, or corporation by reason of producing, or preparing to produce, any of said minerals in compliance with the request or demand of the Department of the Interior, the War Industries Board, the War Trade Board, the Shipping Board or the Emergency Fleet Corporation to supply the urgent needs of the nation in the prosecution of the war.

5. No claim can be allowed unless the expenditures made or obligations incurred were subsequent to Apr. 6, 1917, and prior to Nov. 12, 1918, in a legitimate attempt to produce any of said minerals for the needs of the nation for the prosecution of the war.

6. No profits of any kind shall be included in any claim, and no investment for merely speculative purposes will be recognized.

A questionnaire to be executed under oath by the claimant, or claimants, setting out the facts on which the claim is based, is inclosed herewith. This questionnaire must be returned to the War-Minerals Relief Commission, Room 2131, Interior Department Building, Washington, D. C.

Bituminous Coal Output Falls

WASHINGTON CORRESPONDENCE

Less bituminous coal was mined during the week ended Mar. 22 than during any week since Christmas, the amount being 7,477,000 tons, according to estimates furnished to the U. S. Fuel Administration by the Geological Survey.

Last year the output recorded for the corresponding week was 11,121,000 tons, or nearly 50% more. The chief cause of the drop was lack of orders, and time was lost on St. Patrick's Day.

The loss from full-time production because of "no market" during the week ended Mar. 15 was 42.8%, compared with 41.8, 41.9, and 43.0%, respectively, for the three weeks next preceding. Total losses from full time during the week ended Mar. 15 amounted to 48.0 per cent.

Anthracite production during the week ended Mar. 22 is estimated at 1,171,000 tons, as against 1,206,000 tons the previous week, and 2,099,000 net tons for the corresponding week of last year.

Molybdenum in the British Empire*

According to Sydney J. Johnston, of the Scientific and Technical Department, Imperial Institute, although molybdenum minerals are fairly widely distributed throughout the British Empire, deposits of proved commercial importance are few. The largest producers in the past have been Queensland (111 tons in 1917), and New South Wales (70 tons in 1917), but the United States, Canada (121 tons in 1917), and Norway are now rapidly becoming important contributors to the world's supply. India has produced only 1.7 tons, in 1917. Low-grade orebodies carrying molybdenite are of fairly common occurrence, but high-grade deposits such as were almost exclusively worked before the war are somewhat rare. About three-quarters of the world's output of molybdenum ore has been won from tungsten and bismuth deposits, and a smaller quantity has been obtained as a byproduct in the mining of tin.

Sales of metals by the War Department from Mar. 15 to Mar. 21 are reported as follows: Non-ferrous, $425,966.75; ferrous, $48,015.60.

---

*Abstracted from *Iron and Coal Trade Review*, Jan. 3, 1919, p. 22.

March Mining Dividends

Dividends paid in March, 1919, by 28 United States mining and metallurgical companies making public reports amounted to $12,050,438, as compared with $27,240,511 paid by 35 companies in March, 1918. Holding companies paid $366,572, as compared with $413,433 in 1917. Canadian, Mexican and South American mining companies paid $1,464,840 in March, 1919, and $1,806,213 in March, 1918.

United States Mining and Metallurgical

Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$1 00	$200,000
Allouez, c	Mich.	1 00	100,000
Am. Sm. and Ref., com	U. S.-Mex.	1 00	609,980
Am. Sm. and Ref., pfd	U. S.-Mex.	1.75	875,000
Argonaut, g	Calif.	.05	10,000
Arizona Cop	Ariz.	.36	554,000
Bingham Mines, c	Utah	.25	37,500
Caledonia, l. s	Ida.	.01	26,050
Calumet & Ariz., c	Ariz.	1.00	642,480
Chino, c	N. M.	.75	652,485
Copper Range, c	Mich.	1.00	395,000
Cresson Cons., g	Colo.	.10	122,000
Eagle & Blue Bell, l.s	Utah	.05	44,658
Federal Min. & Sm., pfd	U. S.	1.75	209,757
Golden Cycle, g	Colo.	.03	45,000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.50	125,580
Internat. Nickel	U. S.-Can.	.50	836,692
Isle Royale, c	Mich.	.50	75,000
Kennecott, c	. .	.50	1,393,477
Nevada Con., c	Nev.	.37½	749,797
Oroville Dredg	Calif.	.12	82,385
Osceola, c	Mich.	1.00	96,150
Quincy, c	Mich.	1.00	110,000
Ray Con., c	Ariz.	.50	788,589
St. Joseph Lead	Mo.	.35	493,313
Tintic Standard, l.c	Utah	.08	93,400
United Eastern, g	Ariz.	.07	95,410
Utah Copper	Utah	1.50	2,436,735

Canadian, South American and Mexican

Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	$1.00	$898,224
Florence Silver, s.l	B. C.	.01½	17,650
Hedley, g	B. C.	.10	24,000
Kerr Lake, s	Ont.	.25	150,000
Mexico Mines of El Oro, g.s	Mex.	.96	174,960
Min. Corpn. of Can., s	Ont.	.12½	200,006

Holding Companies	Situation	Per Share	Total
Calif. Explor	Calif.	$0.12	$28,139
Exploration Co	Mex.	.18	135,000
Yukon Alaska Trust	......	1.00	203,433

Total dividends in the first three months of the year were as follows, the 1918 figures being given in parentheses: United States mining and metallurgical companies, $29,434,006 ($47,261,524); holding companies, $696,572 ($743,433); Canadian, Mexican, Central and South American companies, $4,614,412 ($4,627,775).

The dividend record of March, 1919, was largely one of reductions, most of the companies finding it necessary to curtail. Three companies, Calumet & Hecla, Old Dominion, and Utah Consolidated, passed their regular payments. In the case of the copper companies, the reason, no doubt, was the unsettled condition of the market. Of thirteen copper companies, including the American Smelting and Refining Co., seven reduced their dividends by one-half, four by one-third, and two by one-quarter.

Metallurgists and Engineers Needed

The United States Civil Service Commission, Washington, D. C., makes announcement that open competitive civil-service examinations are to be held on Apr. 15, 1919, for junior metallurgists, at entrance salaries of $1500 a year, and junior mining engineers, at entrance salaries of $1200 to $1500 a year; and on May 6, 1919, for mining engineers for metal and mineral mining investigations, at entrance salaries of $3000 to $4000 a year for Grade 3, $2400 to $3000 a year for Grade 2, and $1800 to $2400 a year for Grade 1. Full information may be obtained from the commission.

Mining Convention at Vancouver

To plan the extensive development of the latent mineral resources of the Pacific Northwest; to face the problems of the present with enterprise and courage; and, above all, to display that confidence in the country's wealth which well-substantiated facts warrant—these were some of the general points made by prominent Western mining men who took part in the International Mining Convention held at Vancouver, B. C., from Mar. 17 to 19, inclusive. Between 500 and 600 delegates were in attendance, the greater part of whom were visitors. All the Pacific Coast states, British Columbia's various mineral districts, the Yukon Territory, and Alaska were represented. Vancouver threw open her doors wide, and for the week the city belonged to the mining men, who were warmly welcomed and hospitably entertained.

The British Columbia Chamber of Mines, of Vancouver, B. C., under whose auspices the convention was conducted, is to be congratulated alike on the personnel of the gathering, the educational features of its program, and the thorough preparations made for the entertainment of the guests. A full account of the convention will be given in a subsequent issue.

The Mining Industry in Utah

A committee to represent the operators of mines, mills and smelteries in the State of Utah has been formed to investigate the conditions prevailing there. It consists of Imer Pett, general manager, Bingham Mines Co., and Eagle & Blue Bell Mining Co., chairman; C. E. Allen, manager of mines, U. S. Smelting, Refining and Mining Co., vice-president; Fred Gowans, general manager, Utah Consolidated Mining Co.; C. F. Jennings, assistant purchasing agent, Utah Copper Co.; F. J. Westcott, secretary, Silver King Coalition Mines Co., and J. B. Whitehill, ore purchasing agent, International Smelting Company.

A statement has been issued which draws attention to the fact that the situation is so serious that relief must come in the immediate future if metal mining operations are to continue. When the armistice was signed on Nov. 11, 1918, copper was selling at 26c. per lb., and lead at $8.05 per 100 lb. Almost immediately afterward the market for these metals practically disappeared, and in the case of copper there were no quotations until February, 1919. Copper is now quoted at about 15c., with few buyers, and lead is in limited demand around $5.25. There is no reason to anticipate any substantial advances in the prices of these metals for at least a year to come.

The greatly decreased prices for metals threw a heavy burden on the mining companies of the state. Smaller producers have been compelled to suspend work entirely, and the larger producers have reduced operations materially. The Salt Lake valley smelters have curtailed their operations fully 50%. The mining companies have met the situation in part by reducing wages from the high point reached during the war. Reductions have amounted to from 75c. to $1 per day. To compare with the average wage reduction, the cost of necessaries of life must be reduced about 20 per cent.

The mining companies hoped and expected that they and their employees would not be left to bear the burden alone, and that there would be corresponding reductions in the cost of supplies for the mines and the necessaries of life. Such, however, has not been the case. Almost without exception, supplies have continued at the war-time price levels, and necessaries of life cost as much as or more than they did in July, 1918. The committee purposes to ascertain whether this condition is due to the attitude of manufacturer, wholesaler, or retailer.

The mining industry has borne all the burden it can. Others interested must assume a part of the load unless they are prepared to sacrifice a considerable proportion of the benefits they have derived through mining activity, and from the patronage of those who have gained their livelihood in the state.

Fight It Out for Yourself

In several respects all Americans have gained by the war. They have gained those things for which their boys died, or at least they can feel that those things are now in sight. Some feel that they have lost more than was gained and doubt if it was all worth the price. Thank God that number is small. For the sake of those who fell and were glad to pay that price, let everyone cherish the country's gains and try to forget individual losses which were so much less than the sacrifices of the men who gave their lives.

Their debts have all been paid, their slates are clean. The obligations of those that are left are not canceled. The slacker may say that the war is over and that patriotism is not going to draw any more Liberty Loan money out of his pocket, but it is the duty of the patriotic man and woman to consider what ought to be their attitude in respect to the next Liberty Loan, and to argue the matter out with their own consciences. It is safe to say that both they and Uncle Sam will be pleased with the result of that argument.

The Yerington District of Nevada

The Yerington, or Mason Valley, district, in western Nevada, is, next to Ely, the most productive copper district in the state. Before 1912 it had not produced much copper, but from 1912 to the end of 1918 it produced 80,000,000 lb. The ore deposits of the district are described in detail in a report recently issued by the U. S. Geological Survey, as Professional Paper 114.

Mining began in the Yerington district at least as early as 1865, when attempts were made, at the Ludwig mine, to work bodies of oxidized copper ore. Before 1907, however, mining in the district was intermittent and the mineral output was small. The most important of the early operations was the mining of natural bluestone, which occurred in the outcrops of the chief orebodies of the Yerington district and many thousand tons of which were mined to furnish the copper sulphate used in the mills at Virginia City in the Washoe process. In those early days a smeltery was built at Ludwig, but it was not successful. A smeltery was built also at the Bluestone mine, on the east side of the range, but it was not operated long; and another built at Yerington station made no considerable output. These early attempts were directed chiefly to mining the oxidized ores, which were naturally richer, though far less abundant, than the sulphide ore. In the absence of transportation facilities, the larger bodies of primary ore, nearly all of which are of low grade, were not commercially attractive.

Interest in the district revived about 1907. Some of the largest deposits were bought by energetic companies having adequate capital, and active exploration and development were begun. The Nevada Copper Belt R.R., begun in August, 1909, and completed to Ludwig in September, 1911, was built into the district from Wabuska, on the Southern Pacific system. A smelting plant, eventually increased to a capacity of 1800 tons a day, was constructed by the Mason Valley Mines Co. at Thompson, two miles north of Wabuska. It began operations on Jan. 6, 1912, and soon made a considerable output, largely from the ore deposits of the Yerington district.

The copper deposits of the district consist of chalcopyrite and pyrites, intergrown with pyroxene, garnet, and epidote. They are of the contact-metamorphic type, and their geologic features are of much scientific interest. The investigation of the origin of the ore deposits has led to certain practical recommendations as to the most systematic and effective way in which to explore for undiscovered ore.

Ceylon Plumbago in 1918

Decreased shipments of graphite to the United States in 1918 adversely affected the Ceylon plumbago industry, according to Consul Walter A. Leonard in *Commerce Reports*. In 1916 the United States took 75% of Ceylon's plumbago and in 1917 over 81%, whereas in 1918 America took barely 55% (percentage based on quantity, not value). Before the total prohibition of import was put into effect, on July 1, 1918, American shipments were below normal. According to invoices certified at this consulate, only 7910 tons, valued at $1,374,221, was shipped to the United States in 1918, as compared with 22,121 tons, valued at $6,550,302, in 1917.

Exports of Ceylon plumbago in 1918 were considerably less than in any previous year during the past 10-year period, except in 1914, when 14,300 long tons was exported, as compared with 15,500 tons in 1918. In the record year of 1916 exports totaled over 33,000 tons, compared with approximately 27,000 tons in 1917. The years 1909, 1910, 1912, and 1913 showed exports greater than those in 1917 and nearly equal to the figures of 1916, although the value of the exports during these earlier years was less.

The distribution of plumbago exports covering the years 1917 and 1918, respectively, as compiled by the Ceylon Chamber of Commerce, is given in the following table:

DISTRIBUTION OF EXPORTS OF CEYLON PLUMBAGO, 1917 AND 1918

Countries	1917 Tons	1918 Tons
America	21,965	8,409
United Kingdom	4,600	6,386
India	145	303
Australia	237	294
Japan	...	61
Russia	100	....
Totals	27,047	15,453

It is reported that the high prices of Ceylon plumbago in 1916 and early 1917 made it possible for competition from Madagascar and other graphite fields to react against the Ceylon market. It is not expected that such high prices will rule again in Ceylon. Lump plumbago is now quoted at $115 to $225 per long ton, as compared with prices ranging as high as $500 in late 1916 and early 1917. Prices of other grades of plumbago are at present comparatively low, chips ranging from $65 to $150, dust from $20 to $100, and flying dust as low as $13 per ton.

Editorials

The Task Ahead for America

THE task of winning Prosperity is, if anything, greater than was the task of winning Liberty.

It can be won only by our uniting to solve the problems of Peace as we united to solve those of War; by continuing, each one of us, to do his or her individual, personal share.

The war expenditures of the Government were not cut short by the signing of the armistice; the immense machinery of warfare could not be wiped out in a day.

We still have an unpaid balance of several billion dollars of war debts. We still have a huge army overseas that must be fed, supplied, paid, and brought back home. Our disabled soldiers and sailors must be tenderly cared for. Great hospitals and demobilization camps must be maintained.

In a multitude of unavoidable ways the country is still under an enormous war expenditure.

We have got to *finish the job.*

The Engineer in Public Life

THE calling of an important meeting of a number of engineering societies, for the purpose of discussing the subject of engineers and their obligations in the matter of personal service in public affairs, is a forceful reminder of the fact that the profession has not, to date, contributed its share to the public welfare in this respect. Members of the legal and medical professions continue to influence legislation and public opinion, but engineers appear to lack the required initiative, and timidly remain in the background when experienced advice is much needed, and which, if given freely, would redound to their own good and to the credit of the profession.

The discovery of Hoover was due to the fact that he, and he alone among all the American officials in London at the outbreak of the Great War, had the training and experience to see that the delicate and difficult situations involved in the handling of thousands of dazed and penniless refugees in the English metropolis must be by calm, common-sense engineering methods. And the first step he took was to divide the 24-hour day into three engineering shifts of eight hours apiece.

It was Hoover's experience with men, gained as an engineer in all parts of the world, that enabled him to classify the applicants for relief into "good," "bad," and "indifferent," and with such skill that practically all the money that was loaned was ultimately returned. It was Hoover's practical engineering talent in such elementary though vital matters that resulted in the successful solution of a difficult problem, and led to his translation to other and more important spheres of action; and it is worthy of note that all the undertakings with which his name has been associated have been managed without that chaos and evidence of frantic disorganization that so often hide the inefficiency of speed cranks and diagram-chart experts.

The basis of efficiency is sound engineering common sense. It is to be hoped that the results of the meeting have been to record a definite advance of opinion and resolution in the object for which it was called. The war enabled the engineer to come into his own. The nation needs him no less in times of peace, and when he realizes this fact he will respond nobly.

Commerce and Mining in Argentina

THE constitution of an Argentine-American Chamber of Commerce in New York is one evidence of a welcome *rapprochement* between the United States and the Argentine Republic. The primary object of the new association will be to protect trade interests and advance trade relations between the two countries according to just and equitable principles and methods, to encourage the investment of capital in legitimate enterprises, and to take whatever measures may be practicable to facilitate intercourse and friendly relations.

The proposed objectives are admirable. The obvious result of the purpose of the Chamber to encourage what is desirable, just, and equitable will be to discourage the questionable methods and practices which have tended to keep the industrial and commercial life of the two countries so far separated. The desire for friendly relations must inevitably lead to an attitude of frankness and honesty on both sides, and this augurs well. In addition to fostering the spirit of coöperation and encouraging the idea of mutual interdependence, the Chamber's activities will result in greater publicity for Argentine matters, the dissemination of truthful reports and the appreciation of reliable data. All this will help to clear away many misapprehensions and should encourage expansion and development on a scale commensurate with the aspirations of both countries.

The mining industry in Argentina is looked upon more or less as a joke; and mining engineers are there regarded as quacks and charlatans. Those who take this view have every justification, for the past history of mining in that country has been a lamentable succession of frauds, exploitations made under incompetent advice, and disasters. The contributing cause has been an entire lack of publicity, coupled with an unfortunate isolation from mining camps in successful operation in other parts of the world.

No survey of Argentina's mineral resources has ever been made. Its wealth is therefore unknown even to its own people. Development of outlying districts has been neglected through lack of knowledge of the potentialities of the country. Closer coöperation with the United States should achieve much.

The new Argentine-American Chamber of Commerce will do well to encourage the ventilation of subjects of vital interest to both countries. In course of time we hope to see a more healthful tone exhibited with regard to the mining industry in Argentina, and a recognition of the fact that, in proper hands, it is a legitimate and highly specialized business, involving skill, initiative, and experience. Publicity will achieve much toward the rehabilitation of the industry, and mutual benefit will result.

The Tungsten Market

SINCE early in last November there has been a great depression in the market for tungsten ores and concentrates. For the greater part of the time there has been no market. Imports have continued and stocks have increased. The tungsten industry is in the throes of readjustment. Until such time as the iron and steel manufacturing plants resume normal activity, and the surplus stocks of high-speed steel, ferrotungsten, and tungsten ores have been disposed of, there will be difficulty in the marketing of the product of tungsten mines.

The high prices for tungsten ores that prevailed during a considerable part of the war period stimulated production to an extraordinary degree. The superficial nature of tungsten deposits makes their exploitation easy in many instances. The simple treatment to which the ores respond makes the winning of a marketable product less difficult than with other ores.

The comprehensive paper on wolfram mining in Bolivia, by G. F. J. Preumont, which we reprint in this issue from the bulletin of the Institution of Mining and Metallurgy, gives an excellent insight into the conditions that exist in foreign tungsten-mining centers. That many of the deposits of the kind described will be rapidly worked out or abandoned when new prices for tungsten ores become established is a foregone conclusion. We may liken the exploitation of such areas to the working of rich gold-placer regions. For a time the production of gold from these regions is large, and then rapidly dwindles. Just as the initial placer mining was succeeded by the working of low-grade placers and lode deposits on a substantial and more or less permanent scale, so will the scattered tungsten-mining operations finally reach a condition of stability in the few well-conducted and thoroughly worked mines that will survive the present conditions in countries like Bolivia, China, India, and the United States.

In our country the tungsten industry has been developed to a large extent upon substantial lines, and, were it not for the foreign tungsten product that presses into our market, there would be a ready sale for all of the ore produced. The prospective market will be one of keen competition between domestic and foreign producers. Prices, without doubt, will be substantially lower than those that prevailed during the last year and may approach the pre-war level. What the attitude of the next Congress on the tariff is to be will be looked forward to with great interest, and will be of far-reaching importance to our domestic tungsten producers.

American Merchant Marine

OF WHAT interest is it to the American miner whether his ore or the product obtained from it is carried abroad in American vessels? What possible interest can he have in a merchant marine? He has an interest, rather indirect, but still a very pronounced interest in supporting the development of a fleet of American merchant vessels.

The miner's direct concern is for ever-broadening markets for his wares—expanding markets meaning greater demand and higher prices for ores and their products. The United States is fortunately situated as to her natural resources for nearly all of her mineral supplies. She has been using an immense tonnage at home and has been exporting a much greater value in mineral products than she has imported. But, large as home consumption is in many minerals, our resources greatly exceed domestic requirements, and that producing properties may work to the best advantage still wider markets are required. The field for these is abroad.

In entering foreign markets we immediately meet competition or restriction in some form. What restriction will develop upon the signing of peace no one can foretell. but self-interest of every European country will insist that its nationals be protected from the aggression of foreign producers. This protection may take the form of tariffs or bonuses, and is more than likely to include subsidies to vessels flying its own flag. We may soon expect to be advised of restrictions that confront us; we know that we will have to pay the freight, and it may easily be that our products will feel the weight of subsidized shipping. Here, then, is the interest of the American miner in using his efforts to see that his output may travel the seas under no greater handicap than that of his competitor. According to Robert Dollar, who writes in Bulletin No. 4, issued by the Merchant Marine Committee of the United States, between 1790 and 1830 fully 90% of our exports were shipped in American vessels, but since then the proportion has gradually dropped, until in the year 1914 it was less than 1%. If economic laws were permitted to take their natural course, if we should trust to the law of supply and demand to furnish the ships, and to the survival of the fittest to furnish us transportation at the lowest rates, the merchants of the United States would in all probability. within a few years, be sending their vessels all over the world; or if some foreign peoples could handle the shipping better than we, they would do that while we produced and manufactured for them.

But economic laws have not been allowed to take their natural course. First one nation and then another has taken steps that self-interest indicated would favor her nationals. And once this procedure was adopted, others have had to or did take steps which their lawmakers thought advisable.

In the United States the laws that have been passed, with the good intention of favoring labor and making for efficiency, have simply resulted in causing the American flag to disappear as a factor in international commerce.

In again referring to the Merchant Marine Committee's Bulletin, previously quoted, we learn that, as a result of the passage of the Seamen's Bill, American shipping on the Pacific Coast dropped in four years from 26 to 2%. Wages were an important item in this, as instanced by two vessels of the same horsepower and tonnage: The one under the Japanese flag carried a crew of 36 men and had a payroll of $770 per month; the other, under the Stars and Stripes, carried a crew of 47 men and had a payroll of $3720 per month

Our methods of making ship measurements favor foreign vessels; our inspections are allowed to interfere with operations; our engine room and deck crews are larger than required, and the quality of the personnel is far higher than is the case with our competitors.

If we are to have a merchant marine there must be drastic changes in our present laws before vessels with the American flag can carry our products to foreign ports. Safety need not be sacrificed, wages of the higher-class seamen need not be reduced, but subsidies will probably have to be paid. We all need these vessels, and it is the duty of each of us to urge upon our legislators the necessity of action that will permit of private American enterprise once more becoming a factor in ocean traffic.

Taking the Bull by the Horns

THE statement issued by the Interstate-Callahan, a copy of which appeared in the *Journal* of Mar. 15, has been read by many, no doubt, with keen interest. Other mines are in the same condition; that is, the value of the ore produced has fallen below the cost of production, and the owners are in a quandary as to what to do. The first thought is to take the bull by the horns and do as the Interstate-Callahan has done, shut down until such time as it will again pay to operate the property, for no business can long stand the strain of running at a loss, particularly such a business as mining. Shutting down is not always a simple operation, and seldom means the cessation of all expense. Certain overhead charges must be continued, insurance and taxes must be paid, the machinery and property must be cared for, pumps must be kept running, timber must be renewed, and caving ground must be caught up. The expense of keeping the property in first-class order may be greater than the loss incurred through selling metal at less than cost. Closing down for an indefinite period means the scattering of an important part of the staff and laboring force, and an added expense when the time comes for reorganization.

With the prompt resumption of normal demand for metals, and the steadying of prices for supplies, the gain from cessation of work would scarcely compensate for the loss incurred by continuing operations, but with no prospect of better conditions in the near future the question, to say the least, is serious.

Another important point that the operator must consider is the condition of those who are dependent upon the mine for their daily bread. The dismissal of a small number of men weekly has no appreciable effect upon the mine or community, but the discharge of several hundred at one time is most decidedly a serious matter in a small community. It is a step that may lead quickly to actual want and distress, bringing about greater suffering than would be felt by owners if they lost the whole of their reserves, or even the mine itself.

Legally, a community has no right to ask the mine owners to support it; morally, the workmen are partners in the mine, and if willing to share losses should be protected to the limit by owners.

Whether the mine should be shut down or kept in operation does not depend solely upon the question of profits, but of equal weight are the factors of social and political economy which must be considered, and the mine is fortunate that can do as the Interstate-Callahan has done, and do it with justice to all and without suffering to any.

Some properties are so fortunately circumstanced that a middle course may be taken. They are in a position that will enable them to cease production and yet have at their command sufficient funds available to make it possible to continue the work of prospecting and development. Under existing economic conditions this is the wisest course to pursue if at all practicable.

Production means the addition of metals to a market already overstocked and a lengthening of the time during which abnormal conditions will prevail. Let production lag, but use labor and equipment so far as practicable in opening new reserves and preparing the mine for increased demands that are sure to follow the stagnant period that we have now entered upon. The cost of such development will be higher than good management would sanction, but the metals against which it is charged will sell at a higher price than that now quoted, and altogether it is the best solution of a bad situation.

Mr. Vanderlip's Views

IN A PUBLIC SPEECH early in January, Mr. Vanderlip expressed himself optimistically respecting the economic future, and his other utterances at about that time were of the same nature. But lately he has been looking into things in Europe, and he has been quoted, through The Associated Press, as making the following remarks:

> I doubt if America has begun to comprehend the seriousness of the appalling situation which confronts Europe, and the wreck which the whole fabric of civilization may be facing. America was once told there might be peace without victory. What we have is victory without peace. Production has ceased, and unless production can be speedily resumed, one's imagination cannot comprehend the chaos which may ensue. In France everything waits on settlement of the question of indemnity and progress of events in Germany. Each day makes the prospect of indemnity less possible. If production is not resumed, the horrors of war may be exceeded by the horrors of this after period, which is not war nor peace, but a breakdown of the machinery of civilization. In face of such appalling disaster, every partisan consideration, every unessential difference of opinion and every personal ambition, should be instantly forgotten.
>
> Unless terms of peace can be speedily agreed upon, and permit resumption of something approaching normal industrial life, there is not merely a chance, there is a strong probability, of Russian Bolshevism overrunning Germany. What Bolshevism is can never be really pictured by a normal mind. No description of it has been overdrawn. One may say the temperament and psychology of Germany are not such as to lead that country to Bolshevism. Hunger can lead any country into Bolshevism, and hunger is what Central Europe is facing.
>
> There is no economic legerdemain that can correct the financial difficulties of Europe. Production alone can do that. Production in sufficient quantity to permit export of goods alone can permanently support exchanges.
>
> What can America do? There is certainly one thing it cannot do, and that is to withdraw itself, to rest in belief that this chaos is remote and America can avoid playing her part in international responsibility. We must think in international terms as we never thought before. The gigantic strength of our own position will not keep us free from effects of events here. This is no time for narrow or provincial views.
>
> For example, criticism of actions of governments here in excluding our exports shows lack of appreciation of the financial position of these countries. They have sustained exchanges because they could borrow from our Government. When that ability to borrow ends, these countries will be confronted by extreme difficulty in regard to their exchanges. They must avoid every importation it is possible for them to prohibit, to keep down demand for exchange to pay for importations of food and raw materials.
>
> Necessity for machinery is imperative, and these governments are endeavoring to provide that everything possible shall be made within their own borders, because they have not the means to make payments in foreign markets. They may have made some mistakes in laying embargoes, but in general the effort is one with which we sympathize and do not criticize. The absolutely fundamental necessity is not charity. It is not loans. It is organization of production and distribution.
>
> Transportation is breaking down, and there will be sections that cannot be fed even if there were food and plenty in Europe to feed them. The first essential is to look facts in the face until

terms of peace are known and the available indemnity is measured. Any useful indemnity for the time being must be measured in terms of goods, and delay in announcing terms of peace is rapidly moving into the future Germany's ability to produce goods.

The above opinions are practically identical with those expressed by W. R. Ingalls in an address before the Mining and Metallurgical Society of America in January, which was reprinted in the *Journal.*

A fundamental trouble in the world today is that there are so many men who can not work (for reasons beyond their control), or who will not work, thinking that they do not have to do so. The resuscitation of business, even the survival of our civilization, depends upon the people of the world getting to work and working harder than ever before. The slackers and the strikers are enemies of everybody, themselves included. The main thing is to produce. There are many other economic problems, but none so fundamental as this. The impairment of production is the great danger from the spread of Bolshevism.

We think that in America there is an underlying common sense, which often is insufficiently valued, and therefore we do not look for any serious Bolshevism here. But in spite of our strong financial position we cannot escape feeling to some extent the consequences of Bolshevism in Europe.

The excellent article by S. Ford Eaton which is concluded in this issue throws light upon another one of the little known gold-mining regions of South America. American capital and enterprise are steadily pushing their way into the mining regions of the southern continent. That there is a good field here for mining has long been recognized. As in so many other regions, transportation is a serious handicap to mining operations in Colombia. In time South American governments will awaken to the necessity for road development and will apportion a considerable part of their budget for road and trail work. The elimination of repressive laws and the curtailment of onerous taxes, together with the general improvement in transportation facilities, are necessary factors in encouraging foreign miners to open and operate mines in South America.

BY THE WAY

Few persons regard Cuba as a favorable field for gold-mining enterprise, yet in its day the chief revenue of the island was gold. When Columbus landed near Puerto Principe in 1492 he was informed that gold could be found in Cubanacán, a district now known as Santa Clara Province. Later adventurers, under the leadership of Diego Velazquez, did considerable prospecting in the headwaters of the Arimao River and in the vicinity of Guaracabulla and Placetas del Sur. Don Vasco Porcallo de Figueroa arrived in Cuba about the time that Velazquez started the *repartimiento*, or assignment of the natives as slaves, and devoted his energies to gold mining and agriculture. He achieved the reputation of being severe but just; doing more than any other individual from Spain to put the industries of the island on a sound economic basis and striving to make it a land of homes, rather than purely a field for exploitation. When the arrogant and despotic Hernando De Soto arrived from Spain in 1538, with plenipotentiary powers, he was glad to accept the aid of Porcallo, by that time the richest and most powerful resident of the island, in equipping and provisioning the Florida expedition. De Soto, having reduced Nuño de Tovar to the ranks, offered the vacant post of lieutenant-general to the best man available. Though Porcallo was slightly above the draft age, he accepted his commission in the reserve officers' corps and proceeded to active duty with the overseas force, on the understanding that he was at liberty to establish a government labor bureau on the mainland. The slogan was "jobs for Indians," with very little said about the rate of pay. After a few days' sojourn at some of the Florida shore resorts, Vasco noticed that not even by liberal tipping could he obtain satisfactory service. Moreover, not a solitary dollar-a-year man volunteered. Porcallo and De Soto had a lively argument, resulting in the return of the former to Cuba. Many historians seemed unable to learn just what happened; but one Garcilaso de la Vega intimates that old Vasco put on his best tin shirt and went to call on an Indian chief named Hurri Harri. He lost his way in a swamp, his horse fell on him, and when finally extricated he was thoroughly plastered with mud. Returning on foot, he soliloquized: *"Hurri Harri, Hurri Higa, Burra Coja, Carajo.* May the foul fiend take a land where the language is so difficult and the traveling so bad and profitless. I have my mines and plantations and can well afford to retire and enjoy the rest of my life in peace." During the same year of departure from Cuba, 1539, he returned to his home. In 1542, possibly due to the pleas of the humanitarian priest Bartolomé de las Casas, the employment of Indians in the mines was forbidden by royal decree. In 1544 the bishop of Santiago called at Porcallo's home near the present site of San Juan de los Remedios, but learned that his erstwhile host was in Habana visiting and consoling the widow of De Soto. The chief operator of mines having retired from active business, the practical miners having emigrated to Mexico and South America, and the unskilled laborers having been disqualified by royal decree, it is not surprising that gold mining practically ceased in Cuba.

"The original lazy man," says the Old Timer in the *Salt Lake Mining Review*, "the one who made all who preceded him or followed him look like selling platers, was a Kansan who was employed as a watchman at the old Emma mine, in Alta, during its palmy days. We called him 'Bald-faced Billy,' probably because of the whiskers which covered his features—shaving was too much trouble, anyhow. He could neither read nor write; and he was the hero of the story of the man who, when asked how he put in his time, said: 'Why, I jest sit an' think; an' sometimes when it's real hot I jest sit.' But what I started to say about him was this: One afternoon I passed the Emma on my way to the Grizzly, and there was Bill slouched down on a pile of lumber, with his unlighted pipe in his mouth and a finger and thumb of his right hand pressed against the wheel of an ore wagon. 'What's the main idea, Bill?' I asked. 'Huh? Oh,' he said, 'when Edgar here starts his horses, this here wheel will light a match for me.' And he sat there without moving as I passed on."

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over any order in coupons if so requested.

COPPER

10651—ARIZONA—The Middlemarch Mine and Mill. B. M. Snyder. (Min. and Sci. Press, Feb. 8, 1919; 2 pp., illus.) 20c.

10662—BRITISH COLUMBIA—Indian River Copper Deposits, Vancouver Mining Division. Charles Camsell. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 2½ pp.)

10653—CALIFORNIA AND OREGON—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1917. Charles G. Yale. (Mineral Resources of the U. S., 1917, Part 1; 50 pp.)

10654—MICHIGAN—The Porphyry Intrusions of the Michigan Copper District. Thomas S. Woods. (Eng. and Min. Journ., Feb. 15, 1919; 3½ pp., illus.) 20c.

10655—MONTANA—Gold, Silver, Copper, Lead and Zinc in Montana in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 35½ pp.)

10656—NEVADA—Gold, Silver, Copper, Lead and Zinc in Nevada in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 46 pp.)

10657—SOUTH DAKOTA AND WYOMING—Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1917. Charles W. Henderson. (Mineral Resources of the U. S., 1917, Part 1; 12½ pp.)

10658—UTAH—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 33½ pp.)

GOLD AND SILVER—GEOLOGY

10659—ONTARIO—Notes on Lake Abitibi Area. Percy E. Hopkins. (Ann. Report, Ont. Bureau of Mines, 1918; 15 pp., illus.)

10660—ONTARIO—The Matachewan Gold Area. A. G. Burrows. (Ann. Report, Ont. Bureau of Mines, 1918; 25 pp., illus.)

GOLD DREDGING, PLACER MINING, ETC.

10661—BLACK SAND—Chrome Sands on the Pacific Coast. J. F. Grugan. (Chem. and Met. Eng., Jan. 15, 1919; 2 pp.)

10662—CALIFORNIA—Possibilities of Dredging in the Oroville District, California. Charles H. Thurman. (Min. and Sci. Press, Feb. 22, 1919; 4 pp., illus.) 20c.

10663—YUKON TERRITORY—Explorations in Yukon Territory. Wm. E. Cockfield. (Can. Dept. of Mines, Geol. Surv., Summary Report, 1917, Part B, 1918; 8½ pp.)

GOLD AND SILVER—GENERAL

10664—BRITISH COLUMBIA—The Gold Mines of Sheep Creek, B. C. E. A. Haggen. (Min. and Eng. Rec., Dec. 30, 1918; 7 pp., illus.) 20c.

10665—CALIFORNIA AND OREGON—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1917. Charles G. Yale. (Mineral Resources of the U. S., 1917, Part 1; 50 pp.)

10666—COLOMBIA—The Guamoco District of Colombia—I. S. Ford Eaton. (Eng. and Min. Journ., Mar. 22, 1919; 2¾ pp., illus.; to be continued.) 20c.

10667—MONTANA—Gold, Silver, Copper, Lead and Zinc in Montana in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 35½ pp.)

10668—NEVADA—Gold, Silver, Copper, Lead and Zinc in Nevada in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 46 pp.)

10669—ONTARIO—Mines of Ontario in 1917. T. F. Sutherland, E. A. Collins and J. H. Stovel. (Ann. Report, Ont. Bureau of Mines, 1918; 66½ pp., illus.)

10670—PRODUCTION—The Gold Problem: Report of the Government Gold Production Committee. (Min. Mag., Jan., 1919; 4 pp.)

10671—SOUTH AFRICA—Mining Conditions in South Africa. E. M. Weston. (Eng. and Min. Journ., Feb. 22, 1919; ¾ p.) 20c.

10672—SOUTH AFRICA—Rand Gold Mining. (Eng. and Min. Journ., Mar. 15, 1919; 2¾ pp., illus.) 20c.

10673—SOUTH DAKOTA AND WYOMING—Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1917. Charles W. Henderson. (Mineral Resources of the U. S., 1917, Part 1; 12½ pp.)

10674—UTAH—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 33½ pp.)

IRON ORE DEPOSITS, MINING, ETC.

10675—ARIZONA—Magnetic Iron Ore in Arizona. Sydney H. Ball and T. M. Broderick. (Eng. and Min. Journ., Feb. 22, 1919; 2¾ pp.) 20c.

10676—CANADA—Investigation of Iron Ores. A. H. A. Robinson. (Summary Report, Mines Branch of Can. Dept. of Mines, 1917; 12 pp., illus.)

10677—LAKE SUPERIOR—1918 Lake Superior Ore Shipments. R. V. Sawhill. (Iron Tr. Rev., Mar. 6, 1919; 3¼ pp.) 20c.

10678—PRODUCTION—Iron Ore in 1918. (Eng. and Min. Journ., Mar. 1, 1919; 3 pp., illus.) U. S. Geol. Surv. estimates. 20c.

IRON AND STEEL—METALLURGY

10679—BLAST-FURNACE DESIGN—Progress in Blast-Furnace Design. J. G. West, Jr. (Iron Tr. Rev., Feb. 20, 1919; 6¼ pp., illus.) Abstract of paper before Am. Iron and Steel Inst. 20c.

10680—ELECTRIC FURNACES in the Steel Industry and Their Relation to the Central Station Business. (Chem. and Met. Eng., Jan. 15, 1919; 3¼ pp.)

10681—ELECTRIC PIG IRON After the War. Robert Turnbull. (Chem. and Met. Eng., Feb. 15, 1919; 1½ pp.) Paper before Am. Electrochem. Soc., Oct. 1, 1918.

10682—FERROMANGANESE—Eliminating Phosphorus and Sulphur in Electric Ferromanganese Furnaces. Jay Lonergan. (Chem. and Met. Eng., Mar. 1, 1919; ¾ p.)

LEAD AND ZINC

10683—BURMA—Operations of the Burma Mines, Ltd. A. B. Parsons. (Eng. and Min. Journ., Feb. 8, 1919; 5 pp., illus.) 20c.

10684—CALIFORNIA AND OREGON—Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1917. Charles G. Yale. (Mineral Resources of the U. S., 1917, Part 1; 50 pp.)

10685—CONCENTRATION at the British Broken Hill. George C. Klug. (Min. Mag., Jan., 1919; 2¼ pp., illus.) 40c.

10686—DISTILLING—The Ruck Zinc-Distilling Furnace. (Eng. and Min. Journ., Feb. 15, 1919; ¾ p., illus.) 20c.

10687—FLOTATION of Oxidized Ores of Lead. Glenn L. Allen. (Chem. and Met. Eng., Feb. 15, 1919; 7 pp., illus.)

10688—INDIA—Zinc Smelting in India. (Eng. and Min. Journ., Feb. 22, 1919; 2 pp.) From a report to Burma Corp., Ltd. 20c.

10689—MILL—A New Lead-Zinc Mill in Colorado. (Eng. and Min. Journ., Mar. 1, 1919; 1½ pp., illus.) Describes equipment of Colorado Central Mining Co. 20c.

10690—MONTANA—Gold, Silver, Copper, Lead and Zinc in Montana in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 35½ pp.)

10691—NEVADA—Gold, Silver, Copper, Lead and Zinc in Nevada in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 46 pp.)

10692—SOUTH DAKOTA AND WYOMING—Gold, Silver, Copper and Lead in South Dakota and Wyoming in 1917. Charles W. Henderson. (Mineral Resources of the U. S., 1917, Part 1; 12½ pp.)

10693—SOUTHEAST MISSOURI—Concreting Prospect Drill Holes. Roy H. Poston. (Eng. and Min. Journ., Feb. 15, 1919; 2 pp., illus.) 20c.

10694—UTAH—Gold, Silver, Copper, Lead and Zinc in Utah in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917, Part 1; 33½ pp.)

OTHER METALS

10695—ALUMINUM: Its Use in the Motor Industry in England. E. Carey Hill. (Metal Ind., Mar., 1919; 3 pp.) Continuation of article previously indexed. 20c.

10696—ALUMINUM—The Analysis of Aluminum Alloys and Metallic Aluminum. J. J. Fox, E. W. Skelton and F. R. Ennos. (Journ. Soc. Chem. Ind., Dec. 31, 1918; 5½ pp.)

10697—ALUMINUM—The Inflammability of Aluminum Dust. Alan Leighton. (U. S. Bureau of Mines, 1918; 15 pp.)

10698—ALUMINUM—The Metallography of Aluminum. Robert J. Anderson. (Journ. Frank. Inst., Jan., 1919; 17 pp., illus.) 60c.

10699—ANTIMONY—A Bibliography on the Analysis of Antimony, Part II. Elton R. Darling. (Chem. Engr., Feb., 1919; 2 pp.)

10700—CHROME SANDS on the Pacific Coast. J. F. Grugan. (Chem. and Met. Eng., Jan. 15, 1919; 2 pp.)

10701—MANGANESE—Cuban Manganese in 1918. John B. Stewart. (Eng. and Min. Journ., Jan. 25, 1919; ½ p.) 20c.

10702—MANGANESE—Preparation of Manganese Ores. W. R. Crane and E. R. Eaton. (Resources of Tenn., Jan. 1919; 11¾ pp., illus.)

10703—MANGANESE—The Mining and Preparation of Manganese Ores in Tennessee. W. R. Crane. (Resources of Tenn., Jan., 1919; 15½ pp., illus.)

10704—NICKEL—International Nickel Co.'s Refining Works At Port Colborne, Ont. W. L. Wotherspoon. (Eng. and Min. Journ., Mar. 8, 1919; 6¼ pp., illus.) 20c.

10705—PLATINUM at Franklin Camp, B. C. (Eng. and Min. Journ., Mar. 1, 1919; ¾ p.) 20c.

10706—PLATINUM—The Source of Placer Platinum in the Tulameen District of British Columbia. R. M. Macaulay. (Eng. and Min. Journ., Feb. 15, 1919; 2¼ pp., illus.) 20c.

10707—QUICKSILVER in 1916. H. D. McCaskey. (Mineral Resources in U. S., 1916, Part 1; 16½ pp.)

10708—QUICKSILVER—Mercury Production at Almaden, Spain. Roland Sterner-Rainer. (Chem. and Met. Eng., Jan. 1, 1919; 3½ pp., illus.) Translation of a portion of an article which appeared in "Oest. Zeit. f. B.-u. H.," Vol. 62, 1914.

10709—QUICKSILVER—Minor Occurrences of Mercury in Europe. Roland Sterner-Rainer. (Chem. and Met. Eng., Jan. 15, 1919; 2½ pp.) Translation of a portion of an article in "Qest. Zeit. f. B.-u. H.," Vol. 62, 1914.

10710—SECONDARY METALS IN 1917. J. P. Dunlop. (Mineral Resources of the U. S., 1917, Part 1; 31½ pp.)

10711—STELLITE—The Production and Uses of Stellite. Sidney B. Wright. (Bull. Can. Min. Inst., Feb., 1919; 3¾ pp.)

10712—TIN AND TUNGSTEN—The Ore Minerals of Tavoy. J. Morrow Campbell. (Min. Mag., Feb., 1919; 14 pp.) 40c.

10713—TUNGSTEN and the War. Julius L. F. Vogel. (Min. Mag., Jan., 1919; 6 pp.) Paper before Brit. Science Guild Exhibition, Aug. 30, 1918. 40c.

NONMETALLIC MINERALS

10714—ALUNITE—The Alunite Problem. W. F. Downs. (Eng. and Min. Journ., Mar. 1, 1919; ¾ p.) 20c.

10715—ASBESTOS—South Africa the World's Record Holder in Asbestos. (So. Afr. Min. Journ., Jan. 25, 1919; 1 p.) An abstract from South African Geological Survey publication, by A. L. Hall. 40c.

10716—BARIUM—Future of the Barium Industry. Wm. H. Rollin. (Chem. and Met. Eng., Feb. 15, 1919; 1 p.)

10717—FLUORSPAR. Percy A. Wagner. (So. Afr. Journ. of Ind., Dec., 1918; 4½ pp.)

10718—GRAPHITE—Refining Alabama Flake Graphite for Crucible Use. Frederick G. Moses. (U. S. Bureau of Mines, War Minerals Investigations Series No. 8, 1918; 34¾ pp.)

10719—MAGNESITE—Its Occurrences and Uses. (Min. Mag., Feb., 1919; 4½ pp.) Paper by T. Cook before the Ceramic Society. 40c.

10720—NITRATE—Production and Uses of Saltpeter. Hoyt S. Gale. (Eng. and Min. Journ., Mar. 1, 1919; 3 pp., illus.) 20c.

10721—NITRATE—The Chilean Nitrate Industry During 1918. Donald F. Irvin. (Eng. and Min. Journ., Feb. 8, 1919; 2¼ pp.) 20c.

10722—POTASH—German Potash Deposits. H. H. Taft. (Eng. and Min. Journ., Mar. 8, 1919; ¾ p.) 20c.

10723—PYRITE—The Coal Pyrite Resources of Tennessee and Tests on Their Availability. E. A. Holbrook and Wilbur A. Nelson. (Resources of Tenn., Jan., 1919; 4¾ pp., illus.)

10724—SULPHUR—American Sulphur Industry Expanding. (Chem. and Met. Eng., Feb. 15, 1919; 2¼ pp., illus.) Brief account of the sulphur-bearing saline domes of the Gulf Coast; operations at Matagorda.

PETROLEUM AND NATURAL GAS

10725—FIRES—Extinguishing and Preventing Oil and Gas Fires. C. P. Bowie. (Bull. 170, U. S. Bureau of Mines, 1918; 41¼ pp., illus.)

10726—OIL SHALES—The Present Status of Oil Shales. (Chem. and Met. Eng., Jan. 1, 1919; 3 pp., illus.)

ECONOMIC GEOLOGY—GENERAL

10727—BURMA—The Ore Minerals of Tavoy. J. Morrow Campbell. (Min. Mag., Feb., 1919; 14 pp.) 40c.

10728—CHILE—The Veins of Chanarcillo, Chile. W. L. Whitehead. (Econ. Geol., Jan.-Feb., 1919; 45 pp., illus.)

10729—SASKATCHEWAN—Surface Deposits of Southeastern Saskatchewan. J. Stansfield. (Summary Report, Can. Geol. Surv., 1917, Part C; 8¼ pp.)

MINING—GENERAL

10730—ACCIDENTS—Mining Accidents in Ontario in 1917. T. F. Sutherland, E. A. Collins and J. H. Stovel. (Ann. Report, Ont. Bureau of Mines, 1918; 5¾ pp.)

10731—BLASTING—Use and Abuse of Safety Fuse. (Eng. and Min. Journ., Feb. 1, 1919; 2½ pp.) 20c.

10732—DRAINAGE—Discharging Water From Mining Plants. Chesla C. Sherlock. (Eng. and Min. Journ., Feb. 15, 1919; 1½ pp.) Notes on the legal side of the question. 20c.

10733—DRILL HOLES—Concreting Prospect Drill Holes. Roy H. Poston. (Eng. and Min. Journ., Feb. 15, 1919; 2 pp., illus.)

10734—DRILLING—The Technique of Diamond-Drilling. J. A. MacVicar. (Min. Mag., Jan., 1919; 7¼ pp., illus.) Paper before Cornish Inst. of Engrs. 40c.

10735—DUST—Sampling of Dust in Mine Air. (Eng. and Min. Journ., Mar. 1, 1919; 2¾ pp., illus.) Abstract of a report by J. Boyd, of Transvaal Chamber of Mines. 20c.

10736—EXPLOSIVES—Methods for Routine Work in the Explosives Physical Laboratory of the Bureau of Mines. S. P. Howell and J. E. Tiffany. (Tech. Paper 186, U. S. Bureau of Mines, 1918; 63 pp.)

10737—EXPLOSIVES—Some Notes on Experiments Made with a View to Reducing the Consumption of Explosives and Increasing the Fathoms Broken per Machine Shift in Machine Stoping. (Journ. So. Afr. Inst. of Engrs., Oct., 1918, and Jan., 1919; 2 pp.) Continued discussion of paper of T. H. Bayldon, previously indexed.

10738—MINE SUPPLIES—Economies in Mining Engineering Supplies. W. Elsdon-Dew. (Journ. So. Afr. Inst. of Engrs., Jan., 1919; 23½ pp., illus.)

10739—ONTARIO—Mines of Ontario in 1917. T. F. Sutherland, E. A. Collins and J. H. Stovel. (Ann. Report, Ont. Bureau of Mines, 1918; 68½ pp., illus.)

10740—PROSPECT—Examining and Developing the Mine Prospect. Harry T. Curran. (Eng. and Min. Journ., Feb. 22, 1919; 5¼ pp., illus.) 20c.

10741—QUARRIES—Labor Saving at Limestone Quarries. Oliver Bowles. (Tech. Paper 203, U. S. Bureau of Mines, 1919; 26 pp.)

10742—PUMP CONTROL—Automatic Electrical Control at the Deer Trail. L. Brandenburger. (Salt Lake Min. Rev., Feb. 15, 1919; 2 pp., illus.) 20c.

10743—RAILWAY CURVES—Adapting Railway Curves to Mines. Frederick MacCoy. (Eng. and Min. Journ., Mar. 22, 1919; 1¼ pp.) 20c.

10744—SANITARY ENGINEERING in a Tropic Mining Camp. Harry N. Jenks. (Eng. and Min. Journ., Mar. 1, 1919; 3 pp., illus.) Abstracted from Eng. News-Record. Jan. 23, 1919; describes methods of Burma Mines, Ltd. 20c.

10745—SANITATION—A Mine Latrine. William W. Cort. (Min. and Sci. Press, Feb. 1, 1919; 1¼ pp.) 20c.

10746—SHAFTS—The Rectangular Shafts at Randfontein Central G. M. Co., and New State Areas, Ltd. W. L. White. (So. Afr. Min. Journ., Jan. 25, 1919; 1 p.; to be continued.) 40c.

10747—SPAIN—The Mineral Statistics of Spain for 1917. (Min. Journ., Jan. 25, 1919; 2½ pp.) Abstract translated and summarized from "Revista Minera." 40c.

10748—TIMBERING—Inclined-Shaft Timbering and a Method of Alignment. Arthur Neustaedter. (Eng. and Min. Journ., Feb. 22, 1919; 2 pp., illus.) 20c.

10749—TRANSPORTATION—Linking Up Isolated Mineral Districts by the Loco-Tractor Transport System. Frank Dutton. (Eng. and Min. Journ., Feb. 15, 1919; 3¼ pp., illus.) Abstracted from the So. Afr. Journ. of Industries. 20c.

10750—TUNNEL DRIVING at Copper Mountain, B. C. Oscar Lachmund. (Bull. A. I. M. E., Mar., 1919; 4½ pp., illus.) 40c.

10751—UTAH—Mining in Utah in 1918. Edward R. Zalinski. (Eng. and Min. Journ., Jan. 25, 1919; 5¼ pp.) 20c.

10752—VENEZUELA—The Mineral Industry in Venezuela. Charles F. Z. Caracristi. (Eng. and Min. Journ., Mar. 8, 1919; 3¼ pp.) 20c.

FLOTATION

(See also "Lead and Zinc")

10753—COLLOIDS and Flotation. Frederick G. Moses. (Tech. Paper 200, U. S. Bureau of Mines, 1918; 24 pp.)

10754—FLOCCULATION in Flotation. C. C. Smith and A. R. Pickett. (Eng. and Min. Journ., Feb. 22, 1919; 1 p., illus.) 20c.

10755—PULP-LEVEL CONTROL. Claude T. Rice. (Eng. and Min. Journ., Feb. 22, 1919; 1¾ pp., illus.) 20c.

10756—SILVERADO FLOTATION CONCENTRATOR. W. L. Zeigler. (Min. and Sci. Press, Mar. 8, 1919; ¾ pp., illus.) 20c.

ORE DRESSING—GENERAL

10757—BALL MILLS—Fine Crushing in Ball Mills. E. W. Davis. (Bull., A. I. M. E., Feb., 1919; 46 pp., illus.) 40c.

10758—CALCULATIONS—Milling Calculations. Formulas Useful in Determining Extraction of Processes, Machine Efficiency and Density of Solids, Solutions and Pulps. Robert S. Lewis. (Chem. and Met. Eng., Mar. 1, 1919; 9¾ pp., illus.)

10759—GRINDING AND SIZING DIAGRAMS. Alfred T. Frey. (Min. and Sci. Press, Mar. 8, 1919; 3¼ pp., illus.) 20c.

10760—MAGNETIC CONCENTRATION of Pyrrhotite Ores. J. P. Bonardi. (Chem. and Met. Eng., Mar. 15, 1919; 4½ pp.)

10761—TAILINGS AND RESIDUES—Defining "Tailings" and "Residues." A. W. Allen. (Eng. and Min. Journ., Feb. 15, 1919; 1¾ pp.) 20c.

METALLURGY—GENERAL

10762—ELECTRIC FURNACE—Temperature Uniformity in an Electric Furnace. John B. Ferguson. (Chem. and Met. Eng., Mar. 15, 1919; 5 pp., illus.) Republished from "Physical Rev."

10763—FUME TREATMENT—Notes on Electrical Precipitators. E. E. Thum. (Chem. and Met. Eng., Jan. 15, 1919; 6 pp., illus.) A summary of operations taken from several installations; notes on power consumption, voltage, velocity and temperature of gases.

10764—ITALY—L'industria Mineraria e Metallurgica Toscana. Gaetano Castelli. (Rassegna Mineraria, Oct., 1918; 5 pp.)

10765—PYROMETRY—Calibration of Base-Metal Thermocouples. C. S. Crouse. (Eng. and Min. Journ., Mar. 8, 1919; 2½ pp., illus.) 20c.

10766—REFRACTORIES—Contribution a L'Etude de la Brique de Silice et de sa Fabrication. L. Dauphin. (Bull. Soc. de L'Ind. Minerale, Feb., 1918; 53 pp.)

10767—REFRACTORIES—La Fabrication des Briques de Silice. M. Philipon. (Bull. Soc. de L'Ind. Minerale, Feb., 1918; 3 pp.)

10768—REFRACTORY MATERIALS—Action of Slags on Refractory Materials. (Iron Age, Jan. 23, 1919; 1½ pp.)

10769—REFRACTORY MATERIALS—Influence of Temperature Upon the Action of Slag Upon Refractory Materials. Raymond M. Howe. (Chem. and Met. Eng., Feb. 15, 1919; 1½ pp.)

FUELS

10770—FUEL ECONOMY in the Boiler House. John B. C. Kershaw. (Chem. and Met. Eng., Feb. 15, Mar. 1 and 15, 1919; 11 pp., illus.)

10772—FURNACES—Low-Rate Combustion in Fuel Beds of Hand-Fired Furnaces. Henry Kreisinger, C. E. Augustine and S. H. Katz (Tech. Paper 139, U. S. Bureau of Mines, 1918; 52 pp., illus.)

10773—PEAT in 1917. C. C. Osborn. (Mineral Resources of the U. S., 1917, Part 2; 27 pp., illus.)

10774—PULVERIZED COAL for Metallurgical Furnaces. Charles E. Longenecker. (Iron Age, Feb. 6, 1919; 1¼ pp., illus.)

10775—PULVERIZED COAL—Pulverized Coal in Blast Furnaces at Plant of International Nickel Co. W. L. Wotherspoon. (Can. Min. Journ., Feb. 5, 1919; 1 p.) 20c.

MINING AND METALLURGICAL MACHINERY

10776—AIR COMPRESSORS—Lubrication of Air Compressors. H. V. Conrad. (Eng. and Min. Journ., Mar. 1. 1919; 2¾ pp.) 20c.

10777—AIR LIFT—The Compound Air Lift. A. W. Allen. (Eng. and Min. Journ., Mar. 8, 1919; 1¾ pp., illus.) 20c.

10778—BELTING—Substitutes for Leather Belting. Harry A. Hey. (Industrial Management, Mar., 1919; 1¾ pp.)

10779—DRILL—The Hand Hammer Drill. James P. Cotter. (Bull. Can. Min. Inst., Feb., 1919; 4¼ pp.)

10780—PUMP SELECTION—Points in Pump Selection. B. N. Everett. (Chem. and Met. Eng., Mar. 1, 1919; 1¼ pp.)

Personals

Harry J. Wolf, of the Malm Wolf Co., is in El Paso on professional business.

L. Norris Hobart has been appointed Assistant State Engineer of New Mexico, at Santa Fe

C. E. Wharton, of Salt Lake City, has returned from a visit to the Bankburnett oil fields of Texas.

Irving A. Palmer is in the Cripple Creek district with a party of 40 students of the Colorado School of Mines.

W. B. Calvert, of Salt Lake City, has returned from a professional visit to the Washington County oil fields.

A. J. Seltzer, former chemist for the Bartlesville Zinc Co., Blackwell, Okla., has opened an assay office in Picher, Oklahoma.

F. T. Casler, formerly chemist for the Phosphate Mining Co., Nichols, Fla., is now chemist with the Air Nitrates Corporation.

D. C. Jackling has been making a visit of inspection to the Utah copper mine at Bingham and the company mills at Garfield.

John F. Coats, mining engineer of Vancouver, B. C., made an examination recently of several properties near Placerville, California.

John A. Savage, of Duluth, attended the conference of iron and steel representatives at Washington, D. C., as a member of the iron-ore branch.

E. M. Hamilton, of the firm of Hamilton Beauchamp, Woodworth, Inc., metallurgical engineers, of San Francisco, has returned from Parral, Mexico.

R. T. White, South American manager for the A. S. & R., has been in Salt Lake City recently, making visits from that point to the company's plants in Salt Lake Valley.

Lieut.-Col. John C. Greenway, 101st Infantry, has been awarded the Distinguished Service Cross for extraordinary heroism in action near Verdun, France, on Oct. 23 1918.

Lieut. Carrol F. Reece, 102d Infantry, has been awarded the Distinguished Service Cross for extraordinary heroism in action near Bois de Warville, France, on Oct. 2, 1918.

Rush T. Sill, of the firm of Sill & Sill, mining and metallurgical engineers of Los Angeles, announces the removal of the firm's offices and laboratory to 1011 Figueroa Street.

H. D. Trounce has accepted a position with the explosives division of the Bureau of Mines, with headquarters in Washington, D. C. His address will be Room 1128, The New Interior Building.

Albert Ladd Colby, consulting engineer and iron and steel metallurgist of South Bethlehem, Penn., is the representative of the American Society for Testing Materials on Engineering Council.

A. H. Hubbell, News Editor of the "Journal," started on Mar 31 on an extensive trip, in which he will visit Canadian and Western mining districts in the news interests of the "Journal."

R. M. Crocker has been recently discharged from the engineering corps at Camp Humphreys, Va., and is again engaged in mining-engineering work, with offices at 407 Dooly Block, Salt Lake City.

Albert Burch, of the firm of Burch, Caetani & Hershey, of San Francisco, arrived in Placerville, Calif., recently, and made a preliminary examination of the Church-Union group of gold-quartz claims.

O. P. Hood is to be in charge of an experimental plant to be used in the investigation of domestic deposits of lignite and peat for commercial uses which the Secretary of the Interior has been authorized to make.

W. B. Devereux has returned from overseas, where he served in the aviation branch with the rank of major. He has received his discharge and will resume his connection with the firm of Wilkens & Devereux, New York

Leslie R. Pyle, supervisor of the fuel conservation section of the U S Railroad Administration, and **Charles M. Freeman**, assistant supervisor, arrived in Salt Lake City recently to make a survey of the Oregon Short Line fuel system

Joseph T Terry, Jr., who for some time has been engaged in conducting flotation experiments for the American Zinc Co. Mascot Tenn., has opened an office as a consulting engineer under the title Terry Mining and Metallurgical Corporation, at Salt Lake City

W. R. Doell has resigned as chief engineer of the Wisconsin Steel Co's. coal and coke works at Benham, Ky., and with **Holman I. Pearl**, has taken over the business of **J. F. Wolff**, mining engineer and geologist of Crosby, Minn., under the name of Associated Engineers.

Theodore Chapin, geologist attached to the Alaskan Engineering Commission, and **Sumner Smith**, superintendent of mining in Alaska, are to be the civilian members on a commission which will also include three naval officers, yet to be named, to survey the Matanuska coal field. The commission sailed from the Bremerton navy yard about April 1.

C. K. Leith, professor of geology at the University of Wisconsin, has returned from Paris, where he served as mineral adviser in the Economic Section of the American Peace Commission, and will resume his work at Madison. Prior to going to Paris, Professor Leith performed mineral advisory work for the Shipping, War Industries and War Trade Boards in Washington, D. C.

C. F. Kelly, president Anaconda Copper Mining Co.; **R. L. Agassiz**, president Calumet & Hecla Mining Co.; **Joseph Clendenin**, vice-president A. S. & R., and **Walter Douglas**, president Phelps Dodge Corporation, who represented the Copper Export Association and have spent two months in Europe making a survey of the prospects of immediate copper sales abroad, returned on March 30.

Herbert Salinger, who has been connected with Beer, Sondheimer & Co. and the National Zinc Co. as ore buyer, has announced that he has purchased the interest of Kirk & Leavall in the Western Metals Co., of Salt Lake. He intends to extend the present operations of the company in lead and zinc ores into the rare-ore field, including tungsten, chrome, manganese, vanadium, molybdenum, bismuth and other ores.

Dwight E. Woodbridge, of Duluth, is chairman of the new iron-ore subcommittee of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. The following compose the membership: **Charles A. Buck**, vice-president Bethlehem Steel Co.; **E. F. Burchard**, U. S. Geological Survey; **Charles Catlett**, consulting engineer, Staunton, Va.; **R. C. Allen**, state geologist of Michigan; **George C. Crawford**, president Tennessee Coal, Iron and Railroad Co.; **W. O. Hotchkiss**, state geologist of Wisconsin; **W. J. Penhallegon**, manager mines and quarries, Republic Iron & Steel Co., Birmingham, Ala.; **Charles F. Rand**, president Spanish-American Iron Co.; **William Kelly**, president Penn Iron Mining Co.; **W. G. Swart**, manager Mesabi Syndicate, Duluth; **Oscar B. Warren**, mine manager, Longyear & Bennett.

Obituary

S. S. Rosenstamm, prominent in the copper-sales industry, died on Mar. 30 in New York. He had been associated with Adolph Lewisohn & Sons for a number of years in charge of sales of copper for that firm, which marketed the production of Miami and Shattuck-Arizona Copper companies. Mr. Rosenstamm started with the old firm of Lewisohn Bros., which was succeeded by the United Metals Selling Co. at the time of the organization of the Amalgamated Copper Co. After a number of years with the latter company he again became connected with Mr. Lewisohn. Mr. Rosenstamm was a director of the Miami Copper, Tennessee Copper, Kerr Lake, and General Development companies. He had been deeply interested in Hebrew charities and enthusiastic in welfare work among the soldiers.

Leonard C. Hanna, member of the firm of M. A. Hanna & Co., Cleveland, and brother of the late Senator Marcus A. Hanna, founder of the firm, died on Mar 21, at the age of 68 years. Mr. Hanna was long identified with iron mining and smelting, in addition to coal mining and transportation. In 1872, he formed a business association with E. M. Saunders, the former president of the Northwestern Fuel Co., in the coal business, but became connected with his brother's firm, M A Hanna & Co., in 1875, being admitted to partnership in 1879, and taking charge of its iron-ore and vessel business When M A Hanna became prominent in national affairs, L. C. Hanna took complete charge of the company. He retired in 1905, and reëntered the firm again in 1915. Under his management, the business had grown to large proportions and the firm was the owner of the largest fleet on the Lakes Mr. Hanna was also president of the Lake Superior Iron Ore Association for nine years, president of the Claire Furnace Co., a Hanna interest; director and member of the executive committee of the Republic Iron and Steel Co., and director of the Cleveland Railway Co., the Great Lakes Towing Co., the Kelly Island Line and Transport Co., and various other companies.

Societies

Mining and Metallurgical Society of America held a meeting of the New York Section at the Columbia Club on Apr. 3. Meyer Bloomfield, who has just returned from England, made an address on "The Labor Situation in Great Britain and America."

American Welding Society held the first meeting on Mar. 28 at the Engineering Societies Building and the constitution and bylaws were adopted as recommended by the organization committee. The following officers were elected: President, C. A. Adams, Cambridge, Mass.; vice-president (for one year), J. M. Morehead, New York; vice-president (for two years), G. L. Brunner, Utica. Twenty-four directors, including those for one, two and three years, were also elected. It was voted that the charter should be held open for 10 days and that those applying for membership before Apr. 8 should be considered charter members. At a meeting of the directors in the afternoon W. E. Symons was appointed treasurer and H. C. Forbes secretary.

Industrial News

American Gear Manufacturers' Association will hold the annual convention at the Hotel Statler, Cleveland, Apr. 14, 15 and 16. Papers will be presented on "Gear Steels," "Proper Sizes and Materials for Gears," and "Worms and Worm Wheels."

Huff Electrostatic Separator Co., of Boston, has promised to lend one of the company's separators, with complete electrical equipment, to the department of metallurgy and ore dressing of the Arizona Bureau of Mines for use in instruction and research.

W. A. Jones Foundry and Machine Co., of Chicago, manufacturers of a complete line of power transmission apparatus, special foundry machinery, and the Jones spur gear speed reducer, have opened an eastern office at 30 Church St., New York, under the direction of Lemuel C. Biglow, who formerly for a number of years held a similar position with the Morse Chain Co., of Ithaca, New York.

Zionist Society of Engineers and Agriculturists, 122 East 37th St., New York, is desirous of receiving the coöperation of American manufacturers in order to be in a position to select and recommend the subsequent purchase of tools, machinery and other equipment to be used in the reclamation work in Palestine. This organization is planning to send an engineering commission to Palestine to make a survey of natural resources.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Copper, Hydrometallurgy of. William N Rossberg and Guy E. Sheridan, Butte, Mont. (U. S. No. 1,292,075; Jan. 21, 1919.)

Electrolytic Cell. Elmer E. Niswonger, Dayton, Ohio, and Paul McDorman, Niagara Falls, N. Y., assignors to the Electro Chemical Co., Dayton, Ohio. (U. S No. 1,292,024; Jan. 21, 1919.)

Flotation. Process of Recovering Metals From Ores. Rudolf Gahl, Miami, Ariz. (U S No. 1,291,824; Jan. 21, 1919.)

Manganese. Process of Extracting Values From Manganese and Other Ores. Edward W Haslup, Bronxville, N Y, and Benjamin A Peacock, Philadelphia, Penn.; said Peacock assignor to said Haslup. (U. S No 1,291,867; Jan. 21, 1919)

Mine Cages, Safety Device for Alex G. Biondi, Los Angeles, Calif (U S No. 1,292,236; Jan. 21, 1919)

Miner's Gold-Pan. Edward O. C Ord, U S. Army. (U S. No. 1,292,364; Jan. 21, 1919)

Radium, Art of Recovering H N McCoy, Chicago, Ill., assignor to Carnotite Reduction Co., Chicago, Ill. (U S No 1,292,341, Jan. 21, 1919)

Editorial Correspondence

SAN FRANCISCO—Mar. 31

Argonaut Mine Fire Under Control and bulkheading of the Muldoon up-cast shaft and Argonaut working shaft is proceeding. The fire occurred on the 4000 level on Mar. 28. H. M. Wolflin, chief of mine inspection of the Industrial Accident Commission; C. H. Fry, of the California Metal Producers' Association, and Edwin Higgins, mining engineer for Bulkeley Wells, assisted Manager Kelsey while the rescue services of the Grass Valley, Kennett, and Shawmut properties were brought to the scene.

Natomas Company, of California, net earnings in the calendar year 1918 amounted to only $749,119, as compared to $1,099,309 in 1917. The causes were high costs of materials, scarcity of labor, and curtailment in the use of power, all as results of conditions due to the war. The gross earnings amounted to $2,008,966 in 1918, and $2,303,000 in 1917. At the reorganization of the company in 1914, 13 dredges were in operation, ten at Natoma and three at Oroville. Seven have closed operations, and three new ones have been installed, the present number in operation in the two fields being nine.

Bonanza Days on the Comstock were recalled in the week ended Mar. 15 by the extraction of $40.50 ore from Ophir 1800 level. The mine produced in the week a total of 259 tons, valued at $7455, or an average of $24.92 per ton. In the same week, Consolidated Virginia produced 342 tons, of a total value of $11,029, or an average of $32.24 per ton. The aggregate production of the two mines in the week amounted to 601 tons, valued at $18,584, the largest weekly production from the Northend Comstock in several years. All this ore came from the 1800, 1900, 2000 and 2150 levels, evidence that the upper levels of the Comstock were not cleaned in the Bonanza days. In the week ended Mar. 8, Ophir produced 246 tons, valued at $4256, and Consolidated Virginia, 353 tons, at $8203, or a total of 599 tons from the two mines, having a total of $12,459, or an average of $20.80 per ton. This makes a total production from the two mines in the first half of March of $31,043, from 1200 tons of ore, of an average value of $25.86 per ton. Consolidated Virginia shaft, known as the C. & C., had so long been used for pumping installations and operation for all the Northend Comstock mines that even the upper levels, known to still contain large bodies of good ore, could not be economically mined on a large scale until the completion of the unwatering of the entire Northend down to the 2900 level, which was in July, 1917. Even then only a comparatively small amount of ore could be hoisted through the C. & C. shaft. When development made connection with the Union, which is the main working shaft of the Northend mines, the extraction and hoisting of ore from the Consolidated Virginia increased. Ophir was in similar position, the shaft being used only for ventilation and the lowering of timbers and supplies, and repair operations. Ophir is now connected, and these two mines are supplying the necessary ore while development and repairs are in progress in Union, Mexican and Sierra Nevada. There have been times in the last two years when all these Northend mines were producing some ore simultaneously. But there still remain to be accomplished a great deal of development in the upper levels and exploration in the lower levels and connection to a second upcast shaft before the Northend Comstock mines can all be made profitably productive on the large scale of which they are evidently capable. This is the purpose to which Whitman Symmes, manager, is working and has been working for several years.

BUTTE, MONT.—Mar. 30

Fourteen Anaconda Properties Not Producing ore at the present time, but are closed down under the curtailment plan. The mines, however, with two or three exceptions, are either undergoing repairs, or development work is going on, so that a considerable force is employed. Seventeen properties are in operation, but they are not working to capacity. The mines closed are the Leonard, High Ore, Mountain Consolidated, Mountain View, Moonlight, Belmont, Bonanza, Liquidator, Orphan Girl, Lexington, Original, Pennsylvania, Neversweat, and Anaconda. The properties in operation are the Bell, Silver Bow, East Colusa, Tropic, Tramway, West Colusa, Poulin, Badger State, Southern Cross, Berkeley, Alice, Steward, St. Lawrence, Emma, West Gray Rock, and Nettie. Unless copper conditions improve in the next few months, there are a number of the mines, now closed so far as hoisting ore is concerned, which will remain closed for many months, but when the time does arrive to resume work they will be in a position to operate to capacity.

Reduction of Anaconda Dividend by 50c. a share, together with continued unsettled condition of the metal market and labor troubles again looming up, has given rise to a rumor that a shutdown was imminent, which, however, has been definitely denied. The possibility of a general closing of the mines for probably several months, or at least until such time as the owners of the properties can operate at a profit, has been discussed among the general public, based on the reason that the company cannot be expected to keep on producing copper just for the purpose of furnishing employment. Since the curtailment, the Anaconda company has been employing none but married men or persons who have dependents. All soldiers returning from the service who were in the employ of the company when they entered the service, and who have not any home or means to provide themselves with board and lodging, are being furnished with the same free of charge, and as soon as they secure employment they start out free of debt.

The number of idle men in the district among the miners is not as large as a few months ago, because of the fact that the young men are seeking employment elsewhere. Some are going to work on farms, which now offer a good rate of wages; others secure work at small mining districts where persons are opening up silver properties. Silver mines which had been operated many years ago and which were good producers, but had to close on account of the lack of demand for the metal, are being reopened by Eastern capital, equipped with modern machinery. This is particularly true in the Philipsburg, Alder Gulch, and Basin districts. In addition to the Anaconda properties, the Butte & Superior and North Butte mines are working under a 60 to 65% curtailment.

SALT LAKE CITY, UTAH—Mar. 27

As to the Taxation of Metalliferous Mines in Utah, which has been occupying the attention of the mining interests for some time, it now appears that taxation will, after all, be fixed at the rate of three times the net proceeds, instead of at "not to exceed three times the net proceeds," as the State Senate has accepted the amendment of the House to the above effect. The only way out would be a veto of the Governor, who has been in favor of the bill as originally passed by the Senate "at not to exceed three times the net proceeds."

The U. S. Bureau of Mines at the University of Utah shows in its February report that much work was done during the month on the volatilization process for low-grade and complex ores of the state, on potash investigation (in this connection a process for treating low-grade alunite from Marysvale being sought, whereby both potash and byproduct can be recovered) on ore dressing, and in the treatment of oil shales from Utah and in the territory of surrounding states.

SPOKANE, WASH.—Mar. 28

Mother Lode Copper Mines Co., of Alaska, has been permitted to consummate the sale of its property to Stephen Birch, who agreed to organize a corporation known as Mother Lode Coalition Mines Co., which would take over and operate the property, according to a decision of the Supreme Court of the State of Washington dismissing an injunction obtained by an objecting stockholder on Nov. 15, 1918. This is the substance of a statement in which is summed up the legal effect of the decision given out by James J. Godfrey, president of the company:

"The importance of this decision is far reaching, because it validates the contract of May 7, 1918, between Stephen Birch and the Mother Lode Co. and leaves the road open for immediate consummation of that contract. Likewise it validates in advance securities of the Mother Lode Coalition Mines Co. before they are issued. It also effectually bars any attempt at further litigation based upon this contract. Mother Lode Coalition Mines Co. will file its articles of incorporation in Delaware and immediately take over properties now owned and operated by Mother Lode Copper Mines Co. of Alaska."

WALLACE, IDAHO—Mar. 28.

Hecla Mining Co.'s report for the year ended Dec. 31, 1918, shows a net income from ore sales of $3,996,061; income from other sources brings the total receipts up to $4,035,338. Expenditures for mining and development, $1,245,724; ore sorting, $86,542; hauling from mine to mill, $41,248; milling, $167,392; general expense, insurance and taxes, $306,547. Total expenditures, $1,847,554; net income, $2,187,783; depreciation, $133,066; net profit for the year, $2,054,716. Assets listed in balance sheet include mining property, $4,309,942; permanent improvements, $1,055,474; Liberty bonds, $251,150; U. S. certificates of indebtedness, $1,575,000; ore in transit, $311,290, and cash, $88,046, the total assets being $7,833,025. Liabilities are accounts payable, $76,932; reserves for depreciation, $479,288; property surplus, $4,082,842; surplus, $2,943,962, making the total $7,583,025, from which is deducted capital stock, $250,000. During the year the company milled 309,656 tons of ore and shipped 15,133 tons crude, the gross operating expense, mining and milling, being $4.865 per ton. Total shipments were 52,893 tons; value, $3,996,061; value per ton, $75.549. Cost of production, $1,847,554; cost per ton, $34.929. Silver produced, 1,590,062 oz.; lead, 51,365,676 lb.; zinc, 433,341 lb. It required 8.19 tons milling ore to produce one ton of concentrates, and 7.18 tons of material was raised to produce one ton of shipping product. Ore reserves are estimated at 1,584,115 tons, being about five years' supply at the rate of production of the period covered by the report. Dividends for the year were $350,000, and total paid by the company was $7,255,000. A drift being run on 2000 level will open orebody at depth of 400 ft. below present lowest workings. The report states that the income and excess-profits tax for 1917 is still undetermined, and that the tax for 1918 will be undetermined until the first is settled.

PHOENIX, ARIZ.—Mar. 28

The Fourth State Legislature has adjourned with little action taken on mining subjects. Among the measures killed were the English-speaking bill, aimed at the Mexican labor camps of Ray, Ajo and the Clifton district; a bill calling for electrical blasting, a bill for marking time on fuse wrappers, a new hoisting-signal code, and measures creating the office of boiler inspector, making liens on mining claims for labor run till date of payment of full wages, and providing a state hospital and home for miners, with appropriation of 5% of the state's total tax on mines and taxing private employment agencies out of business. Among the acts passed were: Demanding establishment of heated change rooms in smelteries and reduction works, with shower baths and toilet facilities; defining mine-boundary marks to be six substantial posts, projecting at least four feet from the ground, or substantial stone monuments, at least three feet high; allowing condemnation of private ways of necessity over mining claims; granting a bonus of $10,000 for the first Arizona oil well that shall produce at least 50 bbl. a day for a week; making it a misdemeanor to utter false statements in matter printed in offering for sale any real or personal property; providing a regular tax upon capitalization for investigation of all companies that offer stock for sale. The last, especially drawn against "wild-cat" mining and oil companies, already is in effect, with William Graham, of Phoenix, as inspector, under the Corporation Commission.

The legislative commission appointed two years ago to secure data concerning the proposed establishment of a state smeltery and sampling works reported that it had taken no action. The presiding officers of the two houses have been authorized to appoint three members each on a new commission, which is allotted a $5000 expense account.

JOPLIN, MO.—Mar. 29

An Effort to Decrease Royalties on properties in the Oklahoma section by interesting the Federal Government in lowering high charges is being discussed here. It s pointed out that many Indians are receiving no income from their lands, owing to the fact that the excessive royalties charged by owners of the second, third and fourth leases make it impossible for the company holding the ultimate operating lease to continue production.

Prohibitive Tariff on Zinc Ores is wanted by operators in this field, and an effort will be made to obtain it. Following a talk by Congressman R. W. McPherson before the mine operators and business men of Webb City, a committee of ten men, one-half operators and one-half from other businesses, was selected to coöperate with the Representative to get a tariff. Mr. McPherson frankly stated his position as favoring a tariff high enough completely to stop zinc-ore importations from Mexico.

Profit-Sharing for Mine Workers has been decided upon by the Miami Wonder Mining Co., operating a concentrator about a mile southeast of Picher, Okla. Definite details have not been worked out, but it is proposed that every worker at the property, both above and below the ground, shall benefit from any profits that are made above actual production costs. Such a plan has been talked of in this district before, but this is the first company actually to give the scheme a trial. Fred D. Whiting, of Oklahoma City, is president.

BIRMINGHAM, ALA.—Mar. 27

The Birmingham District is now being seriously affected by the general slowing down of the iron and steel business throughout the country. Opinion is divided on prospects, though pessimism is not rampant. Many think that the situation is a little dubious, but all are confident that the buying movement may bring about a change from the uncertainty that exists.

There is not a large amount of iron in furnace yards in the Birmingham district. About 42,000 tons of off-basic iron is said to be stored, with not more than 50,000 to 60,000 of analysis iron to be found. Curtailment of production has not stopped, two furnaces being scheduled to go out of blast this week. The furnace at Sheffield has banked fires. The Republic Iron and Steel Co. has two furnaces in blast at Thomas, with some iron noticed in yards. The Sloss-Sheffield Steel and Iron Co. has three furnaces in operation, the Alabama Co. has two going, one at Ironton and one at Gadsen, but there is doubt as to the future. A decision will be reached, it is expected, within the next two or three days. The Central Coal and Iron Co. has a furnace in operation at Holt. The Shelby Iron Co. is making charcoal iron.

Operations at all plants of the Woodward Iron Co. have been gradually slowing down since the first of the year. During March three furnaces at Woodward and the one at Vanderbilt have been banked, and all plants at Bessemer, except the byproducts works closed on Mar. 15. As a result of this slowing down, several hundred employees have been thrown out of work, though few are inconvenienced, owing to the gradual closing; in fact the mines and other large centers of employment have been running at half time and some even less for the last few months. The company has made no statement in regard to the general closing down. It is believed to be only temporary, because of the fact that the furnaces were banked and not blown out and arrangements were made through the company's employment bureau to keep the labor close at hand. The company's vertical shaft, known as Woodward No. 4, has reached a vertical depth from the surface of 1210 ft. The shaft will be carried to a point 1300 ft. below the surface, which is slightly below the ore measure, and development work done in the ore. Good progress has been made, everything considered, and an average of about 100 ft. a month maintained, even during the war period and extreme labor shortage. The sinking will be completed early in April. The work was held back considerably during the last month, because of encountering chert, this being particularly hard to drill. The E. J. Longyear Co., of Minneapolis, is contractor on this work and has made rapid progress, owing to good organization.

The Sloss-Sheffield Steel and Iron Co. is now running four and five days a week, eight hours a day. The 120 byproduct coke ovens, under construction at North Birmingham, will be completed this autumn. The Government had contracted to take practically all the byproducts of these ovens, and, though the company has been asked to suspend construction of the plant, it will be completed and the Government asked to compensate the company for the loss of earnings under the terms of the contract. The production of this company shows a decrease for the last year as against the prior two years in coal, iron and coke, the most important factor having been labor. More than 700 employees went to war, and a great demand existed for labor on Government construction in the territories where the company's properties are situated. The brown-ore mines at Russellville are being closed this week.

No changes have been made in the operations of the Republic Iron and Steel Co., and at present there is no indication of change. The furnaces are running on the same schedule followed throughout the war, and it is fair to say that this company is almost alone in this respect. This condition is largely owing to the furnaces being kept in repair during the war period and the high cost absorbed by the high iron market. The production at the company's Raimund group of mines has been steadily upward for the last three months. As the ore from these mines is self-fluxing, the cost of coke and fuel used in reducing it is lower than for any other ores of the company and most of the company's competitors, and the furnaces consume it as rapidly as mined. For this reason there is little probability of these mines being closed, although a great deal of work neglected during the war for the sake of production must now be carried out. The company's Spaulding mines are now stocking, and, though this ore is not so valuable as the Raimund ore, there is no indication of these mines closing. Electric tramming is now in operation at Spaulding, it being the first ore mine in Alabama to adopt electric haulage. This is no innovation, and only the backwardness of operators has prevented them from using it, as it has been used in other districts and is one of the economies that will have to be worked out. Electric tramming is bound to come as the distances become greater and if labor is to be maintained at the present high scale.

On Mar. 17 the keel of the first steel ship to be built by the Chickasaw Ship Building Co., a subsidiary of the Tennessee Coal, Iron and Railroad Co., was laid at Mobile, Ala. The steel was produced at the Tennessee company's steel mills at Ensley, Ala., worked over at the big Fairfield plant, and sent to the shipyards. Fabrication of steel plates is now being done at the Mobile fabricating plant, and, as the Fairfield plant is rapidly progressing toward completion, it is expected to begin the fabrication of steel plates there by the middle of April, the plate and blooming mills already being operated. The plans of the company are to lay keels until eight ships are under construction at one time, plenty of steel being in sight. It is understood that the first ships built are for the use of the company, but there is no doubt the increased demand after the peace settlement will use all the company can build. At present there has been no general cut in wages or force, though the employment and accounting departments have had some reductions, and in the operating departments of all plants a close trimming is taking place, with the view of weeding out extra or incompetent men the company was forced to employ during the war period. Of the five furnaces owned by this company in Bessemer, one is down for repairs and two are down for lack of orders for pig iron. The hot metal from the other two furnaces is being shipped direct to Ensley for use in the steel mill.

The blast furnace of the Gulf States Steel Co. at Gadsen, Ala., is scheduled to go out of blast this week. This company has three of its six openhearth furnaces in operation. Plenty of basic iron is on hand, hence the decision to shut down the blast furnace at Gadsen. There are still a number of orders on hand for finished steel products, wire nails, and like materials, but no new business is reported. The company's Shannon mine, which had been sunk to a depth of about 2000 ft., with a year more to go before reaching ore, was closed during March.

DULUTH, MINN.—Mar. 27

Shipments of Iron Ore from the Mesabi Range will be greatly facilitated from this time on by the operation of the new ore dock which the Duluth, Missabe & Northern R. R. will put in service on or about May 1. The new dock is known as No. 6, and in all its dimensions is the largest of its kind in the world. It is 2438 ft. long, 84 ft. high and with a storage capacity of 3000 cars, or 153,000 tons. It outstrips its nearest competitor by 33,000 tons, or the equivalent of a cargo each for three of the largest Lake freighters. It was built by the American Bridge Co., and cost $3,500,000.

The Preliminary Mineral Survey of about 300,000 acres of cut-over timber land situated in northeastern Minnesota has been ordered continued by the directors of the Virginia & Rainy Lake Co. The survey was started some time ago by Prof. C. K. Leith, and later suspended by press of other affairs. It is now about half finished, and Professor Leith has been directed to complete the work as soon as possible. Many portions of the tract are adjacent to operating mines, and a good deal of it lies at the extremities of both the Mesabi and Vermilion ranges as now established.

HOUGHTON, MICH.—Mar. 27

Calumet & Hecla's Action in passing the quarterly dividend is the most actively discussed subject in the Michigan mining district. This is due to the fact that a larger proportion of Calumet & Hecla stock is owned in Michigan than of any other mining company and because a great number of Calumet & Hecla shareholders here depend for their livelihood on the company's dividends. Generally the deferred dividend action has been accepted by shareholders as marking a course in consideration of the rights of employees that is radical and new, but justified. The fact is understood here that the company today does not know whether it is operating at a profit or a loss. It is not selling enough copper under existing conditions to show anything. Though the treasury surplus is large, it will be needed if the organization is to be kept together during this period of depression and be able to carry the output of copper, which continues to accumulate by the hundreds of thousands of pounds.

TORONTO, ONTARIO—Mar. 28

The "Sale of Shares Act," generally known as the "blue-sky law," was introduced in a modified form on Mar. 26 in the Ontario Legislature by Hon. I. B. Lucas, Attorney General. The clauses respecting the shares of mining companies or syndicates were stricken out, Mr. Lucas stating that the government had been deluged with objections to this feature of the bill, on which it had been found impossible to get any basis of agreement. He further intimated that it was doubtful whether the measure in any form would be passed at this session, as the question of proceeding with it, or leaving it for further consideration, would be determined by the attitude of the members when it came up for discussion at a later date. As this is the position taken by the government, it seems altogether probable that the bill will be shelved for the present. Though much of the opposition to the bill so far as it concerned the mining interests came from promoters of doubtful enterprises or those having shares of little or no value to dispose of, there was at the same time, a strong feeling among mining men that the measure would adversely affect legitimate undertakings. Although admitting the desirability of further legislation to protect the public against fraud and misrepresentation, they looked with considerable distrust upon the proposal to place arbitrary powers in the hands of a commissioner, who would probably owe his appointment to political influence and might be entirely unqualified by technical knowledge or experience for the duties of the position. The success or failure of the law, it was urged, would be entirely dependent upon its administration by the commissioner, and considering the frequency with which the public interest is sacrificed to political expediency in making such appointments, the risk of serious detriment to the mining industry counterbalanced any possible advantage to be secured by the enactment of such a law.

The Mining News

ARIZONA

Cochise County

PHELPS DODGE CORPORATION (Bisbee)—Plan to resume work on concentrator.

Gila County

IRON CAP MINES (Globe) — Having plans prepared by D. Cole for a mill.

Mohave County

SILVER BELL EXPLORATION (Hackberry)—Has been incorporated by W. W. Lewis, who will drive 400-ft. tunnel on steep hillside to vein, 30 in. wide, sampling $25 at 100 ft. of shaft depth.

NEW COMSTOCK (Kingman)—At local meeting, company arranged for financing development of Catherine mine, in Blue Ridge range, lately examined by O. H. Hershey. Milling ore 33 ft. wide has been crosscut beyond faulting that caused abandonment several years ago. W. C. Howard, manager.

RICO EXPLORATION (Kingman) — Shipped carload to Humboldt, sampling $360 in gold and silver. Ore was taken out by M. C. Cleveland, manager, in drifting operations.

WALDRON (Kingman) — Will drift on 600 level to southward. George Hill in charge.

UNITED EASTERN (Oatman) — Has secured injunction against Tom Reed company, preventing any working in ground claimed by latter under alleged apex rights.

Pinal County

MAGMA COPPER (Superior)—February production of copper was 1,211,175 lb.; January, 900,000 pounds.

Santa Cruz County

AMERICAN BOY-HOSEY (Patagonia)—Lease taken from Clarke & Peterson by Gross & Kennedy, of Duluth, who will build wagon road, install adequate surface equipment, and sink shaft 300 feet.

CALIFORNIA (Patagonia)—Operated by Bethel & Wilson, with reported cutting of 6 ft. of commercial ore.

DUQUESNE (Patagonia)—Started upon development with view toward possible erection of mill.

EL PASO (Patagonia)—Property near Mowry, under management of W. J. Mitchell, sinking shaft to 400 ft., to strike sulphides. Company has $35,000 surface plant. Mr. Mitchell also managing nearby Olive mine for Arizona Consolidated Copper Mines Company.

HARDSHELL (Patagonia)—Shipped a carload of good ore taken out in sinking new shaft. New hoist has been installed.

MORNING GLORY (Patagonia) — Will ship 500 tons manganese a month. Manganese also now being shipped from Salvadore property.

MOWRY (Patagonia) — New strike of silver-lead found on 250 level. Experimental mill planned by company's main stockholder, A. J. Hazeltine, of Warren, Penn., now on ground. Manganese lease on same property operated by Shaw & Daughs.

THREE R (Patagonia) — Several new chutes of good copper ore cut at depth.

Yavapai County

CONSOLIDATED ARIZONA (Humboldt) —G. M. Calvocoresses, manager, states the payroll has been reduced less than 50% and now numbers 400 employes in all departments. The Blue Bell and De Sota will be kept in operation, and only loss will be in custom patronage.

GADSDEN (Jerome)—Drift on 1200 level passing through shist carrying particles of chalcopyrite and native copper.

UNITED VERDE EXTENSION (Jerome) —Planning to build extensions to copper smeltery.

BOGGS (Mayer)—E. E. Hill, of Mayer, has purchased of Douglas, Lacy & Co., of New York, the tailings dump of the old Boggs-Hackberry smeltery, first operated by the Commercial Mining Co., a Phelps Dodge corporation. The ore was basic, heap-roasted, and contents of the slag and tailings are said to be recoverable by flotation concentration.

BRADY (Mayer)—Old property in Turkey Creek district showing high-grade silver ore at bottom of 150 ft. shaft. Charles Batre, of Big Ledge Co., and James O'Brien, of the Henrietta, interested.

LIBERTY (Mayer)—Preparing to sink to 1000 ft. and installing new hoist and compressor. D. G. Kidder, in charge.

ARIZONA BINGHAMTON (Prescott)—Having plans prepared by D. Cole for the construction of a mill and tramway. Estimated cost is several hundred thousand dollars.

RUBY SILVER, DESORIS AND BLUE DICK (Prescott)—Three old silver producers in the Jersey Lily belt are to be reopened. Ruby Silver has already completed about 200 ft. of development tunnel.

ARKANSAS

Boone County

HARVEY (Zinc)—The J. P. Harvey Mining Co. started operations again on property in Coon Hollow; making good production of hand-cobbed silicate of zinc. Also taking out considerable rich mill ore.

RHODES-MANCHESTER (Zinc) — The McCurry Mining and Milling Co., operating this and other mines in this camp, will start work on a concentrating plant at once. Machinery has been purchased. Plant will be of 100 tons' capacity. Ore developed for continuous operation.

Marion County

LONNIE BOY (Rush)—Articles of incorporation were filed at Yellville and at Little Rock this week for the Lonnie Boy Mining Co., which is operating the zinc mine at this place. Officers are: W. E. Layton, president; Pat McCormick, vice-president, and Stanley Hanford, secretary and treasurer. Work in progress at the property, and results satisfactory.

CALIFORNIA

Amador County

EAST EUREKA (Sutter Creek)—To retreat sulphurets from 20-stamp mill not operating for several years. Mine was developed and produced good ore, but through improper management was forced to close.

OLD EUREKA (Sutter Creek)—To build station at 3000 ft. depth, the lowest point of shaft.

Calaveras County

HERZER (Railroad Flat)—Reported that agents of George Wingfield are sampling this and Fritz Seeman mine. Recent strike of good ore in latter reported.

Madera County

SIDNEY COPPER (Raymond)—Installing leaching plant. Ore to be hauled on motor trucks from mine at Green Mountain.

Nevada County

IDAHO-MARYLAND GOLD MINES CO. (Grass Valley)—Incorporated with $3,000,000 capitalization to operate Idaho-Maryland mines. Metals Recovery Co., of New York, is the holding company, which recently also took over the Gold Point and Union Hill.

CHAMPION (Nevada City)—Good grade of ore extracted. Full crew employed. Opening new territory.

THREE SEVENS GOLD MINES CO. (Nevada City)—New incorporation substituted for the Norambague Consolidated. New York men, owners.

Riverside County

SILICA ORE mined at Murietta is shipped to Los Angeles for use in manufacture of pressed brick. Large tonnage reported.

San Luis Obispo County

MANGANESE ORE recently shipped through San Luis Obispo reported to have sold at San Francisco at $40 per ton, the ore containing 54% manganese, 17% dioxide, 2.4% silica. The same grade of ore sold previously at $125 per ton, and A. H. Simpson, the shipper, states the operation is unprofitable.

Santa Clara County

MAGNESITE MINES at Morgan Hill reported closed and 50 men out, owing to the declining market since the signing of the armistice.

COLORADO

Teller County

PORTLAND (Cripple Creek) — Has opened promising bodies of high-grade ore in new development of lower levels.

IDAHO

Kootenai County

OLD HICKORY (Cœur d'Alene)—Drift reported run 300 ft. from tunnel level following oreshoot 2 to 4 ft. wide. Wood being used for fuel, because of lack of coal, and power for machine drills being obtained from star property. Employing two shifts.

Shoshone County

COPPER KING (Mullan)—Work will begin Apr. 1 by parties under bond and lease. Bond is for $250,000, $10,000 payable first year, $40,000 the second, and $50,000 each year thereafter. Bond also provides for construction of mill of at least 50 tons' daily capacity and to keep not less than 14 men employed continuously. Estimated that 3000 tons milling ore, lead-silver, on the dump, with much ore available in mine.

IDAHO-CARBONATE HILL (Mullan) —W. D. Greenough, president, announces work will be resumed about May 15. Shaft down 400 ft. Will crosscut nearby vein and continue sinking to 1000 feet.

COLUMBUS (Murray)—Contract let to drive crosscut 100 ft. to intersect second vein. Main tunnel in 800 ft., with considerable lead-silver ore, but not of commercial quantity. Owned by Pennsylvania and New Jersey interests.

KANSAS

Joplin District

BLUE MOUND (Baxter)—Has started sinking new shaft near north line to tap run being mined by Webber.

MAGIC (Treece, Kan.)—Has two shafts just down to ore northwest of Blue Mound. Jesse Graham, Coffeyville, Kan., president.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Put on few men Mar. 17; cleaning up mine, closed since Dec. 1. Will start actual mining operations soon.

Mesabi Range

MISSABE MOUNTAIN (Virginia)—Operating three shovels and ten locomotives on stripping. One shovel removing taconite along the north bank of Missabe Mountain, Lone Jack, and Ohio properties.

Vermilion Range

CHIPPEWA IRON (Ely)—Sinking shaft to depth of 300 ft. Shaft bottomed in partly clean ore.

SOUTH CHANDLER (Ely)—Producing 6000 tons per month; normal production about 10,000 tons.

MISSOURI

Joplin District

HEATON-HODGES (Granby) — Have begun sinking shaft on sheet ground section developed during last six months by drilling. Expect to sink four shafts and erect at least one large concentrator. Ten-inch hole put down for Pomona pump to help in shaft sinking. Ore lies below 210 ft. of solid lime formation. Warren Heaton, Granby, manager.

MONTANA

Granite County

SCRATCH ALL (Philipsburg)—Reported that considerable high-grade silver ore has been struck. Former producer.

TRUE FISSURE (Philipsburg)—Showing of high-grade silver ore, according to reports, has been struck. Shaft now down 500 ft. to be sunk to 1000 ft. depth.

Jefferson County

AMALGAMATED SILVER (Clancy)—Stoping silver ore for shipment from 100 and 250 levels on Free Coinage vein.

DAN TUCKER (Clancy)—Silver-bearing ore, in shaft at 280 ft. depth. Work to be resumed in April.

LLOYD-CROSSLEY STRIKE (Wickes)—Copper-silver ore at depth of 700 ft. in drift from breast of tunnel.

MOUNT WASHINGTON MINE (Wickes)—New strike in 4000-ft. tunnel breast changing to copper ore. Vein 40 ft. wide.

Lewis and Clark County

CRUSE CONSOLIDATED (Helena)—Drifting and crosscutting to contact vein at 400 level. Silver-lead ore in shaft vein.

WHITLATCH GOLD (Helena)—Shaft 500 ft. deep. Streak of commercial gold ore uncovered west of shaft at 450-ft. depth. Mill of 25 tons' capacity on the ground. Electric power.

PEERLESS QUEEN (Rimini)—Bunches of silver ore at 250 level.

NEVADA

Clark County

YELLOW PINE MINING (Goodsprings)—Discontinued shipments of zinc concentrates. Mill continued operating and zinc concentrates stored; lead concentrates shipped until Mar. 10, when mill shut down because of fire at mine on Mar. 6, which destroyed hoisting equipment. Installation of new hoist, compressors and electrical equipment expected to be in operation on Mar. 15. Mill being completely overhauled and calcining plant being installed for treatment of zinc concentrates during interval of shutdown. Morris P. Kirk, general manager.

Esmeralda County

TONAPAH DISTRICT ore production for week ended Mar. 15 was 7351 tons, valued at $124,967. Producers were: The Tonapah Belmont, 2259 tons; Tonapah Mining, 1050 tons; Tonapah Extension, 2220 tons; West End, 800 tons; Montana, 171 tons; Tonapah Divide, 245 tons; Jim Butler, 221 tons; MacNamara, 210 tons; Midway, 75 tons; Halifax, 100 tons.

Lyon County

MASON VALLEY MINES (Thompson)—February production of copper was 917,336 lb.; January, 1,111,000 pounds.

Nye County

ALLIED DIVIDE (Divide)—Owns four claims adjoining on south of Merced claim of East Divide. H. B. Ruhl agent and Gust Hanson manager.

BEN HUR (Divide)—Developing group east of Rosetta in eastern part of district.

DIVIDE ANNEX (Divide)—Has two claims adjoining Mammoth claim of Divide. Starting work. E. J. Ramsey secretary and agent.

DIVIDE CITY (Divide)—Adjoining Mammoth claim of Divide group; on main road, and will be site of Divide townsite. J. H. Miller president.

FLORENCE DIVIDE (Divide)—Installing hoisting equipment on group adjoining Sutherland Divide on southeast. J. H. Miller president.

GOLD REEF DIVIDE (Divide)—Owns group of five claims adjoining Gold Zone and Alto. Walter C. Lamb heads new company.

GOLD SEAM DIVIDE (Divide)—Nearly adjoins Rosetta, and has been worked for some time. M. E. Arnold manager.

GOLDSMITH DIVIDE (Divide)—Owns Gypsy claim, near Ben Hur.

GOLD WEDGE DIVIDE (Divide)—Started sinking on group in southeastern part of district. E. H. Mead secretary and W. G. Heller superintendent.

HIGH DIVIDE EXTENSION (Divide)—Adjoins High Divide on north.

MOHAWK DIVIDE (Divide)—Will sink deep shaft on large group adjoining Divide Consolidated on west. J. H. Miller president.

NORTH DIVIDE (Divide)—Has good plant and is sinking on group adjoining Sutherland Divide on west. W. E. Davis superintendent.

ROSETTA DIVIDE (Divide)—Will sink new shaft. D. F. Murphy manager.

SILVER KING DIVIDE (Divide)—Machinery on ground and shaft started. Gust Hanson manager.

HIGH DIVIDE (Divide)—Property, owned by Wingfield and Brougher, embraces high, cone-like mountain east of Tonopah Divide and adjoining East Divide on the north. Work will be conducted on a broad scale. William Watters superintendent.

ALTO DIVIDE (Divide)—Property, adjoining Gold Zone and East Divide, well equipped, and compressor will supply air also to East Divide. Sinking in progress on Alto No. 2 claim, near East Divide vein. Joe Mayer president and manager.

White Pine County

NEVADA CONSOLIDATED (McGill)—Will open a new company store at McGill; also at Ruth.

OKLAHOMA

Joplin District.

CHOCTAW CHIEF (Hockerville)—Taken over and being operated by W. H. Logan and associates.

UNDERWRITERS' (Joplin, Mo.)—Have put mules in No. 2 mine.

GOOD LUCK (Lincolnville)—Being operated by Mather Concentrating Co. Mill has been working tailings, but will handle mine-run dirt once more.

PROSPECTORS' (Miami)—Building new concentrator near Hockerville.

ANNA BEAVER (Picher)—Sinking new shaft on No. 2 property. Both mills idle, but expected to be in operation soon.

TEXAS

Matagorda County

TEXAS GULF SULPHUR CO. (Gulf)—On Mar. 18 pumping to first well started and production of sulphur began following day at rate of over 400 tons every 24 hours. On Mar. 23, second well started to produce, and two wells now making about 1000 tons daily, or about capacity of present plant.

UTAH

Juab County

TINTIC SHIPMENTS, week ended Mar. 22, amounted to 141 cars, or about 7000 tons, valued at $250,000.

CENTENNIAL-EUREKA (Eureka)—Winze from 1900 level understood to have been sunk 100 ft. below level; station cut preparatory to drifting. Water encountered below 1900, but flow not excessive.

CHIEF CONSOLIDATED (Eureka)—Sinking of No. 2 shaft, after completion of concreting thus far, resumed; concreting in future to be carried on at same time as sinking. Work to be pushed to 1000 level, from which connection with ore-showing in Plutus can be made, and this property developed to best advantage. Prospecting by churn drill new territory in eastern end. Assessment work to be done on individual claims rather than in central place.

GOSHEN VALLEY RAILROAD (Eureka)—Work started on this branch line from near Elbert to reach Tintic Standard and Iron King mines and furnish general outlet for eastern end of district. Line to be seven miles long, and hope to have operations well under way by July 1.

LEHI-TINTIC (Eureka)—Connections between new tunnel and older workings, in which some ore was left, to be completed within 200 ft. Better air available, and cheaper operation possible with connection.

TINTIC MILLING (Silver City)—Shipped 35-ton car of bullion in week ended Mar. 22. Value was higher than usual, being worth from $60,000 to $70,000. Mill treating 200 tons of ore daily, most of which coming from Dragon Consolidated under lease.

Salt Lake County

COLUMBUS-REXALL (Alta)—Five hundred-foot raise almost completed to bottom of old Toledo shaft reported to contain rich ore. Shipping good tonnage of low-grade ore from general clean-up.

OLD EMMA MINES (Alta)—This company, adjoining the Emma Copper, and Emma Consolidated, holding company for 90% of Old Emma Mines and Emma Copper stock, to be reorganized, and new company, a Utah corporation, to be formed. Columbia Trust Co. appointed trustee to handle Emma Mines. Assessment of 10c. per share announced, which will probably furnish funds to pay all amounts required, and leave working capital of approximately $100,000.

MIDVALE MINERALS (Midvale)—Has added considerable new equipment, including 90-ft. Dorr thickener of 500-ton capacity and centrifugal machine of 200-ton capacity per 24 hours for separation of finely disseminated lead from zinc. Product from latter shows 55 to 60% lead and 28 to 42% zinc.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Operations, after temporary shutdown, resumed; crew of 40 men, now working, to be increased. Shaft sunk to 700 level, 400 ft. below level productive last year, and crosscut being driven for ore expected at 300 ft. from shaft. Ore in this property grows richer with depth. Average contents on 300 level: Silver, 5.5 oz.; lead, 13%; copper, 2%. Mill at Salt Springs, 27 miles from mine at Gold Hill, treating 50 tons daily, to be moved to property and enlarged.

Summit County

PARK CITY SHIPMENTS, week ended Mar. 22 amounted to 1325 tons, as compared with 2034 tons the week preceding. Usual large shippers except Silver King Consolidated, but tonnages in general smaller.

WASHINGTON

Ferry County

QUILP (Republic)—Has resumed production after being closed several years. Stoping on large body of ore carrying gold and silver.

CANADA

British Columbia

GRANBY MINING, SMELTING AND POWER CO. (Anyox)—Expected to resume operations on Apr. 1. Plant closed the first week in March, when property was damaged by fire.

LOUIS CREEK MINING CO. (Louis Creek)—Has installed machinery for recovery of gold.

NELSON M. AND D. (Nelson)—Option purchased from P. J. Sheridan, of Nelson, on following properties in Lardo River Valley: Comstock, Noonday, Silver Hill, White Water, Barker, Rambler, Markwell, Spokane, March, Six Friends, and Volunteer. Consideration $60,000, to be paid over four-year period.

CONSOLIDATED M. AND S. (Trail)—Shipments received of ore and concentrates in first two months of 1919 totaled 65,733 tons, compared with 61,393 in same period of 1918, when five-week strike of smeltermen took place, and with 77,537 tons in 1917.

REPUBLIC (Slocan City)—Car of good-grade silver-gold ore recently shipped. Development work progressing.

Ontario

ADANAC (Cobalt)—Additional high-grade ore found on 310 level.

LA ROSE (Cobalt)—Report for 1918 shows production of 288,556 oz. of silver.

OXFORD (Cobalt)—Begining the development of two claims in the Keewatin area, opposite the Kerr Lake.

HITCHCOCK (Elk Lake)—Six-inch vein of high grade encountered at depth of 116 feet.

LAKE SHORE (Kirkland Lake)—In February mill ran 98.8% of possible running time, treating 1651 tons of ore and recovering $11,605, or an average of $25.20 a ton.

MINAKER-KIRKLAND (Kirkland Lake)—Operations recently resumed and a number of well-mineralized veins opened up on the surface. Shaft being put down on one of them. John W. Morrison, manager.

TECK HUGHES (Kirkland Lake)—In February treated 1683 tons of ore, averaging $10.97 a ton, as compared with 2459 tons, averaging $8.62, in January.

ASSOCIATED GOLDFIELDS (Larder Lake)—Number of employees increased to 75. Showings of gold ore encounted on 500-ft. level of Block B. Diamond drilling will soon be started.

DAVIDSON (Porcupine)—Preparing to start 10-stamp mill.

DOME MINES (Porcupine)—C. D. Kending, general manager, has returned from British Columbia. Work of installing large underground crusher will probably occupy about one month. Reopening of the mill is expected about the middle of May.

Quebec

MARTIN GOLD MINES (Hurricanaw Area)—Small mill installed, but production has so far been intermittent. Shaft is down 90 feet.

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver		Mar. Apr.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
27	4.5850	101⅛	49$\frac{7}{16}$	31	4 5850	101⅛	49¾
28	4 5850	101⅛	50	1	4 5825	101⅛	49$\frac{9}{16}$
29	4.5800	101⅛	49¾	2	4.6100	101⅛	49$\frac{3}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar. Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
27	15.05 @15.10	†	5 20 @5.25	4.90 @4.95	6 17½ @6.22½
28	15.05 @15.15	†	5.22 @5.25	4.95 @5.00	6.17½ @6.22½
29	15.10 @15.15	†	5.22½ @5.25	4 95 @5.00	6.17½ @6.22½
31	15.25 @15.35	†	5.25	5.00	6.17½ @6.22½
1	15.30 @15.35	†	5.22½ @5.25	5.00	6.20 @6.25
2	15.30 @15.40	†	5 22½ @5 25	5 00	6.20 @6 25

† No quotations.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0 125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Mar. Apr.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
27	79	77	83½	238	235¾	28	26½	39
28	78	77	83½	236½	234	27	26	39
29								
31	78	76½	84	233½	232	28	26	38½
1	79	78	84½	226½	224¾	27	25	37¾
2	80½	79½	84½	219½	217½	26½	25	38¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Apr. 2, 1919

The metal markets this week were characterized by continuance of the substantial demand for copper, which resulted in a further advance in price. Zinc and lead were featureless.

New export rates are about to be put into effect on export traffic to the Orient and Australia. The rates apply from the Missouri River and east through Pacific Coast ports. The new rates apply to several mineral commodities, as follows. Pig iron, 55c.; pig lead, 75c.; spelter, 75c.; zinc plates and sheets, 80 cents.

Copper—The business on a large scale that we reported last week halted on Wednesday and Thursday, immediately following the advance in price to 15¼c., regular terms. On Friday, however, large business started at that price, and on Saturday some very large business was done, still at the same price, though before the end of the day some producers advanced to 15⅜c., regular terms, and got small orders at that price. On Monday business in diminished volume was done at 15⅜c., regular terms, but, nevertheless, sufficient to cause some producers to feel justified in advancing their price to 15½c. before the end of the day. Some business was done at that price. The business of Tuesday was in the main done at 15½c., regular terms, but all producers did not come fully up to that price. On Wednesday, however, the market was fully established at that figure.

The volume of business transacted during the week was satisfactory, considering that it was wholly for domestic account. Buying was quite general, brass makers, wire drawers, and sheet rollers all participating.

The committee of the Export Association, comprising Messrs. Kelley, Clendenin, Douglas, and Agassiz, which has been abroad investigating foreign conditions and making business arrangements, returned on Sunday last. A public statement was issued on Monday, to the effect that business from abroad was not immediately to be expected, but might reasonably be looked for in the course of time.

Trading in copper was begun on the New York Metal Exchange on Mar. 31. The daily transactions have been insignificant. The big producers take no interest in the matter.

The trade is grieved over the death of Sam Rosenstamm on Mar. 30. He was a well-known figure in the selling of copper and was popular and highly asteemed.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17½@17¾c. per lb. f.o.b. mill, carload lots.

Tin—The situation is unchanged. Smelters being prohibited from selling anything, the only source of supply is the metal that is being distributed through the agency of the Government at 72½ cents.

Lead—The business of the week was light. One reason for the apparent dullness in this market is the large amount of lead that goes into consumption on average-price contracts. At present the proportion of the lead disposed of in this way is much larger than it was a little while ago when production was larger. Respecting business that was the subject of negotiation, there was more inquiry this week, especially in the latter part of it, and there was a firmer tone to the market.

Spanish smelters have been supplying lead to Belgium. With the present freight rate of 1½c. per lb. and with sterling exchange at 4.58, it is very difficult for Mexican lead to be sold in Europe.

Zinc—Small business was done from day to day on the basis of about 6.20c., St. Louis. On Apr. 1 news was received of strikes of smeltermen in some of the plants in Oklahoma in resistance to reduction of wages announced for that day. The two plants of the Bartlesville Zinc Co. at Bartlesville and the plant of the United States Zinc Co. at Sand Springs, are reported idle. At the other works in Oklahoma the smeltermen have accepted the reductions. On the news of the labor troubles, the spelter market stiffened a little.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—The market was dull at 6½@6⅝c. for spot. April-May shipments were quoted at 6½ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Fair business was reported at $67@70. Stocks in this market are reported to be only moderate. On the other hand, buying is merely of hand-to-mouth character. San Francisco telegraphs $70, steady.

Silver and Platinum

Silver—There is no change in the New York official price, but, owing to the improvement of London sterling rates, the London fixed price has declined to 49$\frac{3}{16}$d. London shipments last week were about 540,000 ounces.

A typographical error occurred in the New York silver quotation for Mar. 25. The corrected quotation is 101⅛c.

On Mar. 8 there were in Shanghai, according to Pixley & Abell's circular, 28,100,000 taels of sycee and 16,800,000 Mexican dollars.

Mexican dollars at New York: Mar. 27, 77½; Mar. 28, 77½; Mar. 29, 77½; Mar. 31, 77½; Apr. 1, 77½; Apr. 2, 77½.

Platinum—Unchanged at $99@100 for refined ingot.

Palladium—We quote $115@125.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 29—Blende, per ton, high, $43.15; basis 60% zinc, premium grades, $40; Prime Western, $37.50; sludge, $35; flotation, $33; calamine, basis 40% zinc, $26@25. Average selling prices: Blende, $41.47; calamine, $30.44; all zinc ores, $41.13.

Lead, high, $63.70; basis 80% lead, $60; average selling price, all grades of lead, $57.46 per ton.

Shipments the week: Blende, 11,801; calamine, 369; lead, 1650 tons. Value, all ores the week, $594,440.

A large portion of sellers declined to accept offerings of the lower level of this week, and purchases for Kansas, Oklahoma and Arkansas smelters were light. These smelters announced to workmen some time ago the necessity of a lower wage level to take effect Apr. 1. Smeltery workmen, it is reported, have announced they will not accept the reduction. As it looks now there is a chance that a number of these smelteries will go on dead fire, or close, if the workmen hold against the lower wage.

Platteville, Wis., Mar. 29—Blende, basis 60% zinc, $42.50 base for premium grade and $40 base for high-lead blende.

Lead ore, basis 80% lead, $55 per ton. Shipments reported for the week are 2091 tons blende and 54 tons galena. For the year to date the totals are 23,479 tons blende, 1033 tons galena, and 73 tons sulphur ore. During the week 3591 tons blende was shipped to separating plants.

Other Ores

Tungsten Ore—Charles Hardy reports under date of Apr. 1 as follows: "During the last week the tungsten situation has improved somewhat. There were still several small lots of Eastern ore offered for sale at low prices, but most of these lots have now been eliminated, and it has been impossible to fill a large order, as the quantity available amounted to only a small tonnage. Orders of 50 and 100 tons could not be secured, as most of the Eastern ore is held in strong hands and sellers are unwilling to accept such low prices as $6, which was accepted for the lots referred to. According to information from the West, there is only one mine working in the United States at the present moment, and this mine is only working to keep within the terms of the lease. Inasmuch as the mines in Bolivia, the Argentine and Burma, are also reported to have curtailed their production, if our stocks are not increased by further arrivals the tungsten situation should work itself to a more normal level."

Molybdenum Ore—No business was reported.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Unchanged.

Iron Trade Review

PITTSBURGH—Apr. 1

To all, or nearly all, iron and steel producers the results of the recent price reductions have been disappointing. It is true there has been heavier buying of finished steel products since the reduction, but for three or four weeks, while the reductions were in abeyance, there had been greatly reduced buying, and the common theory was that buyers were holding orders back so as to secure the benefit of the reductions. The buying now is not sufficient to make up the deficit. Of course, if buying would have decreased just the same if no promise had appeared of prospective reductions, then the industry is better off. No buying has come from any new quarter. The specifications and orders are coming from the same buyers as formerly, so that there is no indication that the price reductions operated to stimulate demand.

The steel trade adheres to its theory that price is not the consideration, that buyers are not ready to take hold, no matter what prices are quoted. It is held that next fall is the earliest time at which any widespread buying movement will occur. While the new prices are less than a fortnight old, the statement made at the time of their promulgation, that they were to hold for the remainder of the year, is being forgotten. Buyers, at least, will soon begin looking for another reduction. With the large profits shown for 1918 by earnings reports, computed by adding net earnings, taxes and various war-time adjustments together, steel buyers have no difficulty in seeing that war-time prices afforded large profits per ton, while the reductions to date have been relatively light.

Following the reduction of $5 a net ton in wire products and $7 a net ton in other hot-rolled products, makers of various descriptions of manufactured steel are reducing prices. Cold-rolled shafting is reduced $7 a ton to 28% off list; rivets are down $10 a ton to 3.70c. and cold-rolled strip steel is down $12 a ton to 5.65 cents.

Pig Iron—While the reduction in steel prices brought an improvement in demand, there is practically no improvement in pig iron, the market presenting scarcely any inquiry. Most furnaces have adopted the new prices. A few state that they have not, their object doubtless being to strengthen their position in refusing to adjust old contracts. While Pickands, Brown & Co., Chicago, notified all customers that they would bill contract customers at the new prices, beginning Mar. 21, the case is exceptional and not representative of the pig-iron trade generally. The Standard Sanitary Manufacturing Co. is inquiring for 3500 tons of southern iron for April and May delivery to its Louisville plant. W. P. Snyder & Co. announce their computation of March averages at $31.14 for bessemer and $30 for basic, at Valley furnaces. The market is quotable as follows: Bessemer, $27.95; basic, $25.75; No. 2 foundry, $26.75; malleable, $26.25; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh. The average quoted price on foundry iron in March was $27.72, Valley.

Steel—There is scarcely any inquiry, and none of importance. Specifications on sheet-bar contracts have improved somewhat, but mills are specifying only for immediate needs. Discard and shell steel continues to be available at special prices. For regular, soft-steel makers are adhering to recognized quotations: Billets, $38.50; 2-in. billets, $42; sheet bars, $42; slabs, $41; rods, $52.

Ferroalloys

Ferromanganese—Some of the furnaces have reduced their asking price on 80% ferromanganese from $200 to $150, delivered, but resale material continues available at $130, delivered. Demand is light or the resale material would be eliminated. Resale spiegeleisen is available at $42, shipping point, for 18%.

Coke

Coke—A meeting of coke operators in Uniontown last week developed the idea that furnace coke ought to bring $4.50 and that production should be restricted to actual requirements. Whether this will cause quotations at $4 to disappear remains to be seen. Operators are asking $4.50 for April coke on monthly adjustment contracts, but will probably agree to $4.25, as was done with the majority of such contracts for March. Week before last production was just under 200,000 tons in the Connellsville and Lower Connellsville, and the decrease in production continues this week. Some ordinary grades of foundry coke are available at $4.50, while a few makers quote $5.50 and even $6, chiefly to protect their contract shipments.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75.630	88.702	101.125	36.682	44.356	48.438
Feb	77.585	85.716	101.125	37.742	42.792	48.027
Mar	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	....	36.963	47.215	......
May	74.745	99.505	....	37.940	48.980	......
June	76.971	99.500	....	39.065	48.875	......
July	79.010	99.625	....	40.110	48.813	......
Aug	85.407	100.292	....	43.418	49.077	......
Sept	100.740	101.125	....	50.920	49.500	......
Oct	87.332	101.125	....	44.324	49.500	......
Nov	85.891	101.125	....	43.584	48.969	......
Dec	85.960	101.125	....	43.052	48.492	......
Year	81.417	96.772	....	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan	23.500	(a)	110.000	92.238	125.000	106.619
Feb	23.500	16.763	110.000	78.700	125.000	95.700
Mar	23.500	14.855	110.000	76.821	125.000	82.071
April	23.500	......	110.000	....	125.000	......
May	23.500	......	110.000	....	125.000	......
June	23.500	......	110.000	....	125.000	......
July	25.904	......	119.913	....	134.913	......
Aug	26.000	......	122.000	....	137.000	......
Sept	26.000	......	122.000	....	137.000	......
Oct	26.000	......	122.000	....	137.000	......
Nov	26.000	......	122.000	....	137.000	......
Dec	(a)	......	118.447	....	133.167	......
Year	24.628	......	115.530	....	130.507	......

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	....	329.905	....
May	(a)	....	364.217	....
June	(a)	....	331.925	....
July	(a)	....	360.347	....
August	(a)	....	380.900	....
September	(a)	....	343.905	....
October	(a)	....	335.543	....
November	(a)	....	323.550	....
December	(a)	....	267.736	....
Av. year	(a)	....	330.138	....

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	....	6.701		29.00	....
May	6.818	....	6.704		29.00	....
June	7.611	....	7.511		29.00	....
July	8.033	....	7.750		29.00	....
August	8.050	....	7.750		29.00	
September	8.050	....	7.750		29.00	
October	8.050	....	7.750		29.00	
November	8.050	....	7.750		31.20	
December	6.564	....	6.324		40.00	
Year	7.413		7.222	....	30.10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	51.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021	...	7.701		54.000	
July	8.688	...	8.338		51.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15		32.95	...	33.95	
May	36.20		33.00		34.00	
June	36.30		33.16		34.16	
July	36.60		34.40		34.40	
August	36.60		34.40		34.40	
September	36.60		34.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.15	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 1
Alaska Gold M	3⅞
Alaska Juneau	2¼
Am.Sm.&Ref.,com.	69¼
Am.Sm. & Ref., pf.	104
Am.Sm.Sec., pf., A	92½
Am. Zinc	13¾
Am. Zinc, pf.	43
Anaconda	61½
Batopilas Min	1¼
Bethlehem Steel	69¾
Butte & Superior	22½
Butte Cop. & Zinc	6¼
Cerro de Pasco	37½
Chile Cop.	23¾
Chino	35⅞
Colo. Fuel & Iron	42
Crucible Steel	66
Crucible Steel, pf.	93½
Dome Mines	12¾
Federal M. & S.	8½
Federal M. & S., pf.	36
Great Nor., ore ctf.	41
Greene Cananea	43½
Gulf States Steel	53
Homestake	98
Inspiration Con.	49½
International Nickel	26½
Kennecott	31¾
Lackawanna Steel	69½
Mexican Petrol	180¼
Miami Copper	23½
Nat'l Lead, com.	68
National Lead, pf.	109
Nev. Consol.	16½
Ontario Min	6½
Ray Con	20¾
Republic I.&S.,com.	82
Republic I.&S., pf.	102
Sloss-Sheffield	52
Tennessee C. & C.	13½
U. S. Steel, com.	98¾
U. S. Steel, pf.	114¾
Utah Copper	75½
Va. Iron C. & C.	55
Worthington Pump	65½

BOSTON CURB*	Apr. 1
Alaska Mines Corp.	‡.12
Boston Ely	1¼
Boston & Mont.	.54
Butte & Lon'n Dev.	.11
Calaveras	1
Chief Con	3¼
Contact	‡.05
Corbin	‡.25
Cortez	.12
Crown Reserve	.48
Crystal Cop.	.25
Eagle & Blue Bell	2 1/16
First Nat. Cop.	‡1 1/16
Houghton Copper	.15
Intermountain	‡.05
Iron Blossom	.35
Iron Cap	.10
Majestic	.10
Mexican Metals	.22
Mines of America	‡.05
Mojave Tungsten	.04
Nat. Zinc & Lead	.08
Nevada-Douglas	.15
New Baltic	1
Oneco	.20
Pacific Mines	‡.35
Rex Cons	‡.05
Yukon Gold	.70

SAN FRAN.*	Mar. 31
Alta	.01
Andes	.10
Best & Belcher	.06
Caledonia	.25
Challenge Con.	‡.03
Confidence	‡.03
Con. Virginia	.53
Gould & Curry	.03
Hale & Norcross	.15
Jacket-Cr. Pt.	.05
Mexican	.17
Occidental	.40
Ophir	.50
Overman	.02
Savage	.07
Sierra Nevada	.15
Union Con	.17
Utah Con	‡.02
Belmont	‡3.50
Jim Butler	.32
MacNamara	.53
Midway	.32
Mont.-Tonopah	.18
North Star	.09
Rescue Eula	.08
West End Con	1.10
Atlanta	.05
Booth	.32
Comb. Frac	.03
Florence	.70
Jumbo Extension	.14
Kewanas	.06
Nevada Hills	.03
Nevada Packard	.25
Round Mountain	.38
Silver Pick	.10
White Caps	.14

COLO. SPRINGS*	Mar. 31
Cresson Con	4.93¾
Doctor Jack Pot	.04¼
Elkton Con	.05¾
El Paso	.15
Gold Sovereign	‡.02
Golden Cycle	‡.77
Granite	.14
Isabella	.05½
Mary McKinney	.06½
Portland	1.00
United Gold M.	.10½
Vindicator	.40

BOSTON EXCH.†	Apr. 1
Adventure	‡.75
Ahmeek	67½
Algomah	‡.30
Allouez	38
Ariz. Com.	11½
Arnold	‡.20
Bingham Mines	‡8½
Bonanza	‡.10
Butte-Balaklava	‡.22
Calumet & Ariz.	59
Calumet & Hecla	405
Centennial	‡12½
Copper Range	42
Daly West	2½
Davis-Daly	5
East Butte	8½
Franklin	‡3½
Granby	‡70
Hancock	5½
Hedley	‡12
Helvetia	‡.25
Indiana	.50
Isle Royale	25½
Keweenaw	‡.99
Lake	4
La Salle	‡2½
Mason Valley	‡2½
Mass	‡1
Mayflower	3½
Michigan	‡2¼
Mohawk	55
New Arcadian	‡1½
New Cornelia	16
New Idria	‡9½
North Butte	10
North Lake	‡.50
Ojibway	‡1½
Old Dominion	34
Osceola	47
Quincy	53
St. Mary's M. L.	‡40
Santa Fe	‡.25
Seneca	‡13½
Shannon	2⅜
Shattuck-Ariz.	‡14½
So. Lake	‡1
So. Utah	12
Superior	‡4½
Superior & Bost.	2
Trinity	‡2½
Tuolumne	.75
U. S. Smelting	50
U. S. Smelting, pf.	48½
Utah Apex	2½
Utah Con	7½
Utah Metal	‡1½
Victoria	‡1½
Winona	‡.90
Wolverine	16½

N. Y. CURB†	Apr. 1
Big Ledge	⅝
Butte & N. Y.	‡.50
Butte Detroit	‡.05
Caledonia	.31
Calumet & Jerome	⅝
Can. Cop. Corpn.	1 1/16
Carlisle	‡2
Cashboy	‡.13
Con. Ariz. Sm.	1 5/16
Con. Coppermines	5
Goldfield Con.	.20
Goldfield Merger	.06½
Greenmonster	‡⅝
Hecla Min	4½
Howe Sound	‡3¾
Jerome Verde	⅞
Louisiana	.25
Magma	28
Marsh	.05½
McKinley-Dar-Sa.	.46
Milford	‡.75
Mother Lode	.45
Nixon Nevada	‡.40
Ohio Cop	‡⅝
Rawley	1½
Ray Hercules	1¼
Richmond	‡.56
Rochester Mines	.26
St. Joseph Lead	12¾
Standard S. L.	½
Stewart	‡.15
Success	.05
Tonopah	3¾
Tonopah Ex.	2¼
Tribullion	½
Troy Arizona	‡.10
United Eastern	5
United Verde Ext.	‡32½
United Zinc	½
Utica Mines	‡.08

TORONTO*	Apr. 1
Adanac	.17
Bailey	.04
Beaver Con	.43
Chambers Ferland	‡.10
Coniagas	2.00
Hargraves	.03
Kerr Lake	5.00
La Rose	.25
Lake Shore	.92
Min. Corp. of Can.	2.00
Nipissing	‡8.75
Peterson Lake	.07
Temiskaming	.30
Wettlaufer-Lor.	.04
Davidson	.68
Dome Exten.	.25
Dome Lake	.24
Hollinger	5.12½
McIntyre	1.82½
Newray	.12½
Porc. Crown	.26
Teck-Hughes	.26
Vipond	.20
West Dome	.13

* Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

April 12, 1919

Volume 107 *Number* 15

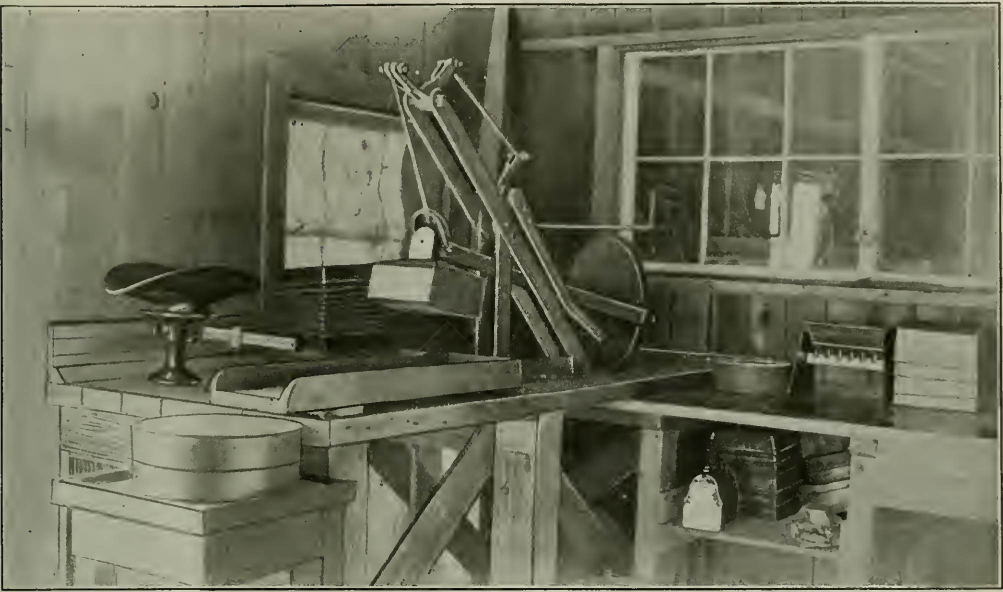


FIG. 1. A CORNER IN A MODERN SAMPLING PLANT, SHOWING AN AUTOMATICALLY OPERATED MULLER FOR BUCKING ASSAY SAMPLES

Sampling Practice at Independence Mill

By CLAUDE T. RICE

A detailed description of the plant and the methods of sampling at one of the newer mills of the Cripple Creek district of Colorado. Accuracy is increased by the elimination, as far as practicable, of the personal element and the substitution of automatic appliances of proved efficiency. Several interesting features are mentioned, including a mechanical bucking apparatus and a sample mixer and divider, both of which devices have proved satisfactory for the final handling of the pulp.

THE Independence mill, at Victor, Colo., was built by the Portland Gold Mining Co. to treat a considerable tonnage of custom ore, and an excellent sampling plant was incorporated in the design. The receiving bins are arranged side by side at the head of the coarse-crushing building, and consist of six 150-ton and six 75-ton hopper bins, over which run a track connecting with the narrow-gage system of the district, and a 24-in. track that serves the mine. The ore is crushed to 1-in. size before going to the bucket elevator serving the sampling mill—first in No. 7½ D Gates crushers to 2½-in. and then in Garfield rolls to 1-in.

At the head of the sampling mill is a small hopper bin of sufficient size to permit the remainder of the system to be cleared of ore before shutting down, in case some part of the crushing plant suddenly causes trouble, as well as to provide sufficient ore to insure regular feed through the sampling mill. The sample is taken by Vezin cutters, four in number, each of which takes a one-fifth cut. The first two of these machines are fitted with two wings, whereas the latter two have four wings each. Between each sampling the ore is crushed in rolls, being fed to them by a shaking tray feeder so as to get a thorough mixing of the pulp between samplings. The last pair of rolls has the faces set almost in contact, giving a nominal ⅛-in. product.

The final cut at the sampling mill is caught in an iron sample buggy such as is shown in Fig. 2, in which it is moved about the plant or stored until the sampling results have been accepted by the shipper. Present sampling practice at the Independence mill provides for ores that assay $4 or less a ton. For that reason it is not essential to mix the sample so carefully as would be required if a $20 ore was being handled, as at the Golden Cycle mill. This also enables a satisfactory sampling of the shipment to be obtained when cutting out only a 1-625th as the final bulk sample, even if there is a tendency for the gold-carrying minerals to go to the fine sizes. The third of the pulp that has been crushed the finest always carries at least two-thirds of the gold in a Cripple Creek ore, so that one-fifth is taken as the sample at each cutting down of the pulp and the sampler is run at as high a speed as is consistent with satisfactory results. Especially when the ore has been crushed to ¼-in. size and finer does the segregation of the gold into the fine pulp become markedly noticeable; and it is on that account that the last two Vezins are made with four wings, instead of with two, as is customary.

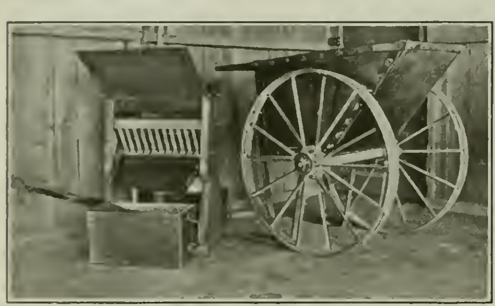


FIG. 2. JONES SPLITTER AND SAMPLE BUGGY

The sample, which, as it comes from the mill, has, with the exception of balls of clay gouge, been crushed so that all will pass a 4-mesh and 50% a 10-mesh screen, is taken to the plate room in the buggy in which it has been caught. There the sample is dumped on the floor, and all balls of clay or talc are chopped down to 4-mesh before it is mixed for final bulk splitting on the Jones splitter. This consists in distributing the sample, a shovelful at a time, into four pans. These are made of sheet iron, with the handles riveted on vertically (see Fig. 2), thus making it easier to pour the ore from them upon the splitter in a regular and even stream. As these pans hold about 80 lb. when full, four pans are usually ample. But in case that number should prove insufficient, the contents of the four pans are poured over the splitter and then the remainder of the original sample is shoveled into the four pans and this last portion of the sample split down and added to the rest before any of the pulp is cut down a second time.

THE JONES SPLITTER INSURES ACCURACY

No other mixing is necessary. Before any of the pulp is cut down, all reject from the previous split is returned to the original sample buggy for holding until acceptance of the sampling. This insures freedom from mix-ups. To minimize the possibility that inequalities present in the construction of the splitter may vitiate the results of the sampling, the rejection is taken first from one and then from the other side of the machine in splitting down custom ores. But as testing has shown this to be unnecessary to insure accuracy of sampling, and it is now resorted to merely to avoid any possibility of criticism by the shipper, this practice is not followed in the case of company ore; for, when it is not done, the sample can be split down more rapidly and with less work.

The final reduction is done in two small rooms partitioned off at one corner of the roll floor of the coarse-crusher building. To make the rooms as dust proof as possible they are built with double walls, paper being placed between as lining. Ample windows provide plenty of light and, in addition, remove any appearance of secrecy in the sampling. To facilitate shoveling and cleaning, the floor of the plate room is covered with turn sheets. Compressed air at 30 lb. per sq. in. is used in cleaning up the rooms and apparatus.

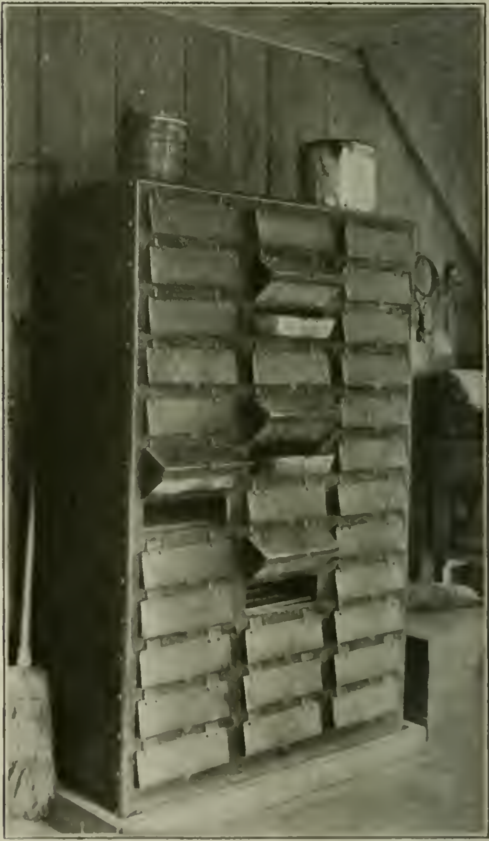


FIG. 3. SAMPLE DRIER

The bulk sample from the mill is split on the Jones splitter shown in Fig. 2. This consists of a cast-iron piece composed of 24 sections, each ⅜ in. wide, that is carried from 1-in. board end-pieces on wheels so that it can be moved about the plate room conveniently. A sheet-iron hopper feeds the pulp evenly over the top of the riffle-casting. Sheet-iron doors confine the dust as it rises from the pulp, yet permit easy access to both sets of channels in case a large piece of ore may jam in them. This splitter is made so as to halve the pulp each time that the sample is poured over it, and the cutting down of the sample is continued until the pulp is brought down to between 4 and 8 pounds.

REJECT SAMPLE IS HELD IN BUGGY

The reject is then properly labeled and wheeled to one end of the plate room, where it is held in the original buggy until the sampling is accepted by the shipper. A 5-lb. moisture sample is taken from the reject, which, after having been dried, is returned to the buggy.

The samples are poured into enameled iron pans in the bucking room and properly labeled. On these labels the company's lot number, the shipper's name, the shipper's lot number, the car number in which the shipment arrived at the mill, the number of the bin in which the shipment was stored, and the time at which the ore was sampled are given. Later, the times when the material is put into the drier and the grinder, and when it is made up into a 20-oz. sample and sent to the Coard mixer and divider are added. A complete history of the sample is therefore recorded on the tag which accompanies it.

A USUALLY NEGLECTED FEATURE OF A SAMPLING PLANT HAS RECEIVED PROPER ATTENTION

In Fig. 3 is shown the drier. This consists of a cast-iron front with sheet-iron sides in which are a series of steam coils forming 12 shelves, each of which will carry three samples. It will be noted that these doors are cast so that the bottom rim of the door above will catch upon the nose tip of the door below and thus hold it open —a convenient arrangement. The coils are heated by steam under a pressure of 15 lb. per sq. in. Usually the samples are allowed to dry overnight before being ground to 120-mesh. Enameled iron pans are used in handling the pulps in the bucking room, because they are much more easily cleaned than ordinary iron pans. The moisture sample is weighed as soon as it has been dried and the assay sample is sent on to the pulverizer for fine-grinding before being split down to final size of 20 ounces.

In the McCool pulverizer practically the whole sample is reduced to 120-mesh, and little subsequent grinding is necessary. The machine will grind a 6-lb. sample in about half an hour, after which it is thoroughly mixed by being poured from one pan to another. Then it is split by a small Jones splitter and adjusted by spatula so as to bring the weight of the final sample exactly to 20 oz. This is then passed through a 120-mesh screen. Less than an ounce will remain as oversize, and this is then bucked down on the King-Stanwood gravity muller shown in Fig. 1.

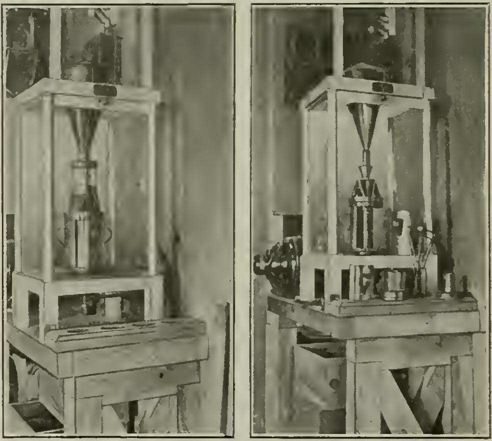
THE KING-STANWOOD MECHANICAL BUCKER

This simple and efficient device consists of a muller operated by a crank rod from the driving disk of the machine. On the raising and lowering of the connecting rod, the muller is given a rocking motion that simulates closely that imparted in hand bucking. A lever is provided for raising it while the pulp is being swept off the plate. The drive shaft is run at 60 r.p.m. by the same 5-hp. motor that drives the pulverizer. As the oversize from the 20-oz. final sample weighs less than 1 oz., it takes only a minute or two to grind it down to size with the gravity muller. This device is made by the Hassel Iron Works, Colorado Springs, Colorado.

The ground oversize is put through the 120-mesh screen and added to the rest of the sample, which is then poured into the hopper cone of the Coard mixer and divided. There the final sample is mechanically mixed and divided into four parts.

THE COARD MIXER AND DIVIDER

The Coard mixer and divider (Figs. 4 and 5) is an excellent device, for not only is it a time-saver, but its use also insures freedom from any suspicion of partiality in the splitting of the final sample. This is an important point when any marked segregation of the valuable minerals results from fine-grinding. When the quartering method is used, an expert sampler can dishonestly manipulate a number of types of samples in an effective manner during the final quartering and splitting operation if he so desires. As the Coard mixer and divider is entirely automatic in operation, can be cleaned quickly after each sample is put through it, and is so constructed that it requires little attention to keep it in perfect running order, it deserves special mention. The war has delayed its manufacture, and, up to date, the machines have been made by hand, and consequently only a few are in use. Now that the war is over, the inventor, A. J. Coard, of Colorado Springs, who was formerly in charge of the sampling at the Portland mill, intends to begin to put them on the market in quantity sufficient to supply the demand.



FIGS. 4 AND 5. COARD MIXER AND DIVIDER

MIXER AND DIVIDER OPERATIONS

The Coard mixer and divider is shown assembled in Fig. 4. In Fig. 5, it is shown taken apart as for cleaning. It consists of a mixing cone in which rotates a mixer that ends in a feed screw at the bottom, as can be seen in Fig. 5. From this mixing hopper the pulp is fed on to the slightly concaved base of an inverted cone that rotates at 600 r.p.m. From this cone the pulp is thrown, by centrifugal force, against the sides of a glass cylinder, and falls down into a stationary splitter that divides the pulp into four approximately equal parts. These four samples then feed through spouts down into the hoppers of the sample-cup spider, which rotates at 200 r.p.m. in an opposite direction to that of the cone, and which carries four cups that receive the final samples. The control samples are poured from the cups into envelopes, which are properly labeled and then sealed. An attempt was made to design the mixer and divider so that the four controls would be caught directly in the envelopes and sealed without any handling of the pulps by the person assigned to the work, but that was found impracticable.

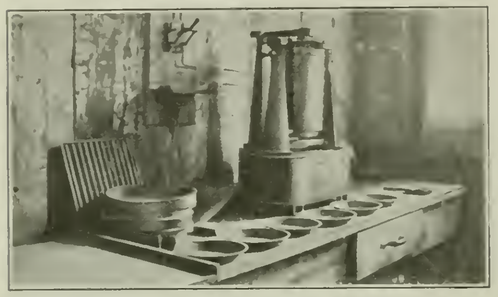


FIG. 6. RO-TAP SCREENING DEVICE

The device is contained in a glass case to protect it from dust. A ½-hp. motor drives the mixer and divider, which, owing to its design and construction, is easily taken apart and cleaned by compressed air after a sample has been put through it. The device has been in use for several years under the severest of tests, and has been found thoroughly satisfactory.

Probably no ore except one containing metallics is more difficult to sample and to divide than is the higher-grade Cripple Creek ore. The tellurides are rich in gold, and, in the crushing of the ore, they invariably break up considerably, with the result that the bulk of the gold is scattered through the pulp in the form of minute particles of rich telluride.

Mechanical Screening Adopted in the Laboratory For Screening Dried Mill Samples

In Fig. 6 is shown the Ro-Tap screen made by the Tyler Company, used in the cyanide laboratory of the Independence mill for screening the mill samples after they have been dried. On pulps resulting from fine-grinding of ore from the Independence and Portland mines and dumps, this screen works admirably. But there are certain ores, for instance this very Cripple Creek ore after it has been roasted, which will not screen properly when dry. In such cases a Ro-Tap or any similar device is not satisfactory. At the Independence mill the time necessary for putting the dry pulp through the series of screens has been found by testing, and an allowance made for safety. At stated intervals the Ro-Tap is stopped, and the washers used on the different screens are changed from one side of the pans to the other, so as to vary their paths of travel, and thus insure thorough rolling of the pulp on the different screen surfaces.

The Future of Geo-Chemistry*

Speaking recently at a joint meeting of the Liverpool Section of the Society of Chemical Industry and the Liverpool Geological Society, H. W. Greenwood said that, to the geo-chemist, every rock might be regarded as one of many components. Every change involved a change of equilibrium. In the study of these changes lay the province of the geo-chemist. The author referred to the work of van't Hoff, Liebig, and others, in the study of geo-chemistry and mineralogy, and of American investigators of recent times. They had proved that research paid, and paid handsomely. Reference was made to potash as a substance to which attention was now being drawn, and of the values of furnace dust as a source of potash. It was clear, Mr. Greenwood said, that much of the future supply of potash must come from furnace dust. Of 35,000 tons of potash required per annum, it was estimated that 15,000 tons could be obtained from the furnaces of Great Britain. That was a low estimate, and it should not be difficult to double it by the methods invented by Kenneth Chance. Regarding feldspars, the speaker thought it a waste of time to deal with these, when thousands of tons of potash could be extracted as byproducts from present industries. As a source of potash alone the feldspar industry had no future whatever.

Noting, in passing, Indian and Italian sources of materials from which potash could be obtained, the lecturer next referred to the large deposits of volcanic lavas. He thought that in these deposits there was a field that would pay for chemical investigation, and that further experiments should be performed. The work could be carried out in electric furnaces. If the methods proved feasible, it would then be possible to prepare silicates of known quality; and the information gained would be of great use to the ceramic industries, and would possibly be the means of utilizing vast quantities of material which were not now available, in those industries, owing to deleterious matter. All of the scientific work of those industries lay in geo-chemical investigation.

Refractories for furnace work were to be obtained, Mr. Greenwood declared, but it was different when the question of high-temperature research and investigation was approached. Modern methods of metallurgy demanded control of a totally different character from that of the past. He alluded to zirconium, tungsten, and corundum as valuable refractories. Investigations of these were, however, wanted, because furnace work in the future would depend on possessing the perfect refractory.

Speaking of the distillation of coal and shales, Mr. Greenwood said that, in 1918, it was found possible, on results obtained by the Glover-West retorts, to obtain a valuable fuel oil for use by the navy. It was most important that a supply of fuel oil not only for the navy, but for the mercantile marine, and for other uses, should be obtained from that source. It seemed to him that a more progressive policy of research was called for in that direction and in other directions also. It was well known that some of the bituminous shales had been found to yield as much as 30 gal. of oil per ton. The bituminous beds in Yorkshire yielded considerable amounts of shale, and it would be desirable to direct attention to the question of recovering the oil contained.

---

*Abstracted from the *Chemical Trade Journal and Chemical Engineer*, Jan. 18, 1919, p. 50.

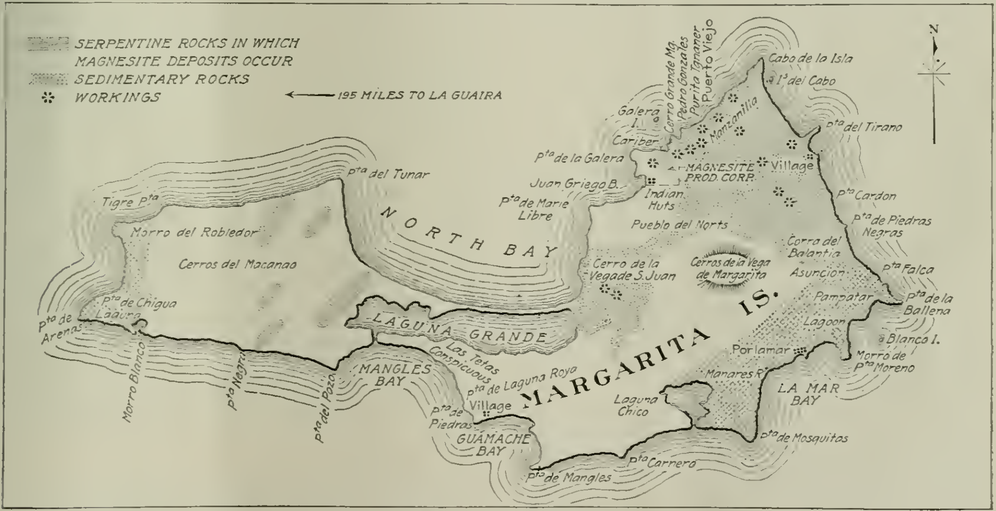
Magnesite on the Island of Margarita

By CHARLES F. Z. CARACRISTI*

Magnesite is an important industrial mineral, and the presence of large deposits of it accessible to ocean transportation is of considerable interest. Little success has attended the efforts to exploit these deposits, and whether magnesite can be produced from them in competition with other sources of supply at present is open to question.

THE growth of the market for magnesite in recent years has stimulated prospecting for this mineral in many parts of the world. The shortage of ships and the consequent lack of tonnage space due to the war have not only made importations from Greece, formerly one of the principal sources of American supply, impossible, but also prevented the working of the considerable magnesite deposits of the island of Margarita, Venezuela.

The island of Margarita is geologically a post-Eocene intrusion. It lies 11 miles north of continental Venezuela and 190 miles northeasterly from the port of La Guayra and is, in reality, two islands connected by a sand strip. An examination has convinced me that the two islands were formed at approximately the same geological time and that they were eventually connected by coral beds, which are now covered with sand and a soft tufa composed of limestone, silica, and iron oxide, together with cemented gravel and other shore wash. The western part of the island is known as Macanao, and contains an area of 110 square miles; the eastern section, or Margarita proper, contains 272 square miles. The neck connecting the two has an area of 36 square miles. It has a maximum length from east to west, following latitude 11° N., of 34 miles and a width of 16 miles from north to south. Although the island of Margarita was first occupied by the conquerers, and settlement began in 1520, there exists no map of the territory except the outline charts of the navies of the world based on the old Spanish data, slightly revised but as a whole incorrect. The government of Venezuela is now compiling a map, but as it is not based on an actual survey it will have little value. The Cerro de la Vega Mountain, reaching an altitude of nearly 10,000 ft., is in Margarita proper. The Cerro de San Francisco Mountain is in Macanao, and reaches an altitude of 7210 ft. There are many other high peaks on the island. The census of the island gives 70,000 inhabitants, but I am of the opinion that 50,000 is probably nearer the actual figure. I estimate that Macanao has less than 1200 inhabitants, and, owing to the fact that they live entirely in towns and villages, the greater part of the area of the island being mountainous, it is probable that 90% of the population occupies less than 75 square miles. The island is barren, and rain is not abundant. Sometimes three years pass without rain enough to develop a crop, and even drinking water is scarce.



MARGARITA ISLAND
From a U. S. Hydrographic Survey Map

All of the island except the area lying to the southeast and embraced by a line drawn from Piedras Negra Point to the northwestern extremity of the salt water lake known as Laguna Chica on the U. S. Hydrographic Survey map, shown on this page, and the western extremity of Macanao, is composed of basic igneous rocks, peridotite, pyroxenite, dunite, serpentine, talc, diorite, andesite, amphibole and a schistose rock that I have not been able to classify definitely. The amphibole, serpentines, soapstones and talcs, with their associate minerals, pargasite, asbestos, actinolite and chromite in small quantities, are associated with wolchonskoite and other chrome ochers, and magnesite.

---

*Geologist and consulting mining engineer, Macuto, Venezuela.

The line of contact between the igneous intrusions and what appear to be the upper Cretaceous sedimentary beds, forming the apex of a northeast and southwest anticline, is a siliceous limestone crystallized into a compact gray marble. This anticline is traceable from Point Piedras to Laguna Chica, a distance of 11 miles in a straight line. It is well defined, and the formation that lies to the south of and parallel to it consists of soft limestone, lignitic shales, and transition beds. The shales are exposed and can be best studied on the seashore at the Port of Pompatar.

At the extreme western end of the island, known as Macanao, metamorphic shales are found, but I am not certain whether these shales are of sedimentary or igneous origin. I am led to refer to them as metamorphic because, at a point, Boca Chica, at Punta Arenas, I found, in 1916, petroleum seepage, and also owing to the fact that to the east in the mountains I found what appears to be the contact with the basic igneous rocks forming San Francisco peak in the Macanao uplift. The seepage seems to offer hope that petroleum may be developed at or near this point.

MINERALS OF ECONOMIC IMPORTANCE

The only minerals of economic value found on the island are magnesite and talc. When I undertook the investigation of the deposits, in 1916, I found that there existed no data on the subject except such as had been published by a German promoter who operated in the United States, and who had apparently little accurate knowledge.

On the island of Margarita, the magnesite is found in two forms, first, in veins and seams, usually not continuous, in the serpentine, similar to the deposits in California; and, secondly, in deposits of large area occupying troughs composed of amphibole, pargasite and serpentine. The troughs are usually V-shaped and vary in width between wide limits. They are from 5 to 200 ft. deep. The larger deposits are assumed to be 200 ft. in depth, although no excavations have been made to that distance from the surface, but some workings on the deposits and tests indicate even greater depths. I have found that the deposits rise from the sea level to a height of over 1000 feet.

The widest trough is at the Maneiro ranch. The width of the deposit here is 284 ft. The channels that hold the magnesite have been eroded in the basic rocks by ancient streams, as may be seen at the Puerto Viejo quarries, which I operated in 1917. The removal of the magnesite leaves an opening such as would result from erosion by water, and the mineral does not follow the crevices caused by the cooling of the igneous rocks, as might be expected had the magnesite been formed prior to the troughs. Also, at the bottom of the magnesite, at the quarry known as the Manzanillo, I found, on the contact with the amphibole, water-worn gravel made up of peridotite and some opal. The magnesite found in these troughs consists of a honeycomb interlacing of seams that invariably inclose a fine sand. It is mechanically inclosed within the magnesite, as has been shown by the microscopic examination of hundreds of samples and by analyses. At one point, known as Risgo quarry, at Puerto Viejo, the sand contains considerable iron oxide, and it has formed a hard concrete that disintegrates on exposure to the atmosphere. The sand inclosed is usually fine enough to pass a screen of from 80 to 100 mesh. The sands contain less than 4% magnesia, 11% alumina and in rare cases lime varying from one-half of 1% to 2%. I have found at the quarry known as La Plata, at Puerto Viejo, as much as 2% of Cr_2O_3, but this was in a few exceptional cases. There is little doubt that the magnesite was deposited in the troughs subsequent to their formation. The precipitation of the magnesium carbonate was probably due to the magnesia-laden waters coming in contact with the carbon dioxide liberated by decomposing organic matter.

There is no doubt that the mountainous region on the slopes of which the magnesite is found has lost much of its height through erosion. Though the magnesite itself is of characteristic hardness, it has been the practice to work it with picks, owing to the fact that the walls of the stockwork are usually thin and offer little resistance. Associated with the serpentine at various points I found outcroppings of arfvedsonite carrying a high percentage of soda, as much as 20% in one instance and as low as 4% in another; also actinolite and anthophyllite, the latter carrying 25% magnesia and 51% silica. These conditions are general and refer to the Juan Griego-Mata Siete belt, which covers the northeastern portion of the island, and apply to all the deposits that exist in association with sand and refilled superficial channels that were untouched by the igneous flows. The probability is that the carbonate of magnesia is genetically related to the breaking down of the serpentine and other silicates of magnesia. The presence of soda and iron found in the anthophyllite and arfvedsonite might also have assisted the work of decomposition. I probably should not have stated that "these conditions are general," because they are modified by the substitution of inclosed clays in place of sand, but the analysis of the sand and the clay varies only slightly, the clay carrying lime in greater quantities.

The troughs or channels that carry the magnesite in many instances radiate from the center of the mountain cones or peaks. Thus the deposits are like the spokes of a wheel, and the principal peaks are the centers or hubs. However, the general topography of the region has undergone a marked change since the deposits were formed; but this change was caused by erosion and not by subsequent movements. These conditions are notable at the San Jose, Triano, Pueblo Viejo, and Maneiro outcroppings. In the mountains of San Juan similar conditions are found.

At the village of Alta Gracia, northeast of Juan Griego, the magnesite is found under conditions almost identical with those existing in the Deer Creek deposits of Tulare County, Calif. A 4½-ft. vein has been opened under my direction, and appears to extend for a distance of 3000 ft., cutting across a mountain known as the Cerro Grande. The magnesite is found on the contact between decomposed serpentine and amphibole. The prospecting work done was not sufficient to justify me in making a definite statement as to the exact size of this particular deposit.

The Alta Gracia-Pedro Gonzalez deposits, known as the Cerro Grande group of prospects, have a supply of magnesite in vein form of approximately 420,000 tons, according to estimates made by Dr. Amadoe Hernandez, Venezuelan government engineer. My own estimate, however, is far below this figure.

It is practically certain that these deposits will not be developed so long as the magnesite previously described is available, because of the lower cost of mining the trough deposits in comparison with the higher cost of mining the magnesite found in veins and stockworks.

ESTIMATED QUANTITY

I estimate the supply of magnesite on the island of Margarita to be distributed about as follows:

	Tons
Cerro Grande deposits, including Pedro Gonzalez	300,000
Pueblo Viejo-El Taque deposits	200,000
Manzanillo-Estacia-Mata Siete deposits	700,000
Tirano-Asuncion deposits	250,000
San Juan deposits	400,000
Macanao deposits (approximated)	350,000
Total estimated supply	3,200,000

The methods of mining the magnesite used up to the present have been of the most primitive type—pick, shovels, and wheelbarrows. It must be remembered, however, that the work accomplished has been mostly for the benefit of the promoters and the local management. In a country that has practically no skilled labor, the less machinery introduced the better; that is, unless the work is to be carried out on a large scale, such as will justify the bringing in of foreign mechanics and miners. The most important property on the island, known as Estacia, recently purchased by a New York company, as well as other deposits in the region covered by the Manzanillo-Estacia-Mata Siete group, can be successfully operated by the use of steam shovels. The deposits of the Pueblo Viejo and Tirano groups that lie near the Caribbean Sea can probably be cheaply operated by the hydraulic system, using salt water for the purpose. The hydraulic system cannot be applied in the quarries in the interior of the island, because of the scarcity of water. The steam shovel and the use of screens are next lowest in cost of operation.

COSTS AND ANALYSES

The experimental work which I conducted at Pueblo Viejo proved that, at that particular point, the cost of production of magnesite ready for shipment was $3.15 per metric ton. This was by hand work. At other points the cost was only $1.80, but both estimates included the cost of stripping the quarries. This expense should and can be reduced to $1 per ton at the quarry by operating with machinery and on a large scale.

An analysis of samples taken at Alta Gracia gave the following:

	Per Cent.
Magnesia (MgO)	47.13
Carbon dioxide (CO_2)	51.08
Lime (CaO)	0.22
Ferric oxide (F_2O_3)	0.38
Silica (SiO_2)	0.26
Alumina oxide (Al_2O_3)	0.70
	99.77

One sample taken from the Alta Gracia vein gave 2.23% sodium carbonate; another contained 0.37% of potash, and still another gave the surprising result of 51.88% MgO. This test was made in Virginia, in 1915, and I was at a loss to learn where the error was, but found when I examined the property that the magnesite in spots was filled with shot-like concretions. These on examination proved to be magnesium oxide. As under the microscope these concretions showed iron stains, and analyses gave 4% ferrous carbonate (not Fe_2O_3), I am inclined to believe that the difference was due to the chemical change brought about by the iron carbonate.

The average of a number of analyses in the Pueblo Viejo belt gave the following:

	Per Cent.
Magnesia (MgO)	46.71
Carbon dioxide (CO_2)	51.18
Lime (CaO)	0.05
Ferric oxide (Fe_2O_3)	0.26
Silica (SiO_2)	0.30
Alumina (Al_2O_3)	0.09
	98.59

The average of 62 analyses of the Estancia prospect gave:

	Per Cent.
Magnesia (MgO)	47.68
Carbon dioxide (CO_2)	50.98
Lime (CaO)	0.07
Ferric oxide (Fe_2O_3)	0.19
Silica (SiO_2)	0.24
Alumina (Al_2O_3)	0.15
	99.31

There is little doubt as to the value of the magnesite deposits of the island of Margarita, but the operation of the mines depends upon the ability of the Venezuelan government to control certain influences that dominate the local courts of the island. To this end General Gomez, the president, is said to be devoting his attention, and it is probable that he will succeed in eliminating the impediments that have interfered with the development of the magnesite industry. The cessation of operations by the only two companies working mines on the island, owing to local difficulties, has thrown 300 men out of employment and injured some American interests.

Auxiliary Power-Plant Requirements*

In steam plants power is required for running a number of auxiliaries, such as coal-handling apparatus, stokers, boiler-feed pumps, and circulating pumps. The methods used for obtaining this power are determined as a compromise between reliability, convenience, thermal economy, and financial economy. A careful consideration of all the methods warrants the following conclusions:

1. The smallest thermal cost for auxiliary power is incurred when generated by steam with complete absorption of the exhaust in the feed water.
2. The greatest possible part of all of the auxiliary energy required can be obtained in this way when the steam drives used with the auxiliaries have the greatest possible thermal efficiency.
3. Auxiliary power in excess of that obtainable with exhaust steam absorption can be procured from the main generators in electrical form at a lower thermal cost than in any other way.

To these conclusions may now be added two commonly known facts:

1. The increasing price of fuel is leading more central stations to the use of economizers.
2. The greatest saving is effected with economizers when the water supplied them is at the lowest permissible temperature. This value is probably somewhere between 120° and 150° F., depending upon the type of economizer used and the degree of care with which it is operated.

Because the Hostilities Are Over do not shift into careless spending, but thrift forward into wise saving. Buy W. S. S.

---

*Abstracted from Technical Paper 204, "Economical Operation of Steam Turbo-Electric Stations," Bureau of Mines, Department of the Interior.

Sources of Basic Refractories*

BY J. SPOTTS McDOWELL AND RAYMOND M. HOWE

MAGNESITE is an important refractory in openhearth, heating, and electric furnaces for steel making and in many of those employed in the metallurgy of copper and lead. It is sold in the form of brick, finely ground "furnace magnesite" for brick laying, and dead-burned grains for making and repairing furnace bottoms. The latter are a mixture of granules varying in size from pieces of about 5/8 in. diameter to fine but sandy particles. Dead-burned magnesite results from calcining the crude or lightly burned mineral at a temperature that will not merely drive off practically all the CO_2, but will also cause sintering of the particles. During this process the pieces shrink considerably and become hard, dense, and inert to atmospheric moisture and CO_2; under-burned material, on the other hand, will hydrate on exposure to the air. A small percentage of ferric oxide seems to be necessary for the production of a satisfactory sinter; from 4.5 to 8% in the dead-burned grains is considered the most desirable amount.

Dolomite has been little used for brick making in the United States, but it is prepared for use in the granular condition, calcined or "doubled-burned," and is the principal ingredient of several materials offered for sale under various trade names for refractory purposes. Dolomitic refractories are almost wholly confined to the openhearth and electric furnaces, where they are used for fettling and as substitutes for magnesite.

Much more magnesite and dolomite are used for basic openhearth steel making than for all other refractory purposes. The hearth of the furnace is usually built up of magnesite brick and dead-burned grain magnesite, so laid that the brick base is protected by a working bottom of the granular material. The latter is sintered into place in layers ½ to 1 in. thick to a total depth of 12 to 18 in. at the center of the furnace. After each heat, burned dolomite is thrown against the banks as high as it will stick, and all holes in the bottom are filled. At most plants such holes, at the end of each week, are also carefully filled with dead-burned grain magnesite. For temporary patching, dolomite is generally used, as it sets more quickly than is the case with magnesite and its first cost is less.

Prior to 1914, the world's supply of refractory magnesite came almost wholly from the crystalline deposits of Austria-Hungary. Its superiority lies in its high refractoriness and long range of vitrification, which enable it to frit together at high temperatures without fusion or excessive softening. These properties are imparted by a fairly high content of iron oxide, together with an extremely low percentage of harmful impurities. The dead-burned Austrian magnesite sold in the United States had the following range of analysis: MgO, 83.7 to 87.3%; CaO, 1.9 to 3.9%; SiO_2, 1.1 to 4.1%; Fe_2O_3 and Al_2O_3, 4.7 to 8.6%. With the cessation of shipping from Austria, magnesite was imported from Greece and Canada, domestic deposits were developed, and, as a temporary expedient, dolomite was substituted for magnesite where practicable. The deposits of this country are now developed sufficiently so that an adequate supply is available and ample reserves are blocked out to last many years. Table I shows the great expansion of domestic production since 1914. All figures are reduced to a calcined basis, assuming 2 tons of crude magnesite equal to 1 ton of calcined.

TABLE I. TOTAL MAGNESITE CONSUMPTION OF UNITED STATES ON A CALCINED BASIS

	1913	1914	1915	1916	1917
Net Tons:					
Imported ...	173,719	128,494	51,458	46,941	19,093
Domestic.....	4,816	5,646	15,250	77,487	158,419
Total..... ..	178,535	134,140	66,708	124,428	177,512

At the beginning of the war, the refractory manufacturers were crippled by a lack of calcining facilities, because the Austrian material had been imported in the calcined condition. The low iron content of the available magnesite caused additional difficulties. To obtain the proper sintering and bonding properties, it became necessary to add iron oxide and to incorporate it thoroughly by burning at an extremely high temperature. Magnesite thus treated, if sufficiently low in harmful impurities, is a high-grade refractory and has given conspicuously satisfactory service.

GRECIAN DEPOSITS

The deposits of Greece are of the amorphous type, and had been operated on a large scale for many years, but their output was rapidly increased after the war began. A considerable amount of magnesite was imported from Greece in 1915 and 1916, but shipments were suspended late in the latter year. Much of the Grecian product is of exceptional purity, as shown by the accompanying typical analysis of crude rock, though some of the imported material was high in CaO and SiO_2, owing, doubtless, to improper selection at the mines. The percentage of impurities after calcination will be practically double these figures, an account of the loss of CO_2.

TABLE II ANALYSES OF CRUDE MAGNESITE FROM GREECE

	Per Cent	Per Cent	Per Cent.	Per Cent.	Per Cent.
SiO_2	0.67	0.46	1.19	1.63	2.28
Al_2O_3 and Fe_2O_3	0.30	0.50	0.43	1.36	0.19
CaO ...	0.92	1.24	0.80	1.44	1.56
MgO	46.06	46.22	45.83	45.75	44.78
Ignition loss	52.16	51.51	50.42	49.88	49.76
	100.11	99.93	98.67	100.06	98.57

The magnesite of the Greenville District, Quebec, is white to grayish, finely crystalline, and high in lime, due to dolomitic inclusions. Wilson[1], in 1917, estimated that there were in sight a little under 700,000 tons in the deposits of the district containing less than 12% lime (equivalent to over 20% lime when burned). It has been stated that when calcined and mixed with furnace slag or dead-burned with iron ore, the Canadian magnesite has given satisfactory service in furnace bottoms[2]. However, the leading refractory manufacturers prefer the purer mineral of California and Washington, and endeavor to maintain the CaO content below 4% in the dead-burned material. During the period of greatest scarcity of magnesite, the Canadian product was utilized by several companies in the manufacture of magnesia brick as a minor constituent of the mix, but this practice has probably been entirely abandoned. It is, however, being employed for the production of dead-burned grain magnesite, by sintering with iron oxide in rotary kilns.

---

*Abstracted from a paper presented at the New York meeting of the A. I. M. M. E., February, 1919.

[1] M. E. Wilson, "Magnesite Deposits of Greenville District, Quebec." Canadian Department of Mines, Memoir 98, 1917, p. 52.

[2] A. Stansfield, *Iron and Coal Trades Review*, Jan. 12, 1917, p. 31.

California magnesite, which is of the amorphous type, is found at many places. It occurs in the form of veins, lenses, and stockwork in serpentine and the deposits are usually small. The largest and most important are those near Porterville, Tulare County, and St. Helena, Napa County. Prior to 1914, about 10,000 tons was being produced annually; hence the mines had not become sufficiently developed or equipped to produce large tonnages before the summer of 1916. Transportation was a serious problem in the rainy seasons, as nearly all of the deposits are a number of miles from the railroad, and hauling to the cars is done by means of trucks. Variations in quality at first caused the users considerable difficulty. It was often hard to keep the silica and lime contents within the proper limits, owing to the impurity of some deposits and the lack of uniformity in others, as well as to the common inexperience of the operators. Most of these difficulties were gradually lessened, and in 1917 the production had risen to 211,663 net tons of crude magnesite[3]. In the meantime, a considerable number of calcining plants had been erected near the mines, to give the rock a light burning before shipment. Since a loss in weight of about 50% occurs in this burning, a material saving in freight resulted. Recently the California production has fallen off, owing to the competition of the larger and less expensively operated deposits of Washington. The first analysis, which is uncommonly high in iron for magnesite of this type, is representative of a unique deposit near St. Helena, Napa County.

TABLE III. TYPICAL ANALYSES OF CALIFORNIAN CRUDE MAGNESITE

	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
SiO_2	3.25	5.18	1.10	3.86	1.55
F_2O_3 and Al_2O_3	2.20	1.10	0.40	0.80	0.45
CaO	1.25	3.34	Trace	2.04	1.38
MgO	43.87	41.92	46.54	43.47	45.68
CO_2	49.53	48.78	51.20	49.48	50.97
	100.10	100.32	99.24	99.65	100.03

The magnesite deposits of Washington have become a most important factor in the market since their discovery in 1916. A total of 715 tons of crude rock was mined and shipped in the latter part of that year, and 105,175 tons was produced in 1917. The mineral is finely to coarsely crystalline, and shows many variations in color from white to gray, pink, red, and black. Mining is done by both open-quarry and underground methods. It is reported that diamond drilling at the Finch quarry of the Northwest Magnesite Co. has proved the existence of more than 1,000,000 tons, and that on more than one of the properties an estimate of 1,000,000 tons within 200 ft. of the surface is reasonable[4]. Prior to the erection of calcining plants at the properties, many thousand tons of crude rock had been shipped in which the silica content was uniformly below 3.5% and lime less than 1.5%. The analyses given herewith are typical.

Calcination is now being done near the quarries, and dead-burned magnesite for refractory use to which iron oxide is added during manufacture is being produced in rotary kilns. The material as marketed by one producer has the following average analysis: MgO, 82.5%; CaO, 3.4%; SiO_2, 6.5%; Fe_2O_3 and Al_2O_3, 7.25%; loss on ignition, 0.5 per cent.

For many years prior to the war few basic bottoms in America had been built of dolomite, which was little used except for temporary patching and the fettling between heats. Since 1914, however, calcined dolomite and specially prepared dolomitic materials have been common substitutes for magnesite, being placed in the furnace in the same manner as the grain magnesite. Within recent months the tendency on the part of steel makers has been to displace burned dolomite by specially prepared dolomites for the temporary patching and to return to the use of high-grade magnesite for all original installations and major repairs.

TABLE IV. TYPICAL ANALYSES OF WASHINGTON MAGNESITE

	Per Cent.	Per Cent.	Per Cent.	Per Cent.
SiO_2	1.9	3.3	4.3	0.6
Fe_2O_3 and Al_2O_3	1.0	1.0	0.8	1.2
CaO	1.7	1.4	1.1	0.5
MgO	45.2	44.8	45.0	46.4
CO_2	49.7	49.3	49.5	51.0
	99.5	99.8	100.7	99.7

In the calcination of dolomite either vertical or rotary kilns may be used. In the latter case the rock is usually crushed to pass approximately a ⅝-in. screen, the fine powder screened out, and the granules burned. It is usually held that for best results the heat applied must be sufficiently intense not merely to drive off the CO_2, but to cause the pieces to shrink and become hard and dense. The rock is frequently "double-burned" by being heated in one kiln merely high enough to drive off most of the CO_2, and further shrunk in a second at a higher temperature. The usual range of composition of the crude rock is CaO, 28 to 35%; MgO, 14 to 20%; SiO_2, 1 to 7%; Al_2O_3, 0 to 4%; Fe_2O_3, 0.5 to 5%; CO_2, 43 to 46%. As high a magnesia content as possible is considered desirable.

Burned dolomite, as ordinarily prepared, air-slakes readily, on account of the high percentage of lime. For that reason it cannot be kept in stock for long, without deterioration, and should be made just before use. A dolomite bottom is likely to show considerable slaking after a shut-down of even comparatively brief duration. Dolomite does not set as solidly as magnesite, so that patches of a dolomite bottom are more likely to become detached and float in the bath.

SPECIAL DOLOMITIC REFRACTORIES

Within the last few years, numerous investigations have been undertaken in the attempt to overcome the marked slaking properties and other defects of calcined dolomite. As a result several articles consisting of specially prepared dolomite have been placed on the market under various trade names, some of which are superior to ordinary calcined dolomite, being more resistant to atmospheric slaking and giving better service in the furnace. In most of these preparations the granules are coated or impregnated with pulverized basic slag, iron ore, or similar material by burning at a high temperature in a rotary kiln. The attempt has likewise been made to coat the crushed rock with a pulverized slag suspension in water, so that upon burning a protective coating will be formed on the surface[5]. In other cases the slaking properties are diminished by using an impure dolomite, preferably one high in iron. The analysis considered most desirable may be obtained by mixing raw rock of different compositions.

---

[3] C. G. Yale and R. W. Stone, "Magnesite in 1917." Mineral Resources of the United States, 1917, Part II, p. 65.

[4] Yale and Stone: *Op. cit.*

[5] A. V. Bleininger, "Some Aspects of the Testing of Refractories." *Proc.* Eng. Soc. Western Penn., 1916-1917, Vol. 32, p. 612.

One patented material is prepared by grinding together dolomite and iron ore to form an intimate mixture and calcining at a temperature reported to exceed 2850° F. (1565° C.). The finished product for furnace bottoms is said to show the following range of analysis: CaO, 42 to 55%; MgO, 38 to 25%; SiO_2, 6 to 13%; Fe_2O_3 and Al_2O_3, 8 to 14 per cent.

Another compound consists of an intimate mixture of granular dolomite and about 10% basic openhearth slag. The manufacturers prefer hard, compact and dense varieties of dolomite, as high as possible in magnesia. It is said that the granules, after calcination in a rotary kiln at about 2800° F. (1540° C.), are mixed, upon coming from the kiln and while still hot, with the granulated slag and the mixture is sent through a rotary cooler. It is claimed by the manufacturers that material thus prepared may be transported without slaking when the magnesia content is high and the dolomite is extremely hard burned. The average analyses of several shipments is given herewith: CaO, 48 to 55%; MgO, 29 to 32%; SiO_2, 4 to 11.5%; Al_2O_3, 3 to 6.5%; Fe_2O_3, 4 to 7 per cent.

London-Paris Letter

By Mark R. Lamb

Whatever your business, and whatever your representative is expected to do, there are a few points to which he should attend immediately upon his arrival. This statement is based on the supposition that he wants to appear normal—not eccentric. Of course, if his idea is to be stared and smiled at, these notes are not for him.

For his own comfort and economy he should buy his supply of underwear, socks, shirts, ties, and collars in America before sailing. What he will find here is of miserable quality and enormous price. His hats, top coat and suits should be made in London. The quality of workmanship will be bad, as tailors and nearly all wool have been requisitioned for the army. The cuts, however clumsy, will be English, and therefore normal in London and Paris, as in the good old times. This is an important point when visiting European customers.

Provide your representative plentifully with sugar, or his temper will be bad from breakfast to bedtime. This morning a young Scotchman who was my neighbor at breakfast had found his sugar spilled through his grip. He managed to gather enough together to sweeten his porridge, but his tea lacked sugar, and he was angry. My *vis-à-vis* at lunch drew forth her jewel box and gazed at its contents longingly, finally choosing one small lump of sugar and several tiny scraps. Three officers haggled over a small soap box of coarse brown sugar possessed by one of them. Undoubtedly, this shortage of sugar has undermined the morale of the English nation.

A passenger is permitted to bring in but 1 lb. of sugar, yet most trunks are saturated with packages, and customs officers are not particularly keen on wasting time looking for sugar. When your representative comes, provide him with large quantities of sugar and candy, the first for his customers and the second for their wives. So long as his stock lasts he will be extremely popular and can get you much business.

The very best raincoats are none too good in quality, as the rubber and wool have been adulterated owing to the shortage of both. The price is $30 and over, and in both England and France this garment is a necessity, because the sun rarely shines here. Cigarettes are as popular here as in the United States, and smoking them is not objected to, but American Army men who chew tobacco certainly create a sensation—particularly the officers. In the bars, hotels, and clubs in America the cuspidor is ubiquitous, and personally conducted spitting is entirely unobjectionable. In England it simply is not done! Nowhere is a spittoon in evidence. You may object that it is necessary, or that it is indecent at times not to spit. I cannot help it. It simply isn't done! Colds? Of course! Half of England has a cough and a cold constantly; but that fact does not matter—it simply isn't done!

There are six or a dozen words and expressions in American vocabularies which have entirely different meanings in England. A friend was nearly thrown out of the club for using one of them. Your representative should get the assistance of a gentleman to explain these terms, as it is not possible to cover the points acceptably on paper.

When you start him off, remember that England is a manufacturing country and that Englishmen are patriotic. They are actually paying more now for longer deliveries and inferior goods of home production than would be necessary if purchases were made in America. Some of them are "fed up" with the prices and deliveries which they have been forced to accept lately in America. Cotton goods, heavy machinery, rails, and wire goods are due for a chilling surprise, in spite of the glowing expectations of the New York newspapers and the *Iron Age*. One of the largest American manufacturers of heavy machinery is removing his head office from London to Paris after 15 years. He expects little more business in his line to be placed in the United States by Englishmen.

In France the government policy is to prohibit importation of everything, even including equipment actually required to start industries. Industrials are ready to buy, and few fear competition, but the few are influential momentarily. France is expecting much help from the indemnity to be demanded from Germany, and we all hope she gets it; but deserving and getting are quite distinct. It is easily possible to feel so much self-pity, and to expect so much help, that self-help will be delayed over-long. It is also quite possible that after Germany is told to pay, she will find it difficult, and, without a stable government, impossible.

Everyone who has seen the devastated regions is in favor of their being restored at Germany's expense, and this will be done undoubtedly if it is possible, but France will not wait. I predict a great change in sentiment during the next six months. Opinion among representatives of American houses as to trade conditions varies with the success that each achieves. Some are fortunate in having good stocks ready for immediate delivery, and, when purchases are made through the comptoirs, all difficulties of importation fade away. Greater difficulty is experienced, however, in delivery on direct sales.

No safe generalization is possible, and the only way to ascertain whether business is obtainable is to come over and try.

Lincoln Said: "When an occasion is piled high with difficulty, we must rise to the occasion." There are war tasks to be concluded, readjustments to be effected, individual and national prosperity to be achieved. Buy W. S. S.

Estimating Screen Efficiency

By W. O. BORCHERDT*

Of late years there has been an increased realization of the importance of efficiency records of the work of the various units in an ore-dressing plant. The paper following discusses screen efficiency in detail, points out the fallacy of treating the subject only from the theoretical or academic standpoint, and draws attention to important alternative methods of estimation that deserve consideration.

WRITERS on ore dressing commonly refer to "screen efficiency," and occasionally this term is defined, as in the article by Prof. Robert S. Lewis,[1] wherein the efficiency of a screen is given as the weight of undersize passing through, divided by the total weight of undersize in the feed to the screen; and in the article by Harold Rabling,[2] wherein screen efficiency is defined as the tonnage of undersize divided by the tonnage of fine material in the feed sample.

Both writers give methods for determining the efficiency of a screen when screen analyses are given of the feed, undersize, and oversize products of the screen. Mr. Rabling, in addition, calls attention to the self-evident fact (which is, however, often overlooked) that the efficiency can be correctly derived only when the sizing tests of feed, oversize, and undersize samples of the mill screen are made on a hand screen clothed with the identical screening medium used on a mill screen. This should be done, regardless of whether or not a further screen analysis of each sample is carried out on ordinary testing screens, and if the screening medium on a mill screen has been in use any length of time, so that the openings have enlarged by wear, the efficiency test should properly be made upon a section of the screening medium cut from the mill screen. This procedure prevents the reporting of an absurdity, as Professor Lewis has done, where the cumulative analysis of the mill screen undersize shows 13.9% of plus 30-mesh material, whereas the mesh of the mill screen is stated to have been 30! If it is desired to know how much the holes in the mill screen have enlarged, that is a different question, one which has no connection with screen efficiency, and to be determined by preparing two hand screens, one clothed with a piece of the screening medium which has not been worn and another with a piece of the screening medium cut from the mill screen. A sample of the oversize of the mill screen should then be screened on the unworn cloth, until no more undersize passes through, the material remaining on the screen then being weighed and screened upon the worn screen to determine the percentage which will pass because of enlargement due to wear. Usually, of course, sufficient indication of wear can be obtained by an ordinary laboratory screen test of the undersize of the mill screen.

Although the definition and methods noted above seem to be commonly accepted, I am of the opinion that it is not possible to derive a figure which will denote the efficiency of a screen if the term "efficiency" is used in accordance with its strict definition—as the ratio of output to input. It seems to me that, strictly, the figure derived as above should be called the coefficient of effectiveness of the screen, and that it might be still better to indicate whether this coefficient of effectiveness is based upon the consideration of the undersize or of the oversize of the machine.

My objection to speaking of the efficiency of a screen is based upon the belief that an efficiency figure should be absolute and not relative. When one speaks of the efficiency of an electrical generator, he means thereby the ratio of electrical output to mechanical input expressed in electrical units, which is the same everywhere so long as the stated conditions of the test are realized. The same applies to the thermo-dynamic efficiency of a steam engine, or the mechanical efficiency of a system of gears. In all these cases it is possible to insure the same kind, quality, and amount of input to the machine, or to a similar machine, no matter where the test is made. In the case of a screen, however, there is no way of insuring that the same machine will be fed with the same class of feed at different times, or that two screens of the same or different kinds, situated at different places, can be supplied with the same quality of feed.

Everyone who makes screen analyses must have noticed the peculiar variation in the percentage of samples at any given size. Considering a number of samples of crushed ore, all of them through the same ruling size, no two will give the same cumulative percentage curve. Sometimes the curves will be convex, sometimes concave, frequently reverse, and sometimes compound reverse, and only rarely will they approximate a straight line showing quantities nearly proportional to screen openings. This "bunching" or "crowding" of certain sizes in the pulp which shows so plainly in many screen analyses is, of course, the result of the action of many variables, but in practice it is so marked as to make a fair comparison impossible as between two screens working in different ores.

In Fig. 2, as an illustration, I have platted three hypothetical cumulative screen analyses. In all three the material is through the ruling size of 8 mesh, and in each case 70% of the sample remains on 28 mesh. Curve *D* is a straight line; curve *E* is convex, showing a disproportionate amount of the coarser sizes, and with its fines extremely fine. Curve *F* is concave, and contains nothing finer than 150 mesh.

If a given mill screen clothed with 28-mesh cloth was successively tested with ore represented by each of these samples, the rate of feed and other conditions being maintained constant, the so-called screen efficiency would not be uniform in the three cases. The ore represented by curve *E* would be the easiest to screen, and would show the highest efficiency, because it contains little material close to 28 mesh in size, and the real fine material would, of course, slip through with ease. The ore represented by curve *D* would give intermediate results; that represented by curve *F* would show the lowest efficiency, because its 30% of undersize is all between 28 and 150 mesh, and there is 10% of minus-28 plus-35 mesh, which is naturally the hardest material to get through the 28-mesh screen.

It seems to me that this illustration shows clearly the fallacy of the term "screen efficiency," unless the definition is qualified by requiring an identical feed in each case, which would represent a condition impossible of attainment in practice.

---

*Austinville, Virginia.

[1] *Met and Chem. Eng.*, Dec. 15, 1916.

[2] *Eng. and Min. Journ.*, July 14, 1917.

There is another way of deriving a figure for so-called screen efficiency, which, however, does not give true efficiency either, but furnishes a more convenient and in some respects a fairer method of comparing the performances of a screen under different conditions of load, quality of feed remaining the same, or at fixed tonnage with variable quality of feed.

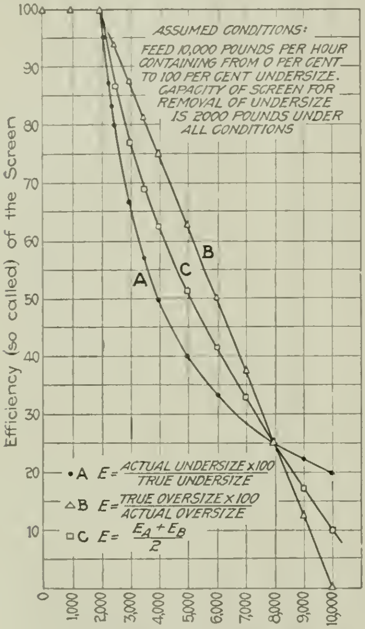


FIG. 1. DIAGRAM OF SCREEN EFFICIENCY

The method given by Professor Lewis and Mr. Rabling looks upon the performance of the screen from the point of view of the undersize in the feed, and may be formulated as efficiency per cent:

$$E\% = \frac{\textit{Actual undersize} \times 100}{\textit{True undersize}}$$

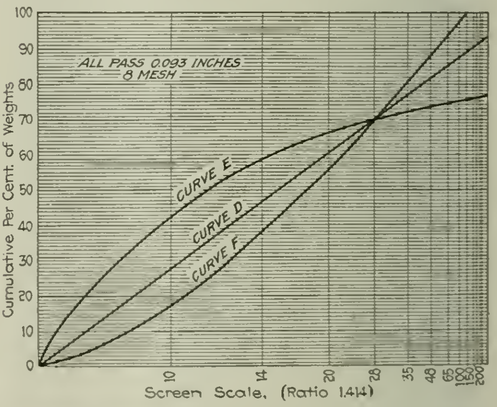
The alternative method mentioned in the preceding paragraph regards the performance of the screen from the standpoint of oversize and efficiency per cent:

$$E\% = \frac{\textit{True oversize} \times 100}{\textit{Actual oversize}}$$

In Fig. 1 I have assumed that a given screen is capable, under all conditions, of taking 2000 lb. of undersize per hour out of the feed. This condition would, of course, not be realized in practice, because, as pointed out in connection with Fig. 2, the class of the feed has a considerable influence upon the performance of the screen, even when the total feed and percentage of undersize remain the same. It is assumed, also, that the feed consists of 10,000 lb. per hour, varying from 0% to 100%, and the efficiency, so-called, is platted by both methods against the pounds of true undersize in the feed. Curve *A* shows the efficiency according to the usual method based upon the undersize, where in each case the numerator of the efficiency fraction is constant at 2000 times 100. Curve *B* shows the efficiency, so-called, based upon the oversize, the efficiency fraction having a constant denominator of 8000.

Both curves show 100% efficiency with feeds containing 2000 lb., or less, of undersize. The *A* curve drops away rapidly in its upper portion, and much more slowly in its lower portion, whereas curve *B* decreases at a constant rate. Considering curve *A*, if the feed contains 3000 lb. of undersize, of which the screen is capable of taking out only 2000 lb., the efficiency drops 33⅓%, though if in its lower range the feed contains 10,000 lb. instead of 9000 lb. of undersize, the efficiency drops only 2½ per cent.

If the function of the screen is to get out the largest possible quantity of undersize, and, for example, return the oversize for regrinding, then it is, no doubt, correct to view the performance from the standpoint of curve *A*. If, on the other hand, the screen is employed to produce an oversize material for treatment on a jig or table, for example, it would seem fair to view its performance from the standpoint of the quality of the oversize which it produces, as in curve *B*, and in this case throwing over 8000 lb. of oversize instead of 7000, though, of course, not desirable, would penalize the efficiency only 12½%, which would probably be a closer measure of the value of the performance than that given by curve *A*. In the lower part of its range, however, curve *B* does not give due credit to the screen for taking out some undersize, and as there results, accordingly, the condition that the upper part of curve *B* and the lower part of curve *A* seem to measure performance within their respective ranges most fairly, I



Screen Scale Ratio, 1.414						
Openings		Diameter Wire		Cumulative Per Cent. Samples		
Inches	Millimeters	Inches	Mesh	D	E	F
0.093	2.362	0.032	+ 8	0.0	0.0	0.0
0.065	1.651	0.035	+ 10	27.5	42.5	17.1
0.046	1.168	0.025	+ 14	47.6	58.2	37.5
0.0328	0.833	0.0172	+ 20	60.0	66.0	56.0
0.0232	0.589	0.0125	+ 28	70.0	70.0	70.0
0.0164	0.417	0.0122	+ 35	76.6	72.2	80.0
0.0116	0.295	0.0092	+ 48	81.3	73.3	87.5
0.0082	0.208	0.0072	+ 65	85.0	74.2	93.2
0.0058	0.147	0.0042	+100	87.2	75.0	97.2
0.0041	0.104	0.0026	+150	89.0	75.4	100.0
0.0029	0.074	0.0021	+200	90.0	76.0	..
..				100.0	100.0	

FIG. 2. CUMULATIVE DIRECT DIAGRAM OF SCREEN ANALYSIS ON SAMPLE OF FEED TO 28-MESH SCREEN, USING TYLER STANDARD SCREEN SCALE

have drawn another, curve *C*, which represents the mean values of curves *A* and *B* in each case, and represents the performance of the screen viewed from the standpoint of both the oversize and undersize produced by the machine.

As before stated, I do not believe that any of these figures can truly be called efficiency figures, and I do not believe that it is possible to make comparisons of two screens operating on different feeds or on the same feed at different rates. The legitimate field for the determination of screen efficiency is limited to the comparison of a given machine at different times with the same rate and quality of feed; and, if this is granted, then the oversize method platted as curve *B* in Fig. 1 becomes the most convenient method of securing a comparative figure, because it requires the taking of but one sample, the oversize of the mill screen. This sample is screened upon a hand screen clothed with the same screening medium as that on the mill screen, and the coefficient of effectiveness may be stated as follows:

$$Ce = \frac{\text{Oversize of hand screen}}{\text{Sample weight}}$$

In practice the quality of pulp fed to a screen generally resembles that of the left half of Fig. 1 with less than 50% undersize, and, therefore, comparisons based on curve *B* will not be affected by the consideration respecting the lower part of curve *B*.

Some screen manufacturers follow the practice of screen-testing the oversize of their mill screen on the next finer sized cloth than that used on the mill screen. There seems no reasonable justification for this.

Disinfecting Small Quantities of Water

Occasionally the travels of an engineer lead him into outlying districts where sanitary conditions are far from perfect and available supplies of drinking water may be pulluted. The following article from *Engineering and Contracting* offers a method of avoiding contamination and should be of interest.

As the result of a study by Dr. Henry A. Dakin, the English chemist, a new product has been found for disinfecting such small quantities of water as are used by the soldier or the engineer in his water bottle. The experiment conducted by Dr. Dakin indicates that the substance will sterilize an ordinary heavily contaminated water (e. g., containing coli, typhoid or cholera organisms) in about 30 min. It imparts a perceptible but not disagreeable taste to the water. The disinfectant is put up in the form of tablets, which if properly made are stated to be stable enough for all practical purposes.

To ascertain the effectiveness of the tablets on a heavily polluted water, a series of tests was made recently in the water laboratory of the Bureau of Engineering of the Florida State Board of Health. The water used was obtained from a stream heavily polluted with surface wash and receiving considerable sewage. In the test one tablet was applied to each 250 c.c. sample. The raw water contained 5000 bacteria per c.c. After the tablet had been in the water 15 min. the count was 500 bacteria per c.c.; after 20 min., 160 and after 30 min., 50 c.c., which is a 99% reduction in 30 minutes.

A second series of samples from the same source was tested, a tablet and four drops of lemon juice being added to each 250 c.c. of water. In this test the bacteria count was reduced to 120 in 15 min., to 90 in 20 min., and 50 in 30 min. These results, states the official bulletin of the State Board of Health from which this note is taken, indicate mainly that the tablets effectively disinfect small quantities of heavily polluted water within 20 to 30 min. with a complete disappearance of gas-forming organisms and colon forms as well as a great diminution of bacteria. The addition of lemon juice apparently hastens the effectiveness to a degree. The chemical name for this disinfecting agent is Parasulphondichloraminobenzoic acid. Its common name is halazone. Halazone tablets are prepared in a convenient form by several large laboratories—small vials of 100 to 1000 being on the market.

Auxiliary Hoist for Traveling Cranes

The average traveling crane employed at a mine shop, power plant, or smeltery during a day's work usually handles a greater number of light loads than heavy ones, and inasmuch as cranes for lifting heavy loads are slow-moving, their use results in a serious loss of time if they also handle the light loads. Thus a 20-ton crane, direct-current, with a hoisting speed of 12 ft. per min. per load, will handle a 3-ton load at but slightly greater speed. But by means of an auxiliary hoist a light load may be handled at a speed from two to ten times that of the main crane. The attachment of such an auxiliary also effects an important power saving. Often the hook and block of the main crane together weigh more than some loads frequently handled. The auxiliary hook and block being much lighter, it is evident that the power saving in a year's time becomes worth while. The saving of labor is another important item, especially when a gang of men must wait for a small piece to be slowly moved by a large crane. This is a vexing circumstance with which many foremen are familiar, and the use of the auxiliary eliminates this labor loss.

A simple and practicable auxiliary hoist that may be attached to any standard overhead electric traveling crane has recently been developed by N. B. Payne & Co., 25 Church St., New York. This hoist is quickly and easily attached, it does not take up any more room overhead, does not require an extra trolley, does not shorten the travel of the trolley on the bridge, nor does it interfere with the accessibility of the main hoist. Ordinarily from one- to five-ton standard auxiliary hoists are supplied by the makers to meet the usual requirements, but larger special sizes are furnished if necessary.

By means of the application of this auxiliary attachment, any standard single-hoist electric traveling crane may be equipped with two lines for drop-bucket service. The control may be arranged from cage, floor, or pulpit, to suit the crane to which it is applied.

Iron-Ore Imports in 1918 decreased and the total was only 787,486 gross tons, as compared with 971,663 tons in 1917 and 1,326,864 tons in 1916, according to *Iron Age*. The source of these imports was as follows: Spain, 38,385 tons; Canada, 115,354; Cuba, 632,442, and other countries, 1281 tons. During 1918 no ore came from Sweden, which even early in the war contributed a liberal supply. Recently little Chilean ore was imported, and that from other countries declined to only about one-eighth of what it was in 1916 or even 1913. As contrasted with the pre-war figures of 1913 the decline is marked in every detail. Exports of iron ore have been fairly constant in the last three years, having been 1,256,431 tons in 1918, as contrasted with 1,132,313 tons and 1,183,952 tons in 1917 and 1916 respectively. In 1913 the exports were 1,042,151 tons.

Air-Volume Regulation in Smelting and Refining Furnaces

BY C. H. SMOOT*

IT HAS been customary almost from the inception of the metallurgic arts to operate blast furnaces for steel and iron with a constant volume of air, which is obtained in practice by assigning one or more blowing engines to each furnace. Desirable results are obtained from this condition of constant volume, which gives a uniform rate of combustion in the furnace and permits charging to be conducted in a uniform way. Variations from a normal condition are reduced by the delivery of a constant volume of air to the furnace as the principal basic condition.

In the smelting of lead and copper ores and the operation of copper converters, many metallurgists have considered a constant volume of air to each furnace to be highly desirable, and for the same reason that it is of assistance in the furnace operation when smelting iron. The rate of charging on these furnaces may be uniformly maintained, and changes of charge need vary only with difference in the quality of materials charged to the furnace.

When furnaces are run in parallel, and supplied by a common system of blowing engines, the air volume delivered to each furnace is not constant. The furnace whose charge is tight receives less air from the common supply than the neighboring furnace whose charge is loose. Such a condition is exactly the reverse of that desirable for uniformity of furnace performance. Generally the furnace whose charge becomes tight should have an increased volume of air for a short time, rather than a decrease in quantity. Conversely, the furnace whose charge is loose should not receive an excess of air.

These conditions have long been recognized in the smelting of copper and other metals, but few smelting installations have been made in which each furnace receives air from a separate blowing engine. Such an installation would greatly increase the expense of the plant, and it is doubtful as to whether the increased cost would be warranted by the improvement obtained. Nevertheless, it is clearly recognized that a constant volume to each furnace, if obtainable, is a highly desirable feature in any smelting operation.

The Rateau-Battu-Smoot Engineering Corporation has been furnishing turbo blowers for some time for use in smelting copper, and similar work, and has developed constant-volume regulators which meet the conditions of the average smelting plant. The system involves a central blower plant, which supplies air to a number of smelting furnaces. Usually a single header for the air blast is employed, from which branch connections are led to each of the furnaces.

A constant-volume regulator is installed in each of these branch sections, which insures that each individual furnace receives the constant volume for which it is adjusted. The lack of this condition is one of the principal causes of frozen furnaces and irregular operation, and also of uneconomical operation.

When the air is deficient, owing to the furnace being tight, the rate of smelting is reduced and the output becomes less. If, on the other hand, the air delivery is in excess and the amount of coke charged is not increased to compensate for the excess oxygen, metal is lost in the slag because of the excess of oxygen and the absence of a sufficient reducing atmosphere in the smelting zone. Hand regulation of the air volume from a constant-pressure source is, obviously, in constant alternation from one condition to the other, because the resistance of the furnace is subject to constant change and therefore the volume of air varies continually above and below the proper amount.

When furnaces are operated without any means of checking the air volume, uneconomical results are inevitable, both coke and metal being lost and the furnace capacity reduced. If, however, the volume is regulated and kept uniform, the furnace may be operated continuously at maximum capacity and efficiency, with a minimum of fuel and maximum of metal recovered. In extreme cases a furnace may freeze as a direct result of incorrect regulation caused by a charge which is tight and which prevents a flow of sufficient air to maintain a smelting temperature.

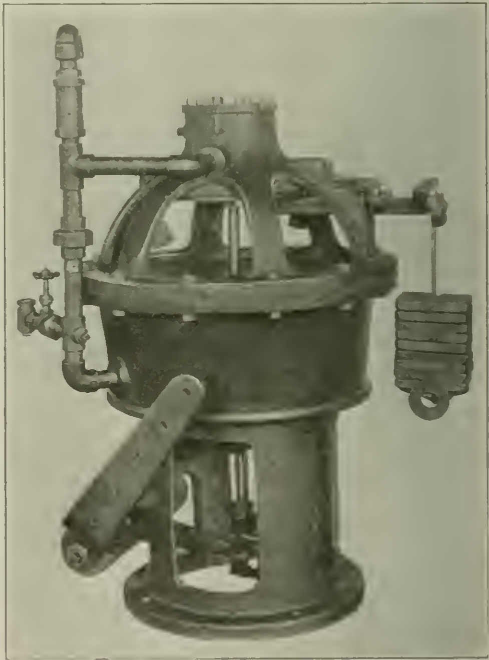


FIG. 1. REGULATING MOTOR FOR VOLUME CONTROL

In the operation of large furnaces it is desirable to carry the regulation even further than to control the volume delivered to each furnace as a whole, by subdividing the control, using several regulators, each of which delivers, to a given section of tuyeres, a constant volume.

---

*Engineer, Rateau-Battu-Smoot Engineering Corporation, 140 Cedar St., N. Y.

For example, two-volume regulators may be used, one controlling each side of the furnace; or, on large furnaces, four regulators could be advantageously employed, subdividing each side of the furnace into two sections, each controlled by an individual constant-volume regulator. This subdivision of control insures a uniform delivery of air to different parts of the furnace and prevents the formation of a hole in one side of the furnace, robbing air from the other side.

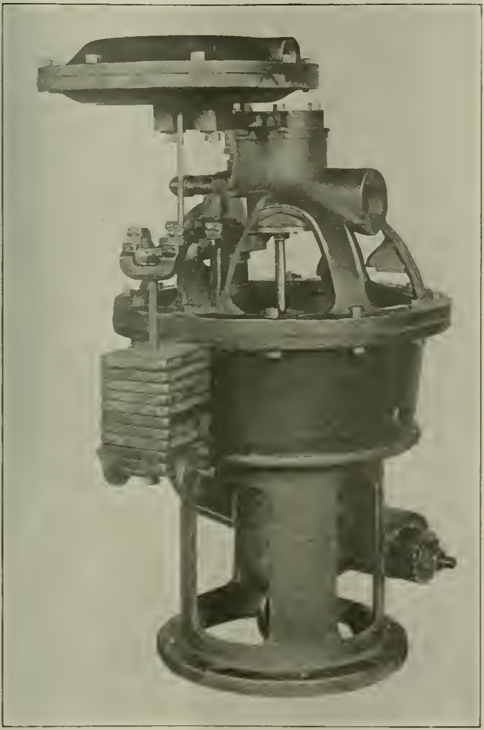


FIG. 2. REGULATOR READY FOR INSTALLATION

It has often been noted, when the furnace is charged with a mixture of bed ore and roaster fines, that it is necessary to distribute evenly over the entire charge the fine and bed ore in order to present as nearly as possible a uniform resistance to the path of air. The reason for this is to be found directly in lack of air-distribution control; for, when a section of the charge receives an excess of roaster fines, the air paths are closed; and, with uniform pressure, the quantity of air passing through this section of the charge is reduced, and an excess passes through some other section in which the fines are not present. A subdivided regulation of air volume serves largely to correct this condition and maintain uniform rates of smelting throughout all parts of the charge.

A large furnace, from this point of view, is in somewhat similar case to several different furnaces, all connected to a common air header, because within a single large furnace there may be sections of the charge through which the air passes more freely than is the case in others.

In furnace operation, the lack of a distributing air-volume regulation requires an excess of coke sufficient to give good results in any portion of the charge which may become loose and thereby receive an excess of air.

No advantage is obvious in regulating a total volume of air to the furnace plant for constant volume, because it is the individual supply of air to each furnace which should be maintained at constant volume. Therefore a regulator has been developed which controls the amount of air flowing from the blast main to each furnace. The regulator comprises a butterfly valve in the blast line, under control of a volume motor. The volume motor is operated from the blast-air volume, and serves to open and close the damper valve in the blast line in such a way as to pass to each furnace or section of furnace a constant volume of air.

Installed in each branch blast line, feeding air to the tuyeres, is an element called a multiplicator, which is inserted through a hand-hole in the blast main, and from which lead two pipes which bring a small pressure for purposes of control to the regulating motor. This control pressure is in response to the volume of air passing the pipe, but does not change with the static pressure.

Fig. 1 shows a regulating motor suitable for volume control. The motor is a complete unit, and is connected to the regulating butterfly valve (within blast main or bustle pipe) by means of a link connecting to the arm shown at the lower left-hand part of the cut. Fig. 2 illustrates a regulator ready for installation in metallurgical works.

When adjusted for delivery of a given volume of air to a furnace, these regulators maintain this volume regardless of furnace resistance and changes in pressure, up to the point at which the maximum available pressure is only just sufficient to pass the required volume through the furnace. Several furnaces may be operated from a common bustle pipe and each furnace receive the constant volume for which its regulator is adjusted, regardless of changes of condition in the other furnaces.

Volume and pressure meters are also available which will draw a 24-hour chart of the air volume delivered to the furnace, and record the bustle-pipe pressure. The charts give a complete continuous record of volume and pressure, and indicate clearly the furnace behavior, showing the presence or absence of holes in the charge, and giving ample warning of such trouble as a frozen charge. The meters also assist in keeping the furnace always at full capacity and maximum efficiency.

The regulating motors to control constant air volume operate through damper valves placed in the air line, opening and shutting as necessary to pass the volume for which they are adjusted.

The equipment is easily installed. The only labor required to equip a furnace with this regulation is usually in connection with the bustle pipe, or the air line to the bustle pipe, permitting the insulation of the control damper valve. This can be done even though the bustle pipe is so closely connected that no external piping is available for installing the control valve, by mounting within the air main a small section—usually rectangular—in which a damper valve is placed, controlling the amount of air flowing to the furnace. Fig. 3 is a diagram of valve and regulator, as applied to the connection between one furnace and the main blast heads.

The detailed operation of the volume regulator is as follows:

The damper valve *A* is the regulating means, which, by varying its orifice, passes constant volume to the furnace. *B* is the multiplicator, which gives a pressure difference between the pipes *C* and *D*, in strict proportion to the air volume passing *B*. *E* is the connecting link, which transmits regulating motion from the constant-volume regulating motor to the valve *A*.

The regulating motor comprises the power diaphragm *F*, which is made of leather $\frac{1}{4}$ in. thick and heavily loaded with cast-iron weights. Energy for the motion of this diaphragm and connected parts is obtained from a small flow of air under 2-lb. pressure entering the apparatus at *G*.

The air pressure underneath the diaphragm *F* is caused to vary 500 times as much as the pressure difference from pipes *D* to *C*. This large multiplication gives 150 lb. of effort at diaphragm *F* to operate the damper valve for each $\frac{1}{10}$-in. water-column pressure difference between the control pipes *D* and *C*. The multiplication is obtained in the following manner:

The differential pressure *D* to *C* bears downward on the diaphragm *H*, which has a large area. This pressure is counterbalanced by the adjusting weights *I*, and in part by the pressure under the diaphragm *F*, which is connected through piping to bear upward underneath the multiplying valve *J*. The multiplying valve has $\frac{1}{60}$ part of the area of the multiplying diaphragm *H*. This valve floats slightly off its seat all the time, and a balance is maintained between the upward pressure on the small valve *J*, the counterweight *I* and the velocity pressure on diaphragm *H*. A slight increase in air volume going through the duct displaces the diaphragm *H* downward a small amount, restricting the air flow through the valve *J* and building up a large increase in pressure because of this restriction underneath the diaphragm *F*, which large increase in pressure supplies the powerful energy to operate the regulating valve *A*.

The fundamental principle employed in these regulators is briefly described as the multiplication of the departure from normal of regulated condition from 400 to 1000, and applying this multiplied pressure departure on a large diaphragm or piston to furnish the necessary energy to accomplish regulation. By means of this principle these regulators are able to control accurately pressure differences heretofore too small to permit regulation. In a general way the multiplication allows pressures of fractions of an inch (water column) to be regulated with the same accuracy and power as have heretofore been possible in regulating pressures of many pounds per square inch.

In a blast-furnace installation the volume multiplicator has a water gage connected between pipes *D* and *C*, and calibrated with a volume scale which is determined for each installation. The volume regulator is equally applicable for use to control the speed of engine or motor-driven blowers for constant volume of delivery; and composite equipment may be used in which both the engine, or blower, and furnaces are individually controlled.

When operating a lead or copper furnace on a constant volume of air, the condition of the charge is continually indicated by the bustle-pipe pressure, as this pressure denotes the resistance of the charge, the presence or absence of holes, and whether or not the charge is tight or loose, and furnishes a nearly complete record of what is going on in the furnace. The bustle-pipe pressure indicates nothing, however, when the furnace is running without a constant-volume regulator; and, when several furnaces are supplied from a common main or bustle pipe, the pressure at each furnace is maintained regardless of condition of charge and presence or absence of a hole through which the blast may be passing freely. When running on a constant volume, should a hole develop in the charge, the pressure in the bustle pipe will drop, and the volume regulator may be temporarily readjusted for a much larger volume than normal until the condition is corrected.

A two-curve recording meter has been devised, which shows on one curve a 24-hour continuous record of the air volume delivered to the furnace, and on the second curve a similar record of the bustle-pipe pressure. This chart of the air pressure and volume makes available to the smeltery superintendent a complete daily record of the furnace performance, and is useful for checking the details of operation.

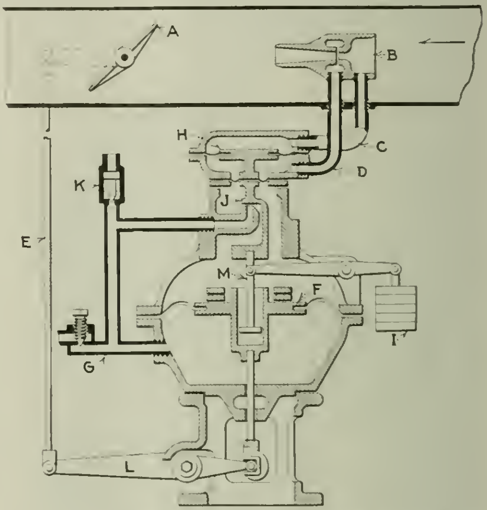


FIG. 3. DIAGRAM OF CONSTANT-VOLUME REGULATOR

A regulator, known as the proportional-volume control, by means of which either gas- or oil-fired furnaces are regulated in such a way that the volume of air is in a fixed and correct proportion to the volume of gas or oil supplied to the furnace, is also available. This is analogous to the gas-engine carburetor, in that it meters the relative proportions of air and fuel. The chemical character of the gases, as well as their temperature, may be accurately controlled; and, furthermore, a maximum economy in consumption of fuel is obtained, because excess or deficiency of air is automatically prevented.

Benjamin Franklin gave this advice to a young man: "Keep an exact account for some time, both of your expenses and your income. If you take the pains at first to mention particulars, it will have this good effect: you will discover how wonderfully small trifling expenses mount up to large sums, and will discern what might have been and may for the future be saved without occasioning any great inconvenience." Put those savings into W. S. S.

Liquid Oxygen Explosives*

The military necessity which compelled Germany to requisition her entire stock of nitric explosives created an emergency which gave liquid oxygen its opportunity, and its development as a mining explosive has occasioned considerable comment.

The explosives now in general use are mixtures or definite compounds containing two essential constituents, a combustible element, carbon, and an ignition element, oxygen. The explosion is the result of the abrupt and violent combination of these two elements. Oxygen is introduced under the form of nitric combination or chlorinated combination, whereas the carbon is in the form of an organic matter. Therefore, in ordinary explosives, the combination of the active elements carries with it a considerable dead weight, constituted by the other elements.

This is not the case with "Oxyliquit," for in the latter the liquefied oxygen is put in contact with carbon in a divided and porous form. Under a system of ignition the combination takes place with explosion, and in principle the procedure is perfect. In the evolution of this process, however, which was first invented by Linde in 1895, many difficulties were encountered.

Liquid oxygen is always produced on the spot where it is to be used, as it is impossible to prevent volatilization for very long, notwithstanding all the precautions. It is prepared by liquefying the air, the mixture so obtained of liquefied nitrogen and oxygen being submitted to a partial distillation, which eliminates the larger part of the nitrogen, more volatile than the oxygen. The resulting bluish liquid contains about 85% of oxygen. A German company exploiting the Linde patents is able to furnish installations giving an hourly output of 23 lb. (10 kg.) of liquefied rectified oxygen.

Transportation of the liquefied oxygen from the place of production to the place of utilization, mine or quarry, required a new container. In the laboratory, glass vessels, so-called "Dewar" bottles, having double walls with a vacuum between, have been used for the keeping of liquefied oxygen. These bottles are not closed—on account of the danger of a closed bottle in handling—but, owing to good insulation, the loss of oxygen by evaporation is small. These glass bottles, easily breakable, are neither convenient for wholesale manufacturing nor for use in the workshop, and are now replaced by containers of metal—especially brass and steel—which give excellent service.

The steel or brass bottles do not hold the vacuum as well as those of glass, and the vacuum must be often renewed. To lessen this inconvenience, Dewar inserts porous charcoal between the walls.

By what is known as the Kowastsch method, the liquid oxygen is poured upon lampblack in the bore hole. A cylindrical cardboard cartridge is made of the same diameter as the hole, the cartridge containing the lampblack or other porous material rich in carbon. It is closed at both ends with cardboard or cork. Two small tubes of thin cardboard pierce the stopper at the outer end. These tubes serve for the pouring of the oxygen; also for the ignition system (fuse or electric). The cartridge being thus made, a metal rod is inserted in each tube to prevent it being crushed, and the cartridge is deposited at the bottom of the hole, which is then packed with a wad of clay. The metal rods are extracted and the liquid oxygen is poured in through the larger tube by means of an elbow funnel. The gaseous air escapes by the shorter tube, and also the overflow of liquid oxygen when the cartridge is saturated completely. The cartridge is now ready for the firing. The explosion is comparable to that of dynamite.

The Marsit method allows of a more regular working. It is therefore more in use than the other. Here the cartridge is saturated before being introduced into the bore hole. To do this the cartridges are immersed in a special vessel of cylindrical shape with double walls filled with liquid oxygen. The cartridges are first exposed for a few minutes to the vapors above the liquid to cool them off, then completely immersed for half an hour. The saturation is therefore complete. When the cartridge is saturated, it is taken out and the ignition system attached as quickly as possible. It is then placed in the bore hole, tamped and exploded.

The manipulation in this method is far simpler than in the first mentioned. The only inconvenience is the unavoidable delay between the taking out of the cartridge and the placing in the bore hole. During the lapse of these few minutes a certain part of the oxygen of the cartridge evaporates. To lessen this loss, and to keep in the lampblack a sufficient excess of oxygen, the walls of the cartridge, which are made watertight, are of corrugated cardboard. No detonator is needed to explode these cartridges, and this is one of the advantages of the new method. All that is necessary is a small primer ignited by a fuse or by electricity.

The principal company manufacturing "Oxyliquit," the Sprengluft Gesellschaft, of Berlin, claims to have delivered each year an equivalent of 10,000 tons of nitric explosives. Even allowing for probable exaggeration, this figure shows how widely this product is used in Germany. Its greatest advantage over other explosives is that it almost entirely eliminates the danger of accidents. The cartridge itself is explosive for about 10 min. only, between the time of its saturation and the time of its ignition. During this time the danger is not any greater than with any other explosives. The result is that in case of a miss it is only necessary to wait half an hour for the cartridge to become entirely harmless, and then one can uncover the bore hole without danger. Moreover, all dangers inherent to transportation and storage of the explosive are entirely eliminated.

The method, however, has its inconveniences, the principal objection being that it is impossible to store liquid oxygen, necessitating the establishment of a liquefaction and rectifying plant at the place where it is used. Also, there is need of experienced hands for a quick charging of the hore holes.

Theoretically the new explosive many claim superiority over others. In practice, however, it gives an explosion hardly equivalent to the most powerful explosives known, common dynamite and gelatin-dynamite.

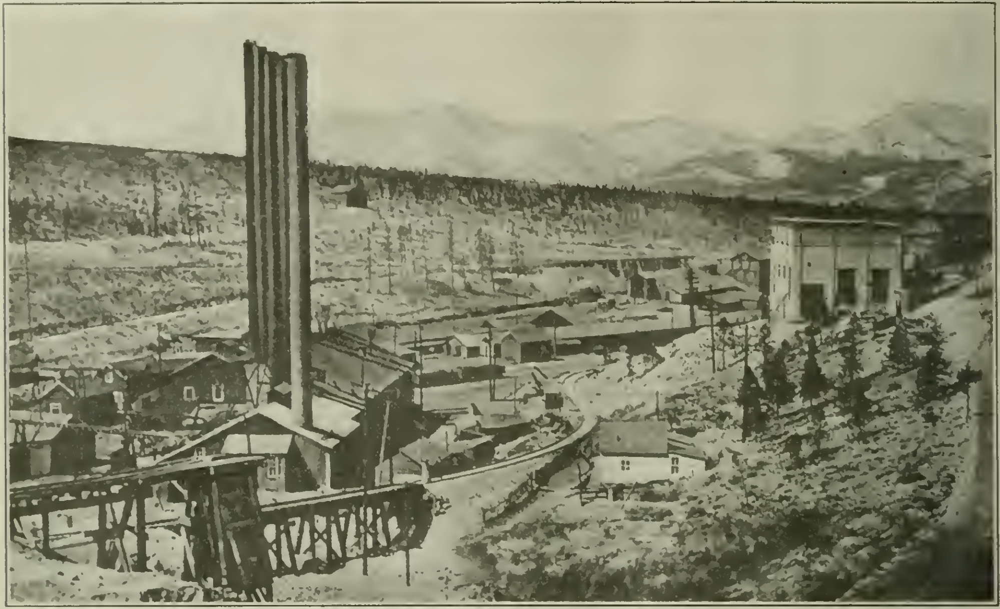
---

*Abstract of an article appearing in the January issue of *Compressed Air Magazine.*

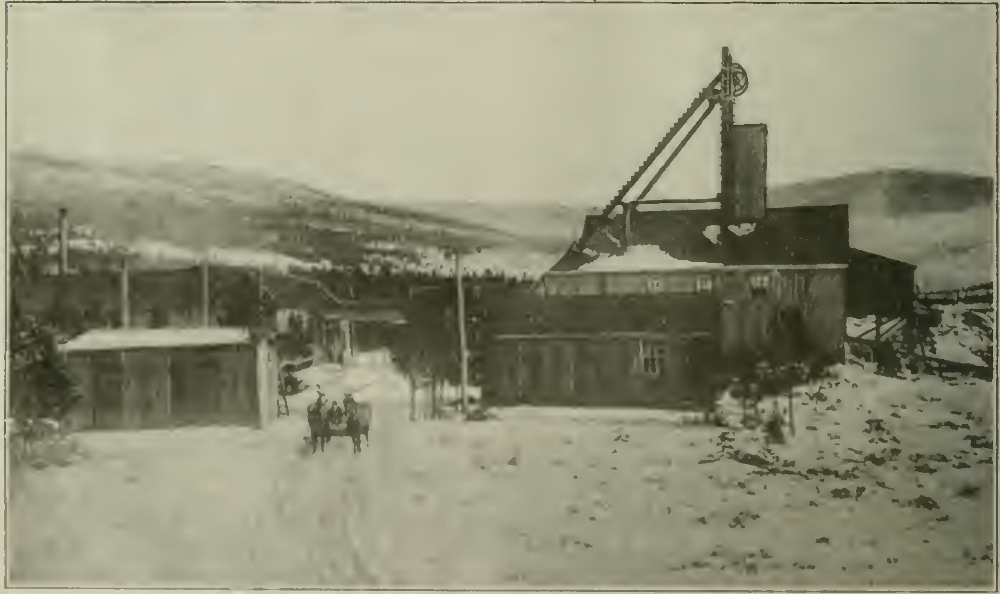
"**Extravagance Rots Character; train youth away from it. On the other hand, the habit of saving money, while it stiffens the will, also brightens the energies. If you would be sure that you are beginning right, begin to save."—(Theodore Roosevelt.) Buy W. S. S.**

Sing a song of Saving Stamps,
The cost of living's high,
But have you counted all the things
These Saving Stamps will buy?

Mines in the Leadville, Colo., District

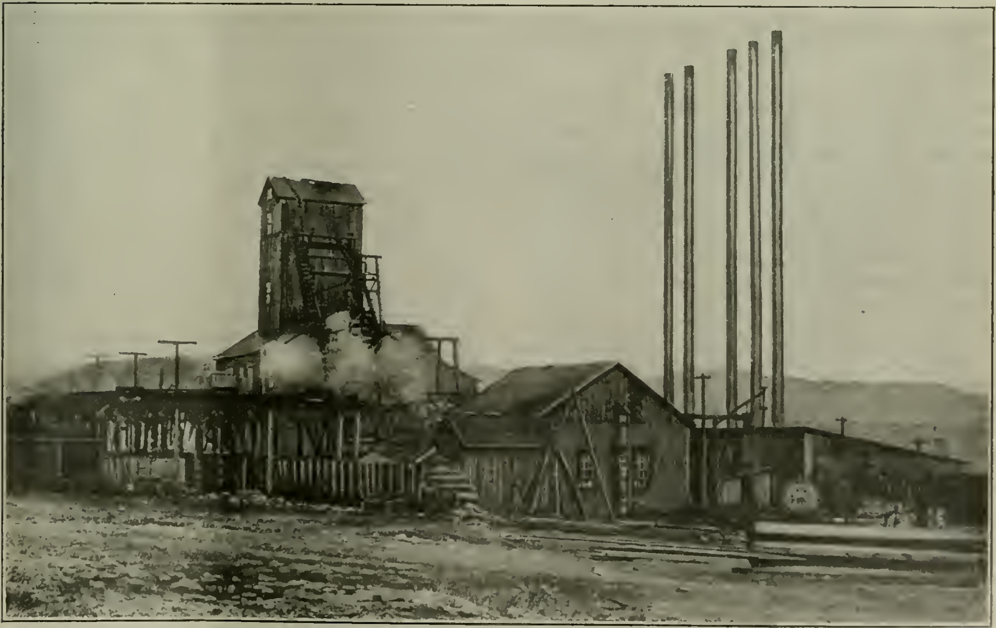


SURFACE PLANT OF THE YAK MINING, MILLING, AND TUNNEL COMPANY



HARVARD SHAFT IN BIG EVANS GULCH, LEADVILLE, COLORADO

MIKADO SHAFT AT LEADVILLE, OPERATED BY THE IRON SILVER MINING COMPANY



WOLFTONE SHAFT OF WESTERN MINING CO. AT LEADVILLE, COLORADO

Mining Convention at Vancouver

After the introductory formalities, consisting of an address of welcome by the acting mayor, and another by A. M. Whiteside, president of the Chamber of Mines, the International Mining Convention was formally opened at Vancouver, B. C., on Mar. 17, by the Hon. William Sloan, Minister of Mines, in an address of more than usual interest. Mr. Sloan spoke to a gathering which packed one of the large halls of the Vancouver Hotel. Reference was made to the excellent results achieved by the mining industry in British Columbia in 1918, statistics showing an increase in the monetary value of its production, as compared with 1917, whereas many U. S. Western mining states, notably Utah, Nevada, Idaho, Colorado, California, and New Mexico, had recorded a decline. The value of British Columbia's coal output had grown materially. The production of the metalliferous mines was much greater in quantity in 1918 than in the preceding year, although showing a comparatively small augmentation in value, because of the lower prices of copper, lead, and other metals. In this connection Mr. Sloan paid tribute to the work done both by coal and metal miners during the war in coöperating with the management of collieries, and of metalliferous miners in the effort to promote production to meet the extraordinary demands created by the war.

THE IRON AND STEEL INDUSTRY IN BRITISH COLUMBIA

Two significant statements were made by Mr. Sloan on questions of administrative policy. One was that it was realized by the government that, if the capital necessary to develop the minerals of the province is to be secured, good returns, as far as possible in mining operations, must be assured. He knew that he was voicing the sentiments of his colleagues, as well as his own convictions, when stating that such was the government's position.

Nothing need be looked for in the way of legislation that was not consistent with good government, and everything practicable would be done to encourage and safeguard the interests of the investor. Mr. Sloan's other pronouncement had to do with the development of the iron and steel industry in British Columbia. He outlined, in this connection, steps already taken with a view to the stimulation of interest in this enterprise, such as the offering of a bounty on pig iron, the obtaining of a report from Dr. Alfred Stansfield on the feasibility of treating British Columbia iron ores electrically, and, finally, the undertaking by the government to obtain from dormant iron properties the tonnage necessary to enable small smelting plants of the province to determine experimentally, in a practical manner, the possibility of manufacturing pig therefrom. He then asserted that it had been established that there was sufficient magnetite ore in the province to assure a small smelting plant a continuous supply. By this was meant that there was enough of the class of ore indicated, either in sight or proved, to warrant the establishment of such an industry on a modest scale. This, however, was not to be interpreted as an admission that the magnetite reserves of the Northwest are of no greater extent, because, personally speaking, he was convinced that, with development, they will be shown to be sufficient to feed the largest industrial plant.

Mr. Sloan's closing remarks roused enthusiasm. He said:

> Again, on behalf of the government of the province of British Columbia, I extend a cordial welcome to our visitors, and more especially to those from across the line. Mr. Chairman, there is no line. We on this continent have lived in peace and harmony for over 100 years. In the great conflict which has just been so triumphantly concluded, the sons of the United States and of Canada, your sons and our sons, have mingled their blood on the fields of Europe in the fight for common freedom. We have been cousins in the past, but now and for the future we are brothers.

DEVELOPMENT OF MAGNETITE DEPOSITS

M. J. Carrigan, of Seattle, in speaking to the delegates assembled at the concluding entertainment of the convention, recalled Mr. Sloan's statement regarding the iron-ore reserves of the province and dwelt on its significance. Mr. Carrigan thought it possible that the importance of the fact that a man in responsible official position had felt justified in going as far in respect to the ore available was not appreciated. It might result in the initiation of an industry. If so, the importance of the matter could not be overestimated, because shipbuilding on the Pacific Coast depended on development such as will permit the securing of the steel needed from local manufacturing centers. That industry, which now was responsible for the circulation of millions of dollars in Vancouver, Victoria, Seattle, Oakland, San Francisco, and other cities of the West, was destined to decline and pass away if steel could not be secured without the burden of transportation from the industrial plants of the East. The shipbuilding industry was born of an artificial condition, and could be maintained only if the West were able to obtain its supplies at rates at least approximating those available to shipbuilders elsewhere. For this reason the iron-ore deposits were the hope of the Pacific Coast, and hence the significance of Mr. Sloan's declaration. Mr. Carrigan averred that British Columbia possessed sufficient iron ore for fifteen years; that his opinion had been confirmed by competent engineers who had visited the chief iron-bearing areas of the province, and that he confidently looked forward to the establishment of the industry, either on the Canadian or the American side, in a comparatively short time.

"Industrial Welfare Work" was discussed by Lieut.-Col. R. W. Leonard, St. Catherines, Ontario, president of the Coniagas Reduction Co. and of the Canadian Institute of Engineers, after the luncheon on Monday, Mar. 17. Colonel Leonard extended, unofficially, greetings and best wishes on behalf of the latter organization.

THE PRINCE RUPERT DISTRICT

In the afternoon the convention listened to addresses by the six government mining engineers, all of whom discussed mining conditions in their respective jurisdictions. They were preceded by William Fleet Robertson, the provincial mineralogist, who announced that the preliminary estimate of British Columbia's 1918 production had been found to be well within the mark; in fact, final figures would increase the output reported in some cases by three-fourths of 1% and in others by 2%. The district engineers who spoke were George Clothier, Northwest Mineral Survey District, Prince Rupert, B. C.; John D. Galloway, of the Northeastern

Mineral Survey District, Hazelton, B. C.; R. W. Thomson, Central Mineral Survey District, Kamloops; P. B. Freeland, Southern Mineral Survey District, Grand Forks; A. G. Langley, Eastern Mineral Survey District, Revelstoke; and W. M. Brewer, Western Mineral Survey District, Nanaimo, B. C. They had been asked to confine themselves chiefly to two points—first, the giving of information as to the sections of their respective districts which, in their judgment, offered best fields for prospectors, and, second, mention of those parts which, in their opinion, were most promising to prospective investors.

Mr. Clothier said that there were large sections of his district which were unexplored, and that it would be hard to find any of the mineral zones which were not likely to prove worth prospecting. His district extended from Seymour Inlet to the northern provincial boundary line, about 600 miles, to the entire width of the province at the north, and included the Portland Canal and Alice Arm districts, both of which possessed unexampled attractions both to prospectors and capital. In connection with the former he referred to the property commonly known as the Bush mine, recounted recent discoveries of high-grade silver-gold ore, and spoke of plans for extensive development next season. He also spoke optimistically of the Big Missouri and other properties in the same locality. Describing the Alice Arm District, reference was made to the Dolly Varden mine, with its promising silver and small gold contents.

THE NORTHEAST DISTRICT

The Northeast of British Columbia was discussed by Mr. Galloway, whose district consists of 100,000 square miles of territory, within which are the Omineca, Cariboo, Quesnel, and Peace River districts. He gave a résumé of the mining operations of the past year, none of which had been of a specially notable character, because of high costs, and, latterly, owing to the unsettled market. He declared that the Skeena, Hazelton, and Telkwa sections were worthy of attention, having been prospected only to a small extent in comparison with their size and mineral possibilities. He emphasized the fact that there is a great unexplored area lying to the northeast, including the Peace River country, of which little is known and which might with prospecting yield good rewards.

Mr. Thomson stated that, although the production of his district was smaller than that of any others of the province, in it was found the greater variety of minerals. He referred to the chromite deposits and the Iron Mask mine, south of Kamloops, an old producer and one of the best known of the provincial copper mines. On the North Thompson, south of Merritt, operators had secured between 80 and 100 claims, with a view to the testing of low-grade ore, and, although Mr. Thomson did not make the statement, it is understood that diamond drilling is planned. He spoke of the lode mining on Cadwallader Creek, where some properties had been worked for about 20 years and where three mills are in operation and making money, although still 30 miles by road from the Pacific Great Eastern R.R. Attention was drawn to the coal fields of the Princeton-Nicola District, the collieries of which produced over 150,000 tons in 1918.

The mines and minerals of the Grand Forks, Greenwood, Sardis, and Similkameen districts were described by P. B. Freeland, mining engineer for the Southern Mineral Survey District. This district is a producer of gold, silver, lead, copper, and coal. Chrome deposits and fluorite also are found. With first-class transportation facilities he believed that both sides of the main Kettle River were worth prospecting, and he suggested intensive prospecting along the high-power electric line which the Kootenay Light and Power Co. will have completed to the Copper Mountain mine of the Canada Copper Corporation this summer.

Mr. Freeland's discussion of conditions in the Greenwood and Phoenix zones, the smeltery of the former place having recently closed, and the mines of the latter being understood to have yielded most of their wealth, was particularly interesting. It was often the case, he said, that bodies of ore are entirely covered by débris and there was little evidence of their presence. This, of course, was widely known in mining circles, and a local case in point occurred at the Monarch mine, in the Phoenix Camp. Here a deposit of 100,000 tons of ore missed having an outcrop by only a few feet and was discovered by a tunnel driven to develop an orebody some distance away. Although the copper industry was on the wane in these two sections, there were chances, and good ones, of discovering other deposits. The speaker continued:

"That this will take patience and effort is probable. There are many outlying districts that have scarcely been scratched, and samples brought in by prospectors show evidences of the same geological conditions that occur in the Phoenix and Greenwood Camp and which have produced such an abundance of copper, gold, and silver.

"The policy of picking the ripest plums is, of course, the most lucrative, but such a condition cannot last forever, and the time will come when districts passed over because they exhibited no large outcrop will be again explored systematically. In a geological survey report on Franklin Camp, which is situated approximately 45 miles north of Grand Forks and embraces an area of 16 square miles, by the late C. W. Drysdale, it is stated that the Franklin contact metamorphic ores resemble closely those of the Phoenix Camp and belong to the same chalcopyrite-magnetite class. The Franklin occurrence has somewhat similar structural relations to that of the ore in Elk Horn mine, in Montana. The orebodies are in the crushed dolomite which served as a channel for the ascending solution. There are a variety of gold, silver, and copper outcrops in this camp which have not been developed to any extent. It is a locality that I believe is worthy of further exploration and development."

Mr. Freeland spoke, too, of the great number of old Crown-granted mineral claims situated on both sides of the main Kettle River. These, he said, were worth looking over. They had lain idle for years, and at the time of their exploration there were few facilities for transportation. Conditions have since changed, and it was his opinion that it might be found that some would repay development.

In referring to Copper Mountain, the speaker said that the highly siliceous alumina content of the ore, of which there was 12,000,000 tons blocked out, made concentration by oil flotation necessary. This locality promised to become one of the leading producers of copper in the country.

As to the platinum of the Tulameen River, Mr. Freeland said that in the early days the placer miners had considered it a nuisance, and much had been thrown away. With 12 years set as the probable limit of time that Russia's supply might be expected to last, it was possible that, in the search for other sources, British Columbia occurrences might be given further consideration and a system devised whereby the platinum and copper ores would be analyzed and paid for by the smelters.

A. G. Langley, of the Eastern Mineral Survey District, said that there were 100 producing properties in his territory, and as many more developing. During the last few years operations had been resumed on many old workings, with good results, the silver-lead-zinc production of the district being of major importance. Much metal had been yielded by all the producing sections. The Standard mine had paid $2,700,000 in dividends; the Rambler-Cariboo, $500,000; and the Slocan Star produced, during a period of 12 years, ore having a total net value of $1,875,372. The Payne mine, which had been one of the largest producers, closed in 1904. Its discovery dated back to 1892, and it produced over 50,000 tons of silver-lead ore, representing a gross value at that time of nearly $4,000,000. Dividends paid between 1897 and 1904 amounted to $1,438,000. The mill concentrate during 1903 averaged 124.0 oz. in silver, 67.29% lead. These data were given to indicate possibilities.

"Among the properties which undoubtedly have made large earnings during the last year or so," Mr. Langley continued, "are the Surprise and Queen Bess. In 1916 Clarence Cunningham took over the Queen Bess, which had been idle for a number of years. Large bodies of ore were soon developed, and the mine has recently become one of the most important shippers in the district. The Idaho, Alamo, Sovereign, Wonderful, Van Roy, and Hewitt and Wakefield have since been acquired by Mr. Cunningham. A 150-ton concentrator, embodying the latest improvements in mill design, has been erected recently at Alamo. The rocks of the Slocan series have been found to inclose the largest and most profitable silver-lead deposits, so that their appearance in other sections of the country is of interest and well worthy of investigation. Although I do not know of any geological survey records which show correlation between the rocks of the central mineral belt of the Trout Lake Mining Division and those of other parts of the district, it is interesting to note that the richest silver-lead deposit in this region also occurred in dark carbonaceous and graphitic slates. Considerable tonnages of high-grade ore have been extracted from the Silver Cup, Netty L., Triune, and other properties. The ore is galena blende and tetrahedrite, carrying much silver. As an example, between the years 1901 and 1905, a total of 534 tons was shipped from the Triune, which contained gold, 0.9 oz.; silver, 250 to 400 oz.; lead, 33 to 50 per cent."

With regard to East Kootenay, Mr. Langley, after reciting the early history of the Sullivan Mine, now owned and operated by the Consolidated Mining and Smelting Co., said:

"This mine is now considered to be one of the greatest on the American continent. For a long time the problem of treating the complex zinc ores prevented large tonnages, high in metallic content, from being considered of commercial value. In 1918 a satisfactory solution of this problem was obtained, and many millions of tons of ore were added to the already large reserve.

"According to the management, by mining and treating this ore on a large scale, the company will be able to produce zinc and lead at a profit on any market price that existed in recent years, providing the price of labor and supplies falls with the prices of these metals. The long adit tunnel, which now has a length of nearly 8000 ft., is reported to be in ore; and preparations are under consideration for extensive improvements with a view to increasing the output.

"It is ridiculous to suppose that the East and West Kootenay districts have been thoroughly prospected, for such is not the case. This must be apparent to anyone who has traveled the mountains and is familiar with the nature of the country. It is still a young mining country, and, if market conditions remain favorable, we should see an increase in production during the next few years. What is needed is more capital and more prospectors. There are still many properties which were successfully operated some years ago and are now lying idle. These are, no doubt, worthy of careful investigation, as they may contain ore which could be developed and worked profitably under existing conditions. For such enterprises, capital is needed as well as for the development of new prospects. Again, there are a number of small deposits, carrying high-grade ore, which are not suitable for working on a large scale, but which could be successfully mined by two or three men. These properties are often worked under lease and bond, and substantial profits are sometimes made."

The Britannia Copper Mine

W. M. Brewer, of the Western Mineral Survey District, drew attention to the fact that within this area was the Britannia mine, one of the most important copper mines of the British Empire, and a monument to the late G. D. Schley, of New York. The district possessed a great diversity of mineral resources, including coal, ores carrying copper and gold, iron, silver, lead, manganese, and molybdenite, and also limestone for cement, quicklime and flux, marble, building stone, clay, talcose, slate suitable for some of the various purposes for which talc is generally used, and graphite, on Harbledown Island.

After dealing with the coal production of Vancouver Island (the output for 1918 was 1,666,582 long tons), Mr. Brewer asserted that the district presented an excellent opportunity for the prospector, who would, nevertheless, have to be prepared to tackle a few difficulties. He would have to be a fair boatman and know how to handle a canoe, be able to use an ax, a crosscut saw, a rifle, and a fishing rod. The various lakes, sounds, inlets, and small bays afford protection and shelter in case of storm and provide unsurpassed transportation facilities, as well as excellent fish food.

The coast range of mountains on the mainland, and sections of the west coast of Vancouver Island, were, in Mr. Brewer's opinion, the most promising to the prospector. As to possible rewards, he noted that, since the original Britannia group was located, in 1897 or 1898, the company had purchased about 350 claims, nearly all of which were staked by prospectors some years ago, paying for them about $1,000,000. As to the best places for the investment of capital, Mr. Brewer mentioned Quadra Island, Texada Island, the Lucky Four group, in the Cheam Range; the Big Eye group, near the head of Great Central Lake and in the Alberni Mining Division, and the Ptarmigan group, adjoining the Big Eye. The last three groups of mineral claims, he said, required large expenditures of capital for development, but all gave promise of eventually developing into such extensive properties as are in favor with the big operators. Texada Island also was a promising field for investment. Here the type of deposits had been proved to maintain continuity to a considerable depth, and other conditions, such as transportation facilities, were as nearly ideal as could be imagined.

Mining as an Investment

"Mining as an Investment" was the subject of a paper read by T. A. Rickard, editor of the *Mining and Scientific Press*, of San Francisco, in the evening. Couched in simple but forceful language, interspersed with a few strikingly apt narratives, and replete with the keen observations of a capable mining engineer of many years of activity, his address was clear and extremely informative. To the layman investor it was an education. "Of well-conducted mining ventures it can safely be said that they meet with a measure of success as large as, if not larger than, an ordinary manufacturing enterprise," observed Mr. Rickard at one point. "Yet mining," he continued, "has been and still is a glorious adventure for the youth of the world—for those young in spirit as well as in body." While the spirit of adventure was natural and vital to this industry, yet mining, properly conducted, was not a gamble. Naturally there was some risk. No sane man would expect to escape it. The idea of avoiding risk in mining was a pathetic fallacy, a weak endeavor to escape the inevitable. The attempt to find mines that would involve no risk to the capital sunk in them had tended to cripple the industry; and the refusal of many so-called exploration companies to incur risk had stultified their operations and paralyzed development.

"When the ore reserves of a mine are at low ebb," continued the speaker, "it may be the most speculatively attractive time to buy the property. There are those who say that the mining of the future will be the economic harvesting of the known ore deposits of low grade, the beneficiation of the masses of mineral already discovered, but heretofore regarded as too refractory for successful metallurgical treatment. That is, the utilization of the visible supply of skimmed milk, instead of finding the metallic cream concentrated by the patient operations of nature. I doubt that. The world is still young and but half explored, a fact substantiated by such discoveries as those of Nome, Cobalt, Porcupine, Tonopah, Goldfield, the United Verde Extension, the Bawdwin Mines of Burma, and a host of other bonanzas of the last 20 years.

"Before a profitable outcome is assured, every mining enterprise must pass through several speculative stages as surely as a child must take the chances of bumps and bruises. The history of the great mining deposits of the Rand, in South Africa, has not escaped the vicissitudes latent in mining which resulted in widespread loss of money. Between 1911 and 1918 the market value of the shares of the three principal companies, representing consolidations of groups of mines, declined $203,931,610, this loss being due to ignoring the common experience that mines eventually become impoverished in depth just as surely as men grow old."

More Money Made by Selling Than by Buying

Mr. Rickard asserted that the biggest fortunes in mines were made during early stages of development. On the whole, more money was made by selling than by buying mines, because the final so-called investment stage of a first-class mine is likely to represent an over-valuation. He ventured to say that more money was lost by over-valuation of rich mines than by worthless prospects. Small men lost their money in big mines; big men in small mines. The most intelligent policy to follow in investing in mines was to allow a liberal margin both ways, taking a larger risk for the sake of a larger gain.

"The sampling of mines," Mr. Rickard went on, "has been allowed to obscure the need for good judgment. It is also another phase of the attempt to make an investment out of a speculation. The ore in reserve in a mine should be regarded chiefly as an indicator of the probability of being able to find and develop more ore of the same grade. The expectation of a profitable venture should be based, not upon the extraction of the known ore, but upon the chance of further intelligent search. It is the spirit of adventure that stimulates the best kind of mining.

Mining Ventures Meet With Average Measure of Success

"The speculative side of mining has an attractiveness that is at the bottom of the energy with which it is followed, and, when brought to the dead level of a steady investment, you will find that the man of ordinary shrewdness saves time by going straight to his broker and buying bonds or consols. This does not mean that one is justified in playing the fool and expecting miracles to happen. The risk of mining should not needlessly be increased. Mining enterprises come to grief often, not so much because of the failure to attain an investment basis, but because they are not put on a business basis. Even if the occurrence of ore in nature is erratic, and mining as a consequence be hazardous, there is no justification for piling human foolishness on top of nature's vagaries.

"Of well-conducted mining ventures," concluded Mr. Rickard, "it can be safely said that they meet with a measure of success as large as, if not larger than, ordinary manufacturing enterprise."

H. N. Lawrie, chairman of the Oregon Bureau of Mines, was the first speaker when the convention reassembled on Mar. 18. His subject—"Gold"—was treated in an informative and entertaining manner. The attitude of "watchful waiting," adopted by so large a proportion of potential developers, was likely, he said, to cause economic distress, and it was his opinion that the mining industry offered a magnificent field in which to utilize returned soldiers. With the assistance of a number of charts, Mr. Lawrie gave an account of the gold production of the world, paying a high tribute to the British pound, its stability, and its universally recognized value. The elimination of artificial barriers of trade, such as excessive exchange rates, was necessary for future development, Mr. Lawrie contended, and an essential to progress was true freedom of trade. The solution of the present problem was "business as usual," development and production. People who were waiting, almost expecting, a general revolution, cancellation and repudiation of debts, and the adoption of new economic standards, were mistaken. Bolshevism was a danger that this waiting and watching in industrial movement tended to assist. The right backfire against Bolshevism was industrial activity that would provide proper employment at right wages.

Discussing the world production of gold, Mr. Lawrie said that it was a matter of common knowledge that the high production of the year 1915—$469,000,000—had been followed by a steady decline. In the United States the falling off in production had been due to labor and machinery increases, and to other wartime factors. Besides, a slackening had been caused by the depreciation in the purchasing power of gold.

With reference to the commodity prices for the next two years, the speaker expressed the opinion that there would be no drop. The fact that people were waiting for such an occurrence was creating stagnation. Credit and currency must be extended to meet the conditions. "Generally speaking," he continued, "we are marking time at a moment when we should be busy. The boys are coming back from the front, better men, men trained to activity. They do not want to take part in this marking time; they want to see action. The mining industry is one of the best in which these men can participate. In peace times the mining wage is always at the top. It is a clean business. It is an outdoor business."

In course of the discussion which followed, Mr. Rickard uttered a warning against the suicidal action of hoarding gold, declaring that a strong display of confidence was essential in successful reconstruction.

"Government Control of Smelteries" was the subject of an able paper by Sidney Norman, of Spokane, who, referring to conditions in the Northwest, said that in years past the utmost good feeling had prevailed between operators and the management of the Trail smeltery of the Consolidated Mining and Smelting Co. of Canada. More recently, however, this sentiment had changed to one of distrust. He did not know whether there was any sound ground for the disagreement, but believed that government regulation of this plant, and of other smelteries, would have the effect of clearing the atmosphere and of benefiting the mining industry. If the smelters were making no more than a legitimate profit, they would have no cause to fear such regulations. If, however, they opposed the proposal, the inference was clear. He did not wish to be understood as favoring government ownership of smelteries—that would be a calamity. Government regulation through the medium of experts, however, was a different thing. British Columbia was to be commended in having the finest mining laws on the continent, and it was fitting that her government should take the lead in this matter. The closing of the smeltery at Greenwood by the Canada Copper Corporation gave the government the opportunity of establishing an operating smeltery on such a basis.

SMALLER SIZES OF COAL MERIT WIDER MARKET

"The Better Preparation and Utilization of Coal" was discussed by G. W. Evans, coal mining engineer, of the Northwest Experiment Station, U. S. Bureau of Mines, Seattle. His plea was for the greater use of the smaller sizes of coal, largely disregarded both by producer and consumer. It was well known to operators, both of British Columbia and Washington, that the percentage of large sizes is decreasing and that of small-size coal increasing. This change had been brought about partly by the inferiority of coal mines of today as compared with those of former years. As, however, it must be recognized that the percentage of lump coal would decrease and that of small sizes increase unless new coal fields were discovered, preparations should be made to make more small coal and to offer it to the public in the cleanest possible condition. He then discussed the best means of getting good results in the washing of coal, emphasizing the importance of the proper design of washer, the necessity of paying attention to the efficient operation of jigs, and the utility of the "float-and-sink" method of testing. Giving examples of how and to what extent savings might be obtained in British Columbia and the State of Washington, he said that he had seen 80 lb. of white rock picked from seven tons of coal that was supposed to have been cleaned. This occurred in Washington.

As to the value of the small coal, Mr. Evans gave attention to the use of powdered coal for fuel purposes, referring to its increasing popularity, and asserting that, with proper development, this branch of the coal trade in the Northwest might be expected to drive much of the imported fuel out of the market, thus permitting its use elsewhere. The oil supply of the world, he said, was limited, and should be conserved. The coal reserves of the Northwest, however, were sufficient to meet the needs of the Pacific Coast for hundreds of years. Francis Glover, of the Princeton Coal and Land Co., followed with some practical suggestions along the same line, among which was that the government should appoint engineers to see that wasteful methods were not adopted in the extraction of coal.

THE ENCOURAGEMENT OF PROSPECTING

"The Prospector, What He Should Be and How To Assist Him," was the theme of a discourse by John McConnell, who, after referring to the absolute need of the prospector in a mining country, recommended that the citizens of Vancouver, Seattle, and other centers might invest more generously in the grub-staking of these men. It was a gamble of a most fascinating nature. Because of the complex character of much British Columbia ore, the prospector and the small operator should be assisted by the establishment by the government of ore-testing mills. One plant should be an adjunct to the scientific department of the University of British Columbia; another should be placed at Nelson, B. C., to serve the Eastern mining divisions; and a third at a point in the Northern interior. He recommended that these plants be under the direction of skilled metallurgists, who would, in turn, be under the control of the provincial mineralogist. Two concentrating plants also were recommended by Mr. McConnell, one to be at Hazelton, B. C., or some other suitable point in the northern silver-lead district, and another in the Kootenays, preferably at Nelson, B. C., to cover the southern galena belt. Mr. McConnell suggested that a course of mining for the special benefit of prospectors should be arranged by the University of British Columbia. Another recommendation was that the provincial government, in dealing with the returned-soldier problem, might consider the advisability of grub-staking those soldiers who would prefer prospecting to going back to the land, for one or two years.

TAXATION OF MINES

"Taxation of Mines" was the subject of a talk by Valentine Quinn, of the Granby Consolidated Mining and Smelting Co., and also T. W. Bingay, of the Consolidated Mining and Smelting Co. of Canada. They were followed on the same question by Nicol Thomson, chairman of the mining committee of the Vancouver Board of Trade. Mr. Quinn argued that interest on capital employed is a fair and equitable charge on the income its employment produces, and therefore should not be taxed. In explanation it may be stated that this is not conceded by the income-tax law of the province in its application to mining companies. The speaker emphasized the possibility of considerable difficulty arising in the obtaining of outside money or capital for investment in British Columbia mining enterprises if the course of making no allowance for interest on bonds in taxation were pursued. "If a refinement of the income-tax act could be secured," he concluded, "eliminating the indeterminate basis on which it is proposed to assess the mining industry, and taking into account the necessity of not only inducing new capital to come into the province but permitting the repayment of capital already invested to be periodically provided for, as well as to receive a reasonable return on its use, say 7%, before determining the taxable income, it would go far toward developing the financial end of British Columbia's mining industry."

Addressing himself to the same question, Mr. Bingay arrived at practically the same conclusion. He thought that the government should, in its taxation policy, exempt interest on borrowed capital in an estimation of what was termed taxable income. His opinion was that it would be more just and equitable to follow the lines laid down by the dominion government income-tax act, which applied equally to all individuals and to all corporations, regardless of the size of the income. "If an individual," he said, "derives income from investments in a company, the normal tax is collected at its source, and he does not have to pay the normal tax again on the same income." This was not the case in the province, he averred, the individual paying income tax first on the earnings of the company in which he was interested, then again on the same funds when coming to him in dividends. He thought, too, that there should be a deduction in figuring income of the salaries paid to nonresident directors and managers. In regard to the allowance of a maximum of 15% for mine depreciation, the government's position that there could not be greater depreciation was illogical. Mr. Thomson's opinion was that any mining taxation should be based on the net and not on the gross income, and that proper allowances should be made for such items as depreciation and development charges. Without such treatment, investors were likely to turn away from the province.

ABOLISHING THE FIXED PRICE OF SILVER

A number of resolutions were discussed and indorsed by the convention before its adjournment on Tuesday evening, Mar. 18. One asked the Canadian government to use its influence with the British government to the end that the present fixed price on silver be abolished. Smith Curtis, of Kamloops, B. C., the mover, said that the authorities were not treating Canada fairly in this matter. She was losing between $4,000,000 and $5,000,000 annually. The present policy was unjust to the producer and to the country. Silver, like any other commodity, should, now that the war was over, be permitted to find its own level. If this were done, silver, indubitably, would rise well above $1 an ounce, possibly advancing to $1.50, certainly as high as $1.30 or $1.40. If the conditions were such that it might be expected to go below $1, it was almost a surety that the government restriction would be removed. Why should the producer be so discriminated against?

There was an enormous demand in the Orient and throughout Russia, and he upheld the right of the operators of British Columbia, as well as of other sections of America, to reap the rewards which conditions offered, because, under adverse circumstances, they had been and would be expected to stand on their own feet. G. A. Caldwell, representing the producers of the Boundary District of the province, spoke warmly in support of the proposal, terming the action of the few who argued that it was an Imperial question, and that the present policy had been acquiesced in by the United States at the behest of Great Britain in order that the economic equilibrium might be maintained in India, as a wielding of cudgels on behalf of the plutocrats. The resolution was carried.

S. S. Fowler, of Nelson, B. C., introduced a resolution proposing that the provincial government be asked to organize and equip an exploratory party for the purpose of exploring the vast northeastern section of British Columbia, of which little or nothing is known and which might possess mineral wealth that would repay a thousandfold the cost of such expedition. This also was indorsed.

Other resolutions which carried may be summarized as follows:

That the provincial government be asked to provide a more substantial financial vote for the carrying on of mineralogical, geological, and like educational work at the University of British Columbia.

That the provincial government be asked to provide an assay office and facilities for the analysis of ore at Prince Rupert, B. C.

That the Minister of Mines for British Columbia be requested to arrange for a tour through British Columbia of a party of British and American mining engineers, expenses of the same to be defrayed by the government.

That the Department of Trade and Commerce be requested to arrange for the filming of samples of British Columbia minerals and to use said pictures in connection with the advertising program it is now preparing.

That the Postmaster General of Canada be petitioned to remove present restrictions placed by the dominion on the importation of such second-class mail matter as representative American mining magazines.

That the "house-cleaning" campaign being inaugurated by the Spokane Chamber of Mines be indorsed. In explanation it may be pointed out that the mining interest attached to this proposal was given as being the fact that, if cities, large and small, began painting their buildings, public and private, so largely would the consumption of paint and its chief ingredient, lead, be increased that the present embarrassing surplus of the latter soon would be eliminated.

Fred T. Congdon, K. C., former member of the Dominion House of Commons for the Yukon Territory, addressing the convention delegates after the banquet of Tuesday evening, stated that it was a fallacy to suppose that the Yukon Territory and Alaska had been depleted in respect of their mineral possibilities. Both these vast territories offered splendid opportunities to the prospector and the operator. The climatic conditions, too, he asserted, were ideal. True, there were occasional "cold snaps," but, taking the year round, the temperature was nothing more than bracing.

VISIT TO BRITANNIA MINE

Other speakers were A. C. Garde, of Prince Rupert, B. C., and M. J. Carrigan, of Seattle, Wash., the former confining himself to the mineral and general industrial possibilities of the Pacific Northwest, and the latter speaking of the potentialities of the iron-ore deposits of the province, to which reference has been made.

On Wednesday, Mar. 19, the convention was brought to a close with a trip to the mine and plant of the Britannia Mining Co., which is situated within a day's return journey of the city of Vancouver. A special invitation was given the visiting delegates, and every opportunity afforded them to become acquainted, at least to some extent, with one of the largest and best-managed mining enterprises of America.

An account of the convention would not be complete without passing reference to the splendidly representative and informative collection of mineral samples, which came from all sections of the Pacific Northwest, and which occupied a prominent position in the Vancouver Hotel. Another exhibition which attracted attention was that of machinery used in mining operations, which was housed in the vicinity.

Officials of the British Columbia Chamber of Mines, too, should receive a word of commendation and congratulation. It was their first attempt at the organization and management of a convention on a large scale, and to their indefatigable efforts is due its unqualified success.

Manufacturing Detonators for Blasting*

Copper sheets are used in the manufacture of the shell or container which receives the detonating composition used in blasting, and these are placed under a punching machine, which cuts small circular disks from each sheet. These disks then pass into another machine which has a descending plunger that cups the flat disk. From the cupping machine the cups are conveyed to a drawing machine, which cups them still more and starts the formation of the shell. After passing through two more drawing machines, the copper is further drawn out and the shell formed with a rough top. This rough top it cut off smoothly in a cutting machine, and the shell is complete. The shells are then dumped into hoppers, from which, by pulling a lever, the operator can load them, 100 at a time, into block trays having holes, into each of which a shell fits in an upright position, ready to receive the charge of detonating substance.

The preparation of the different detonating agents is a rather intricate chemical process, and is attended with infinitely more danger. As an example, fulminate of mercury is made by mixing nitric acid, mercury (quicksilver) and alcohol in the proper proportions. A white residue, or precipitate, called fulminate, is the result of this chemical action. This fulminate is carefully washed to remove all impurities and excess acid, placed while still wet in small fabric bags, and stored in wells in the ground filled with water.

When wanted for use, the fulminate is removed from the water, taken to a barricaded dry-house, where gentle currents of warm air remove the moisture. Dried fulminate is very sensitive; hence the handling from this point must be done with extreme care. The dry fulminate is carried in small rubber-lined boxes to the dry-storage house, situated a considerable distance from the rest of the plant as a safety measure. From the dry storage, the fulminate is taken in small quantities to the mixing house, where it is mixed with the other detonating ingredients in the correct proportions in automatic, specially constructed vibrating machines. Thorough mixing is essential.

The mixed fulminate is then taken to the house, where it is filled by automatic machines into the copper shells held in the trays, and then to the press, which has 100 small plungers that fit exactly into each cap or shell. This gently presses the detonating mixture, and compresses it to a sufficient degree to keep it in the shell. Explosions are frequent in this step of the process, and the press is consequently surrounded by thick walls, and the operator remains outside during the operation, which, however, requires but a short time.

From the press, the loaded caps are conveyed in sawdust to rumblers and screens, where any loose particles of the detonating agent are removed along with the sawdust, and the blasting caps are ready to pack. They are first placed in felt-lined tin boxes, each holding 100 caps, then into heavy pasteboard cartons, and finally into strong wooden cases for shipment.

---

*Extracted from an article, "Detonators for Blasting," appearing in the April issue of *Du Pont Magazine*.

Bingham Mines Co. Annual Report

The 10th annual report of the Bingham Mines Co. for the year ended Dec. 31, 1918, shows that shipments from the Dalton & Lark mine amounted to 2391 dry tons of lead ore and 31,670 dry tons of copper ore, of a gross value of $220,200, comparing with a total of 25,776 tons, valued at $334,667, the previous year. The net smeltery returns were $144,602, compared with $234,966 in 1917. Lessees in the Dalton & Lark and Commercial mines produced 4862 tons, netting the company a royalty of $32,153. The contents of company and lease ore produced in both mines were: Gold, 1666 oz.; silver, 172,567 oz.; lead, 1,426,636 lb.; copper, 875,006 lb.; as compared with 2182 oz. gold, 227,975 oz. silver, 936,125 lb. lead, and 2,971,214 lb. copper in 1917. New work totalled 2755 ft. of drifts, crosscuts, winzes, and raises.

The Victoria mine produced 6790 tons, containing 1047 oz. gold, 139,308 oz. silver, 176,019 lb. lead, and 165,508 lb. copper, of gross value of $170,619, with net smeltery returns of $108,810. The amount of new work was 2313 ft. The Yosemite Mines Co. produced 2010 tons, containing 79 oz. gold, 10,188 oz. silver, 314,258 lb. lead, and 21,034 lb. of copper, valued at $29,577, from which net smeltery returns were $18,421. New work totalled 1799 feet.

The Eagle & Blue Bell Mining Co., a subsidiary, produced 40,369 tons, valued at $1,089,177, comparing with 34,457 tons, valued at $1,068,836, in 1917. The net smelter returns on this ore for 1918 amounted to $626,978, comparing with $714,867 in 1917. The contents of the ore produced in 1918 were: Gold, 2605 oz.; silver, 579,074 oz.; lead, 9,389,376 lb., and copper, 16,012 lb. The amount of new work in drifting, crosscutting and other openings totalled 5519 feet.

Silver King Consolidated Mining Co., of Utah, in its annual report for 1918, states that receipts from ore sale amounted to $275,968.48; stock sales, $266,265.31, and miscellaneous, $28,007.03. Together with the balance on Jan 1, 1918, ($239,086.18), total receipts amounted to $809,327. Total expenditures were $762,618.62, and include development and mining, $97,773.92; tunnel account, $116,146.42; dividends, $70,000, and other items. Production of ore and concentrates for 1918 aggregated 5182 gross tons, or 4901 net tons, the gross value of which was $318,845.50. Deducting charges, (freight, $10,502.47, and smelter charges, $32,372.46), net value was $275,070.57. Progress at the Spiro tunnell was 4001 ft., which was made at an averag cost of $25.508 per foot.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Claims Exceed Appropriation

Judging from the rate at which war-minerals claims are reaching the Relief Commission, the total amount claimed will exceed greatly the $8,500,000 provided by Congress for adjustment purposes. The total number of claims received up to Apr. 4 was 89. These were divided as follows: California, 23; Oregon, 18; Colorado, 8; Arkansas, 7; Utah, 7; Minnesota, 5; Alabama, 5; Georgia, 4; Tennessee, 4; Montana, 2; Nevada, 2, and the following states 1 each: New York, Oklahoma, Pennsylvania, and Virginia. By far the greater number are based on operations for the mining of chrome. Manganese is in second place, and pyrites and tungsten are third and fourth, respectively. Many persons, evidently not knowing that the statute limits relief to the four minerals mentioned, are sending in claims based on nearly all mining activities. One promoter asked to be repaid for his expenditures in an effort to float war-minerals propositions.

At the request of California chrome producers, no interpretation will be made of that section of the law which limits claims to those where a direct "request or demand" was made by a Government agency, until they can be heard on the subject. One provision of the law is being overlooked by many who are filing claims. The law specifies that the work done must have been on the property which contains minerals in sufficient quantities to be of commercial importance. The burden of proof in this regard, therefore, is on the claimant.

Philip N. Moore, of the commission, calls special attention to the fact that it is not necessary for claimants to employ attorneys. The commission much prefers to deal directly with claimants, and will see to it that each has every opportunity to make his case as strong as he can. J. E. Spurr has been selected by the commission as its chief engineer. This work will be in addition to his regular duties with the Bureau of Mines. H. E. Meyer, former chief clerk of the Lake Superior experiment station of the Bureau of Mines, has been chosen as chief clerk of the War-Minerals Relief Commission. Mr. Meyer just has returned from duty with the army of occupation.

New General Import License

The War Trade Board announces that a general import license, to be known as PBF No. 36, has been issued, effective Apr. 7, 1919, covering the importation into the United States from Mexico, Cuba, Haiti, Santo Domingo, and all countries of Central and South America, except British and French possessions, of all commodities except pig tin, tin ore, tin concentrates, all metal alloys containing tin, nitrate of soda, emery, except that mined in Canada; salvarsan, neosalvarsan, arsphenamine, and all substitutes therefor and equivalents thereof; sugar, wheat, wheat flour, rice, peanuts, nitrate of potash, cocoa, coffee, rubber, tungsten ore, and wool.

Foreign-Trade Committee Formed

The State Department has organized a foreign-trade committee for the purpose of outlining policies for the Government's relationship to foreign trade. The mining industry is to be represented by J. E. Spurr, of the Bureau of Mines, who also represents the Interior Department on the committee, as well as the other interests coming under the jurisdiction of that department. This committee is distinct from the Economic Liaison Committee, which was organized recently by the State Department.

Anti-Trust Legislation

Impetus has been given to the movement to secure the reopening of the anti-trust question at the next Congress by the referendum just taken on that subject by the Chamber of Commerce of the United States. The referendum indicates that the overwhelming majority of American business men want to see the uncertainties of the existing laws removed.

Despite the fact that not many months ago the Chamber of Commerce brought out a scathing criticism of the Federal Trade Commission, the vote of its members is strongly in favor of making it the supervising body which would formulate standards of general business conduct. The chamber recommends, however, that the commission be enlarged and new members chosen from among men who would "bring to the commission a proper conception of its duties and purposes." Another reason given why the commission should be the supervisory body is that it has gathered invaluable information concerning industrial and commercial practice during recent times.

Panama Canal Freighting

Now that the nature of the cargoes passing through the Panama Canal again is being made public, it may be noted that minerals form a substantial proportion. The report covering the week ended Mar. 15 shows that cargoes of spelter are moving from Tacoma and Seattle to Gulfport, and nitrates from Calita Buena, Tocopilla, and Mejillones to San Juan, La Pallice, and Charleston, respectively. Copper, in addition to the movement from Chilean ports to New York, is being shipped from Portland, Ore., to France.

Pan-American Industrial Congress Proposed

A Pan-American industrial conference fully as pretentious as was the Pan-American Scientific Congress held in 1915 is under consideration by the Pan-American Union. It is practically certain that such a conference will be held.

As mining is an important industry in Latin America, it will occupy a prominent place on the program. This will be the first conference of the kind to be devoted exclusively to the economic features of Pan-American relationships.

Joseph E. Johnson, Jr.

JOSEPH E. JOHNSON, JR., was killed accidentally at Hartsdale, N. Y., on the morning of Apr. 4. On the way from his home to the railway station he paused for an automobile to pass. The automobile skidded and struck him, knocking him down and fracturing his skull. He died an hour later without regaining consciousness. The news of this sad accident came as a shock to his host of friends in the profession and outside of it.

J. E. Johnson, Jr., was born at Longdale, Va., in 1870, the son of Major J. E. Johnson, who was the manager of the Longdale Iron Co. He was graduated from Haverford College in 1888. He received the degree of mechanical engineer from the same college in 1891, and in 1892 obtained a degree from Cornell University. In the meanwhile he had begun practical work, first as a draftsman for the Baldwin Locomotive Works. Having finished his studies at Cornell, he was engaged from 1892 to 1894 with the Straight Line Engine Co. and the Cranberry Iron and Coal Co. In 1894-95 he was assistant to the superintendent of the Ames Iron Works, and in 1895-99 was engineer and assistant manager of the Longdale Iron Co. Leaving that position, Mr. Johnson worked with the Carnegie Steel Co. in 1899-1901, being identified with its blast-furnace department. In 1901 he returned to his old position with the Longdale Iron Co., with which he remained until 1906. From 1906 to 1909 he was general manager of the Princess Furnace Co., operating blast furnaces, ore mines and a railroad. During 1909 and 1910 he was general superintendent for the Republic Iron and Steel Co. at Thomas, Ala., operating three blast furnaces and 900 coke ovens.

JOSEPH E. JOHNSON, JR.

From 1910 to 1913 Mr. Johnson was manager of the Ashland plant of the Lake Superior Iron and Chemical Co. at Ashland, Wis. In 1913 he opened an office as consulting engineer in New York, and had made this his headquarters since that time. This is a bare outline of his extensive and active career in work among iron mines and furnaces and coking plants. He gained comprehensive experience as a mechanical engineer, as mining engineer and as metallurgical engineer and was splendidly fitted for consulting practice when he entered it.

Previous to his entry into general consulting practice, Mr. Johnson had done much technical work of a major character, which had won for him high professional recognition. His remarkable versatility was exhibited in the variety and wide range of his interests. The introduction of a masterly method of mining, the designing of some ingenious mining machinery, the arrangement of a clever system of tramway transportation, the improvement in blast-furnace practice, the study of the quality of pig iron and the means for raising the grades, were all subjects that engaged his attention with distinctly useful results. He was a generous contributor to the technical press and described his work and offered his ideas in papers in the *Journal*, *Chemical and Metallurgical Engineering*, the *American Machinist*, *Iron Age*, and the Transactions of the American Institute of Mining Engineers. Besides these contributions, which were invariably noteworthy, he was the author of treatises on "Blast-Furnace Construction in America" (1917), followed by "The Principles, Operation and Products of the Blast Furnace" (1918). In his preface to the former work he said: "I happen to have made several investigations which served to explain some of the phenomena of the blast furnace not previously understood, and it seemed proper that the results should be recorded. . . . In many cases my opinions are given for what they may be worth, because it seems to me that those books which simply give a number of opinions without any indication of the author's preference are of little real use." This expression was thoroughly characteristic of the man.

The best efforts of Johnson's leisure for more than three years were spent upon this book, which dealt chiefly with the mechanical side of the blast furnace. It was written in that exact and clear language that was characteristic of its author, which made it easy for everyone to read and put it within the grasp of any intelligent furnace-man. The succeeding treatise exhibited the same admirable qualities.

In a review of "Blast-Furnace Construction" by Bradley Stoughton, than whom no one is more competent to pronounce an opinion, Johnson's professional status was excellently summarized in the following paragraph:

"Probably no living person is qualified for so many different reasons to write a book on this subject as is J. E. Johnson, Jr. His father was an important American ironmaster, and this author may be said to have been born and bred around a blast furnace. For more than 20 years he has held a prominent position as operator, inventor, author, and interpreter. Two of his achievements in the latter capacity would alone be sufficient to place him in the first rank of modern scientific interpreters; namely, his theory of the constitution of cast iron, which has since been expanded and elaborated by himself and others, and his theory of the critical temperature of the blast furnace, which is now generally accepted as the explanation of the saving effected by drying blast, which was once considered (especially by German theorists) as super-theoretical and, therefore, impossible."

In his work as consulting engineer Mr. Johnson found a wide field of activity. One of his recent important works was a professional mission to China. Just previous to his untimely death he had been devoting himself to a new study in the metallurgy of iron, in which he was intensely interested and as to the successful outcome and practical value of which he had great hopes.

Personally, Mr. Johnson was a most lovable character. He had a natural gift for making friends, all of whom enjoyed him immensely. He was a broad-minded man, whose interests were far wider than those of his profession. He was a good citizen. He was a wonderfully clear thinker, and his views were invariably characterized by a striking originality. Added to this was his art of frank, clear, and illuminating expression. A sleepy meeting always woke up promptly when Johnson rose to make any remarks. There is nobody to fill the chair that he has left vacant.

Mr. Johnson was a member of the Mining and Metallurgical Society of America and a member of the board of directors of the American Institute of Mining and Metallurgical Engineers, in which he was marked for high honor. He resided in a beautiful old-fashioned home at Hartsdale, where he leaves a widow and a young son. W. R. I.

Chronology of Mining for March, 1919

Mar. 1—Arizona Copper Co.'s mines in Clifton-Morenci district of Arizona placed on a five-day per week and wages at 18c. price for copper basis, with bonus of $1 per day for underground men and 75c. for surface men.—Further reduction of 25c. per day in miners' wages effective in Bingham district in Utah.—Sliding scale of wages based on price of copper effective at the Granby Consolidated Mining, Smelting, and Power Co., in British Columbia, with a bonus arrangement.—Price of copper declined below 15 cents.

Mar. 8—Employees at the Garfield smeltery of the A. S. & R. Co. returned to work.

Mar. 13—Announced that English government plans creation of permanent petroleum ministry to act as adviser for all departments, to have control of all territory within the empire, and advise and assist British companies or individuals in obtaining concessions and leases in foreign countries.

Mar. 14—Calumet & Hecla passed its dividend; stock declined 50 points.

Mar. 16—Reduction of $1 per day in miners' wages in Cœur d'Alene district.

Mar. 17—International Mining Convention held at Vancouver, B. C.

Mar. 18—Pumping of first well started at property of Texas Gulf Sulphur Co., at Gulf, Matagorda County, Tex., and production of sulphur began the following day at rate of over 400 tons every 24 hours. On Mar. 23 second well started to produce, the two wells making about 1000 tons daily.

Mar. 19.—Arguments heard in U. S. Supreme Court in Washington, D. C., on appeals by Minerals Separation, Ltd., from Federal court opinions denying injunctions to restrain Butte & Superior Mining Co. from infringing flotation process patents.—Walter Renton Ingalls, who was Editor of the *Engineering and Mining Journal* for nearly 14 years, retired from that position and reëntered professional practice as consulting engineer, retaining, however, his connection with the *Journal*, as Consulting Editor.

Mar. 20—The transport "Dakotan" arrived in New York, with 43 officers and 1349 men of the 27th Engineers.—J. P. Morgan & Co. notified by British government to discontinue buying of sterling exchange.

Mar. 21—Price reduction effective for iron and steel as agreed upon between the Industrial Board and general committee of the iron and steel industry.

Mar. 26—Sterling exchange drops to 4.615.

Mar. 28.— Fire occurred in Argonaut mine in Jackson County, Calif.

Mar. 31—Sale of Mother Lode Copper Mines Co., of Alaska, to Stephen Birch permitted by Supreme Court of the State of Washington.—Trading in copper was begun on the New York Metal Exchange.

Sale of American Metal Co. Stock

The sale of 562 shares of the Compañia de Minerales y Metales, S. A., which is less than 3% of the total capitalization, and 34,644 shares of stock of the American Metal Co., Ltd., which is 49% of the capitalization, which securities were seized by the Alien Property Custodian because of German ownership, took place in the offices of the company, at 61 Broadway, New York, on Monday, Apr. 7, at 10 a. m. After the usual preliminary legal formalities had been observed, the 562 shares were put up in one block. The bidding was started by Howard Walter McAteer, who stated he "represented a syndicate," at $28,000. C. M. Loeb, president of the American Metal Co., was the only competing bidder, and the price was bid up in $1000 advances to $57,000, by Mr. McAteer, at which price the block was knocked down to him. Mr. Loeb withdrew with a bid of $56,000.

The 34,644 shares of the American Metal Co., Ltd., were also put up in a single block. Mr. McAteer started the bidding at $50 per share, and keen competition developed between him and Charles Hayden, of Hayden, Stone & Co., the only other bidder, who stated he was "acting for himself and associates." Mr. Hayden finally purchased the stock at a bid of $140 per share. which represents $4,850,160 for the whole block. Mr. McAteer is president of the American Steel Export Co., 233 Broadway, N. Y.

American Electrochemical Society

The general meeting of the American Electrochemical Society was held on Apr. 3, 4, and 5, at the Chemists' Club, New York. More than 200 members and guests were in attendance. On Thursday, after the annual business meeting held in the morning, the following papers were presented in abstract and discussed:

E. F. Northrup: "Principles of Inductive Heating With High Frequency Currents." Gustave Gin: "Uranium." H. D. Braley: "Notes on Electrostatic Precipitation." G. G. Griswold: "Electrolytic Silver and Gold Refining at Perth Amboy." G. A. Guess: "A Process for Electrolytically Refining Nickel." O. P. Watts: "Electroplating on Iron From Copper-Sulphate Solution." O. P. Watts: "Remarkable Pitting of Electroplating."

C. F. Carrier presented an important paper on the Nelson electrolytic chlorine cell. The importance of this cell may be judged by the fact that over 8000 have been installed. In the Government plant at Edgewood Arsenal, Baltimore, Md., more than 3500 Nelson cells were installed for the production of 100 tons of chlorine gas per 24 hours. Mr. Carrier described the developments of the cell and said that it is not claimed that absolute perfection had been attained, but that it is believed that the cell has reached a stage where experiment and abstract theory are things of the past.

The papers presented on Friday were:

W. H. Walker: "The Edgewood Arsenal." O. Hutchins: "Silicon Tetrachloride." G. A. Richter: "The Role Played by Silicon and Titanium Tetrachlorides During the Past War." A. B. Lamb: "Portable Electric Filter for Smoke and Bacteria." E. Gudeman: "Chemical War Secrets and Releasing Manufacturers' Reports." W. L. Argo, F. C. Mathers, B. Humiston, and C. O. Anderson: "Preparation of Fluorine." R. E. Wilson and W. G. Horsch: "An Electrolytic Process for Production of Sodium Permanganate From Ferromanganese." A. G. Reeve: "Lead Plating of Shell Interiors and Boosters." B. G. Klugh: "Electric Furnace Manufacture of Silico Manganese." T. F. Baily: "Electric Furnaces Used in the Production of Essential War Materials."

On Friday evening a smoker was held in Rumford Hall. On Saturday the members and their guests visited the plants of the Loose-Wiles Biscuit Co., the Wright-Martin Aircraft Corporation and Nichols Copper Co.

Initial Relief-Commission Hearing

Washington Correspondence

The initial hearing before the War-Minerals Relief Commission will be held in Washington on Apr. 15, and the claim which will come before the commission at that time is that of the Chestatee Pyrites and Chemical Co., Chestatee, Hall County, Ga. As this is the first hearing and will disclose the procedure which will be followed in subsequent cases considered by the War-Minerals Relief Commission, it will be followed with special interest.

Industrial Representatives at Capital

Government officials having to do with matters pertaining to the petroleum industry are anxious that the newly formed American Petroleum Institute should establish its headquarters in Washington. With few exceptions the important industries of the country are represented in Washington by organizations which are prepared to give immediate information concerning any phase of their activities. By the close touch that is maintained, the bureaus are able to direct their work so as to afford the greatest possible benefits to industry. The committees of Congress engaged in formulating legislation find that it is a great help to have immediately at hand representatives of the industries which will be affected. Their point of view often prevents embodiment in bills of obvious injustices.

British Molybdenum and Tungsten Markets

The following is a letter received at my Paris office from Everitt & Co., of Liverpool, referring to the molybdenum and tungsten ore market in England. The letter is so timely that it should interest your readers:

"We beg to acknowledge receipt of your letter, and note what you write regarding your New York house being able to offer monthly productions of molybdenum sulphide, and also wolfram ore.

"Unfortunately, since the armistice has been signed, the position of these minerals is in a precarious state, and, naturally, as the tungsten steel is required more or less for shell turning and other munition work, with the cancellation of government contracts the steel makers are overstocked with tungsten steel, as also with tungsten metal, and the country is overstocked with tungsten ore.

"As you are probably aware, as far as this country is concerned, the British government made arrangements to take all the ore from our colonies at a fixed price for six months after the signing of peace, and what with the large stocks that are held on government account, and by private firms, and the bad position at the present time with consuming works, there is more ore in the country than one knows what to do with. The government has reduced its price to the actual makers of the tungsten metal to 40s. per unit of tungstic acid in the ore, and we should not be at all surprised to see the price drop before long considerably, and as the government is committed to take all the ore from the mines abroad at a fixed price for six months after peace is signed, this means that the mine owners abroad will send ore into the country as rapidly as they can mine it, and as far as we can see there will be stocks to last for at least two years.

"As regards molybdenite, the position is somewhat similar. The demands for this ore are erratic, and although there was a fair demand during the war, this has fallen away to practically nothing. Prices for this mineral are, of course, high, and when one considers that in 1911 and 1912 the price was about 30s. per unit, it can readily be seen that prices will have to drop considerably in the same way as did those of wolfram ore, and we think it will be a long while before the market gets brisk again in this mineral."

New York, April 18, 1919. Mark R. Lamb.

The Enemy Trading List

Announcement has been made by the War Trade Board that a revised Enemy Trading List for Mexico, Cuba, Haiti, San Domingo, and the countries of Central and South America has been issued which supersedes all previous issues. Persons within the United States may now trade and communicate with individuals, firms, or corporations whose names were contained in previous issues or supplements of the list but which are not included in the present revision, provided such individuals, firms, or corporations are not believed to be trading, directly or indirectly, for or on behalf or on account of any of the individuals of firms now listed.

The provisions of the Trading With the Enemy Act continue in full force and effect with respect to the houses included in this revised list and parties acting on their behalf, and the Bureau of War Trade Intelligence is prepared to answer inquiries concerning any parties to a proposed transaction.

The restrictions heretofore existing with regard to the importation of ferromanganese and spiegeleisen, as included in List of Restricted Imports No. 2, Item 114, have been removed, effective Apr. 1, 1919, according to an announcement of the War Trade Board, and licenses to import these commodities will now be issued freely when the applications are otherwise in order.

Importation of these commodities from the United Kingdom, France, Italy, Belgium, or Japan, or from their possessions, protectorates, colonies, or dominions, may be made under General Import License PBF, 34.

Editorials

Joseph E. Johnson, Jr.

THE sudden death of Joseph E. Johnson, Jr., the result of an accident, coming as it did soon after a meeting of the New York Section of the Mining and Metallurgical Society of America, which he attended, greatly shocked his many friends and associates and left everyone deeply moved. The members of the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers held Mr. Johnson in the highest esteem, both for his technical knowledge and on account of his fine character. The richness of his personality and his charm drew many admiring friends to him. His cheerful, happy smile made the meetings of the local sections of both engineering societies which he attended especially enjoyable. He will be greatly missed, and long will he be remembered.

The Workers' Right To Choose

AT THE recent meeting of the New York Section of the Mining and Metallurgical Society of America, Meyer Bloomfield placed special emphasis, in his discussion of the labor question, upon the effectiveness of the conference method for preventing disputes and settling difficulties in industrial plants. More and more, he said, would the trained labor expert be called upon to advise engineers upon the delicate questions that provoke trouble between wage earners and plant managers. Upon the engineers and managers rests the responsibility for meeting the issues by applying new methods that are based upon equity and fair play. Paternalism and the older system of dealing with labor have had their day, and are no longer effective.

There was much of good sound sense in what Mr. Bloomfield said. With the conference method many engineers are in accord, and there are few intelligent engineers who are averse to making full use of it in the plants that are under their control. It is good business to have well-lighted and properly ventilated working places, clean and well-ordered plants, proper conveniences, good water, good housing facilities, and adequate protection against accidents. Aside from being good business, it is, as Mr. Bloomfield said, to be expected of good management.

Not only should the workmen be encouraged to feel that they have a vital interest in their work, but they should be taken into the confidence of the management in matters where they can assist by reason of their more direct contact with the actual working conditions.

In matters pertaining to so-called welfare work, the workmen themselves should be called into consultation as to the plans that are proposed. Only such changes should be initiated as receive the sanction of the workers. In other words, those who are to be welfared should have a chance to say whether they desire it or not. Much of the resistance that arises against good measures can be overcome by tactfully arousing the initiative of the workers and causing the suggestion for improved working conditions or for certain features of welfare work to emanate from the employee rather than from the management of the welfare division.

With the suggestion of Mr. Bloomfield, that social benefits developed from the bottom up and with full coöperation of the workers to be helped are more lasting, few will disagree. What is wanted are not theoretical and Utopian plans, but an intelligent stimulation of the worker himself to undertake partial responsibility, at least, for the measures that are evoked for his safety and welfare.

Steel Prices and the Railroads

ACCORDING to recent accounts, Walker D. Hines, Director General of Railroads, on behalf of the Railroad Administration has refused to abide by the reduced steel prices fixed by the Industrial Board of the Department of Commerce. The Railroad Administration is energetically seeking a way out of its jungle of deficit. To avoid the reduction of wages and salaries, it is basing some of its hopes upon the opening up of a pathway marked by the reduction in price of certain commodities which it uses in large amounts.

The steel industry is seeking to stimulate market demand for its products by lowering prices, but at the same time trying to avoid lowering them to such an extent as to imperil the ruling wage rates in the industry. The effort of the Department of Commerce in conjunction with the steel industry had for its object the stabilization of prices for a definite period.

Both the steel industry and the Railroad Administration wish to avoid interference with existing wage rates. The Railroad Administration has raised its freight and passenger rates and has reduced service. Between raising rates again and paying less for its necessary supplies, it has chosen the latter course.

It is difficult to see a way out of the dilemma. We believe that steel prices must be materially lowered before demand is increased to a sufficient extent to effect a considerable increase in building and general industry. The prices of other commodities that are maintaining a high price level must also come down. The heavy burden of taxation, the current Liberty loan, and the slackening in the volume of industry make further increase of railroad rates a severe remedy, but the rapidly increasing deficit of the railroads may cause the Railroad Administration to resort to it.

It is becoming clear that substantial price reductions in a moderate number of commodities and slight reductions in others will not work. What is wanted is a horizontal reduction that will affect the basic commodities all along the line. Mr. Hines is taking a justifiable stand in respect to steel prices, but he cannot long delay in reaching the conclusion that the position of the Railroad Administration and the railroads is like that of any other industry. A material increase in service or a decrease in rates is just as necessary under present circumstances as is the reduction in the prices of steel and iron commodities.

Business as Usual

HOW many mining company presidents could advise inquiring stockholders to the effect that the phrase "business as usual" expressed the state of affairs at their property? We venture to say that the list would be small, if any such list could be compiled.

We are all keenly anxious to see the day when we can write "business as usual," but most of us are groping in the dark for some means of doing our share toward bringing about this condition. "Get to work," "Place orders," "Don't let your plants lie idle," "Don't discharge your employees"—these are expressions typical of the advice offered, none of which seems to apply to the producer of metal, who must find a market for his product and meet his payroll and supply bills.

When industry was moving on the up grade a few months ago, every branch of it, through the excessive demands for all sorts of material, contributed its quota toward the general increase in the cost of supplies and labor, sometimes without due regard of proper proportions, and sometimes, we fear, without much respect for justice and with little thought of the day when industry would have to move on the down grade again.

Labor and capital both hesitate to take the initiative in turning backward and coming downhill slowly together, with brakes gently but firmly set. Several industries having only old-fashioned hand brakes have hesitated to make any move. They have come to a standstill, the crews are quitting, and there is a possibility of disaster.

Is there no industry in which we are all interested that could take the initiative, and by its precept and example lead us out of trouble? Our first thought is, "Why, yes: farming." "By reducing the price of our food the farmer could enable all of us to live at a lower cost than we do now; and, as high cost of living is our main trouble, we would soon be in normal times again."

All very beautiful; but the producers of food form a vast army which fixes prices through the law of supply and demand, and it will not be inclined to do any lowering of prices until the demand falls off. There is a very large demand for food in Europe, and so long as such markets are open to our farmers, and so long as there are ships to carry the goods, the farmer will not help us out of our trouble.

How about the railways? Can we look to them to start anything? No, the railways are no longer free-acting corporations. The United States Government is running the railroad business. If the railway companies were free to act, they could, possibly, lead us down intelligently and more carefully than the directors of any other industry. Every man, woman, and child in the country is directly or indirectly interested in the service rendered by the railways; every miner, farmer, mechanic, and preacher uses the service to some extent. An advance in rates or wages is felt by all of us immediately. We have never had a reduction in wages and seldom one in rates, but the opinion might be ventured that we would all benefit by this move likewise.

The Government, by a stroke of the pen, advanced rates and wages. The impositions were suffered with little comment, for the money was needed. The Government could, with equal propriety, reverse its order, but it will not do so. It will be afraid to do this, but what it can do, and what it must do, sooner or later, and what it should do at the very earliest moment possible, is to determine what it is going to do respecting the railway question. This is due the owners and the employees of the railways, and due to all who use the service of the railways—to every American citizen. A mistake will be preferable to inaction, for mistakes may be rectified. Inaction cannot be justified; its losses are irrevocable.

The Miner's Solace

THE cranks are assuming an attitude of belligerency, and the latest proposal, made apparently in all seriousness, threatens to place smoking among offenses against the law. Such an excursion into the rights of a free people can, of course, result only in shipwreck; but, nevertheless, the ventilation of the subject is pertinent, in view of the absurd claims and contentions being made by the sponsors of the new movement.

Liberties that are inimical to our well-being or to the well-being of the state are disadvantageous. The decision with regard to alcohol was accepted in good grace, and by the great majority, as a step in the right direction, and one which must inevitably put the United States well ahead in the race with other nations. But alcohol is a drug, and its value as such is mainly dependent on previous abstention. The ill-effects of immoderation, on the mental, moral, and physical faculties, are too well known to need reiteration. The results of alcoholic excess on national life are such that it is imperative that those whose inclinations are always under firm control must sacrifice much of their personal liberty of action to help the nation to attain a high ideal of national sobriety and progress.

With tobacco no such ill-effects are evident or likely, and an attitude of prohibition with regard to smoking can be regarded only as an altogether unnecessary proposal to encroach on personal liberty, engineered by a group of persons whose purpose is to deprive the remainder of humanity of everything that appears, to their jaundiced view, to be objectionable. Tobacco smoking cannot be classed among pastimes that are harmless, for the simple reason that no such category exists. If looked at from the same queer angle, nothing—absolutely nothing—is harmless.

A love for "My Lady Nicotine" is far from being degrading, and smoking may well be classed among the least objectionable and least harmful of the petty vices. To miners and engineers in all parts of the world, tobacco has been the one sure solace. It soothes in loneliness, compensates for disappointment, and is an outlet for spleen. Who can deny the calming influence of tobacco as a factor in cool reasoning, keen analysis, far-seeing judgment, and deliberate action? Who can but admit that it helps to that frame of mind, that spirit of peace and contentment, that is so eminently conducive to clear thinking?

Mining engineers are accustomed to weigh the pros and cons of any matter with a view to ascertaining the factors affecting the attainment of the highest personal efficiency and the greatest national credit and progress. Tobacco smoking never has formed and never will form an obstacle to the achievement of either, and public opinion will prevent consummation of the present inopportune proposal for its compulsory abolition.

BY THE WAY

The West Coast of Africa presents unique and interesting features even to the much-traveled miner. Among them not the least interesting is the Coast negro, with his typical patois, which sounds to the newcomer like a cross between Jamaica negro English and Chinese pidgin English, to which he must give the closest attention if it is to be understood. Even then he hears words that are evidently of Spanish, Portuguese, French, or German origin, or words that have no meaning at all to the stranger. The voyage from Liverpool to Ashanti is rather pleasant, is to be made in comfortable boats, and, with several stops en route, monotony is broken from time to time. But an unpleasant feature, to one on his first voyage, is the reputation of the country, which grows worse as it is approached. The purser accidentally lets fall a word about the yellow fever at Acra, or the death of the company agent at Axim; several of the passengers are going out to replace men who "will never come home"; there is considerable discussion of the best methods of avoiding some of the malignant fevers. A mysterious bundle, long and white, is dropped off the stern of the steamer by four sailors early in the morning when you are just looking out to see what the ocean looks like at dawn. By the time one reaches his port of debarkation, if inclined to be at all nervous, he is not sleeping well and is figuring on the departure of the return steamer.

The mine boss and the master mechanic were sitting in the office discussing the extension of a new pipe line, runs a story in the *Queensland Government Mining Journal*, when two miners came in very much excited, disputing the ownership of a certain car which had come up the day previous without a check. Each presented his case to the boss, claiming that he was short one car and that the car was his. The mine boss found from the weighmaster that only one car had come up without a check, and as both men had places where they pushed their cars by hand to a parting, he knew he would be unable to identify the particular car in question. He therefore had no evidence whatever to help find the rightful owner, but in spite of this there was no hesitation whatever in his manner as he turned briskly to the two men. "Now, I'll tell you what I'll do with you fellows. I don't know which of you owns that car, so the fairest thing I can do is to give each of you credit for half of it. Is that agreeable to you?" turning to one of the miners. "Yes, that's fair enough," the man replied, after thinking it over a moment. "And how about you?" said the boss to the other. "It doesn't suit me at all. That car belongs to me, and I want it," the second miner replied. "Well, you can go," said the boss. "I'll let you know after a while what I will do about it." After the man had left, the mine boss spoke up to the first miner. "You've got your nerve to try to put one over me like that. I happen to know that you didn't have your place ready to load yesterday until 4 o'clock, and then it was too late to get cars. You heard that we had a car without a check and thought you'd work me for it. I know your kind, and if you ever try to put over any more funny business like that on me I'll fix your clock right. Do you get me?" The man protested a minute and then walked sheepishly out of the office. "I'll hand it to you," said the master mechanic after the man had gone. "You handled that pretty slick. The fellow was a rummy, however, to try it when you knew about his having nothing to load." "But I didn't know. That was pure bluff to make him own up. Any man as willing as he was to split was pretty good evidence that he was getting something for nothing, and I figured if I went at him strong enough he would back down. It is part of the system." Well, I'll say one thing for your system: it's sure a good one." "It ought to be," replied the mine boss. "It's about 3000 years old. Old Solomon was the first man on record to try it, and I guess he was as smart as they come."

Although occupying the western portion of Utah territory, the laws under which the people of the Comstock range were at this time living were of their own making, narrated Dan De Quille in "The Big Bonanza." In August, 1859, two thieves were sentenced by a local jury to have their left ears cut off. Jim Sturtevant, an old resident of Washoe Valley, was appointed executioner. He drew out a big knife, ran his thumb across the blade, and, not finding the edge exactly to his mind, gave it a few rakes across a rock. He then walked up to Reise, one of the prisoners, and taking a firm hold on the upper part of the organ designated by the jury, shaved it off, close up, at a single slash.

As he approached Ruspas, the other prisoner, the face of that gentleman was observed to wear a cunning smile, and he seemed to be much amused at something. The executioner, however, meant business, and, tossing Reise's ear over to the jury, he went after that of Ruspas, whose eyes were following every motion made, and whose face wore the expression of that of a man about to say or do a good thing. Sturtevant pulled aside the fellow's hair, which he wore hanging down about his shoulders, and lo! there was no left ear, it having been parted with on a previous and similar occasion.

Here was a fix for the executioner! His instructions were to cut off the fellow's left ear, and there was no left ear on which to operate. The prisoner looked him in the face and laughed aloud, for the joke was so good that he could no longer restrain himself.

Sturtevant appealed to the jury for instructions, and they, enjoying the scene not a little, and being in good humor, said that they would reconsider the sentence, and that, rather than cause any one to be disappointed, the executioner might take off the prisoner's right ear, if he had one.

The smile faded out of the countenance of Ruspas as he felt Sturtevant's finger securing a firm hold on the top of his right ear. An instant after, Sturtevant gave a vigorous slash, and then tossed the ear over to the jury, saying, as he did so, that they now had a pair of ears that were "rights and lefts," and so properly mated.

This little ceremony over, the pair of thieves were directed to take the road leading over the Sierras to lines on which the franchises have been forfeited and the beautiful "Golden State."

Personals

J. B. Tyrrell made a visit to Timmins, Ontario, on April 2.

E. R. Beets has been elected a director of the A. S. & R. Co.

Henry M. Howe is to sail for Europe in April for a stay of about three months.

Perry Harrison, of Salt Lake City, is in the Lordsburg district making examinations.

Dorsey A. Lyon, supervisor of stations for the Bureau of Mines, is on an extended Western trip of inspection.

John H. McLean, general manager of the Oliver Iron Mining Co., is spending a short vacation in California.

F. G. Stevens, Toronto, has returned from a three months' visit to Mexico, where he was examining properties.

A. W. Allen, of the editorial staff of the "Journal," is visiting the Pittsburgh experiment station of the Bureau of Mines.

Claude Gordon, of Ashland, Wis., has been appointed chief clerk of the mining experiment station at Fairbanks, Alaska.

Victor Ziegler, professor of geology of the Colorado School of Mines, will resign to engage in professional consulting work.

J. S. Lutes, general manager of the Tod-Stambaugh mining interests in Minnesota, has returned from an extended trip in Texas.

R. C. Wallace, commissioner of northern Manitoba, who was recently taken seriously ill at Toronto, has recovered and returned to The Pas.

Harry J. Wolf made an examination of the properties of the Nacozari Consolidated Copper Mining Co. near Pilares, Sonora, Mexico, recently.

John T. Glidden and **C. Carleton Semple** are examining copper properties in the Yauricocha district and coal mines at Jautenhuasi, in Peru.

Edwin R. Eaton, mining engineer of Crown Point, N. Y., has taken charge of the Tate manganese property near Marion, Va., for the Lozier Coal Co.

K. Loggers, an engineer on the staff of the Lindeteves-Stockvis Exporting Co. of Amsterdam, Holland, visited Salt Lake during the latter part of March.

J. Krutschnitt, Jr., manager of the exploration department for the southwest for A. S. & R. Co., has been in the Lordsburg district recently making examinations.

E. H. Clausen has been discharged as captain of engineers in the U. S. Army, and is now associated with the Mine and Smelter Supply Co. in the New York office.

John Hays Hammond and **William Boyce Thompson** were the only speakers at the 12th annual dinner of the Rocky Mountain Club on Apr. 8 at the Waldorf Astoria, New York.

Gelasio Caetani, of the firm of Burch, Caetani & Hershey, consulting engineers, San Francisco, will discontinue professional work because of conditions arising from the late war

Frederick Burbidge, of Wallace, Idaho, manager of the Federal Mining and Smelting Co., is in Oklahoma in connection with the zinc-mining operations of the company in that state.

Stuart B. Marshall, consulting engineer and metallurgist, of Roanoke, Va., has established his headquarters now at Chevy Chase, Md.; telephone Washington, D. C., "Cleveland," 1672. He also retains his Roanoke address

J. B. Foster, president, and **James P. Porteus**, superintendent, of the Bonney mine, have returned to the Lordsburg district from a visit East upon matters pertaining to the further development and equipment of that property.

John F. Coats, mining engineer of Vancouver, B. C., representing English mining interests, made a preliminary inspection of several gold properties near Placerville, Calif., some time ago and returned recently to make a further examination.

C. L. Colburn has returned from service with the Corps of Engineers, in which he held a commission as captain, and has resumed his former work as assistant metal mining engineer for the Bureau of Mines, stationed in Washington.

Maj. Charles V. Bacon, who was engaged during the war on an investigation relating to liquid fire and war gases, has been made Chief of the Research Section of the Engineering and Standardization branch, P. S & T division of the General Staff

William J. Hall, assistant manager of the Federal Mining and Smelting Co., of Wallace, Idaho, has been appointed Commissioner of Public Works by Governor Davis This is one of the positions created by the last session of the Legislature.

William W. Elmer, who has been directing the installation of a high-head hydroelectric plant and compressor equipment for Gibson Mining Co., Ltd., will complete this work soon, but will continue his connection with that company as consulting engineer.

Carl Brewer, assistant chief mining engineer for the Cleveland-Cliffs Iron Mining Co., at Ishpeming, Mich., has been transferred to Hibbing, Minn., where he will have charge of the Bourne mine for this company. **R. J. Chenneoor** succeeds Mr. Brewer.

Captain Claude Cooper, recently returned from overseas service with the U. S. Army, has been named as superintendent of the Calumet & Hecla electrolytic plant at Hubbell, succeeding **J. C. Bryant**. Captain Cooper formerly was assistant superintendent of the Calumet & Hecla smelting plant.

Lloyd C. White will become a member of the new firm of Burch, Hershey & White, consulting engineers, San Francisco, succeeding **Gelasio Caetani** in the former firm of Burch, Caetani & Hershey and will handle the design, construction, and operation of mills, and ore handling and treatment plants.

Robert J. Anderson has resigned as research metallurgist with the Bureau of Aircraft Production, Detroit, and will join the staff of the Bureau of Mines. He will make special investigation in the metallurgy of aluminum and other non-ferrous metals, at the experiment station at Pittsburgh.

Ralph A. Meyer, formerly engineer in charge of the American Tin and Tungsten Co. at Hill City, S. D., severed his connection with that company on Feb. 26, after the closing of the properties on Feb. 10. Mr. Meyer is now engaged in general consulting work, with headquarters at Deadwood.

C. H. Doolittle, formerly general manager of the Utah Metal and Tunnel Co., of Bingham, and later connected with the Fissures Exploration Co., operating the Pacific mine and mill, in American Fork Canyon, is removing from Salt Lake City to California, where he has purchased a large ranch, in the management of which he will be engaged.

William Beaudry, of Kellogg, Idaho, manager of the Stewart Mining Co. and of the Nabob Consolidated Mining Co., a subsidiary of the Stewart, has resigned, effective Apr. 1. His successor is **Maj. C. C. Griggs**, who up to the beginning of the war was engaged in mining in the Tintic district, Utah, when he entered the military service and was assigned to the Ordnance Department.

John G. Kirchen, identified with several prominent Tonopah properties and president of the Nevada First National Bank of Tonopah, was the victim of a serious accident at the White Caps mill, at Manhattan. Mr. Kirchen stepped on the edge of a trommel when entering a part of the mill, and a bolt caught his left shoe, pulling his foot in between the trommel and the frame, thereby crushing it.

A. C. Callen, of Washington, D. C., special agent for mining and representative of the Federal board for vocational education, recently visited Wallace, Idaho, for the purpose of investigating the work of the class in vocational training of miners that has been established by the Idaho School of Mines in the Morning mine. Mr. Callen is also professor of mining engineering in the University of West Virginia, at Morgantown.

Obituary

C. C. Moore, a mining man of Virginia City, Mont., died on Mar 13 from pneumonia Mr Moore had been interested in mining in Mexico, Alaska, and several districts in the United States. He is survived by his widow.

Theodore W. Osterheld, for many years active in financial circles as a mining expert, particularly in the Mexican field, died on Apr. 3 in New York Mr. Osterheld was born in 1866 and was graduated as a civil engineer from Columbia University, then going to Mexico, where he spent the greater part of his life in the development of important mines and several railroads He also became conversant with Central American finances. Upon his return to New York, he was recognized as an authority on financial matters in Mexico and Central America, and in recent years was consulting expert for Iselin & Co. and Lansburgh Brothers, of New York. He is survived by his daughter.

Hon. William John Hanna, of Toronto, president of the Imperial Oil Co., and formerly Provincial Secretary of Ontario, died suddenly on Mar. 20 at Augusta, Ga., where he had gone on account of ill health. He was born in 1862, in Middlesex County, Ontario, and began life as a school teacher. In 1890 he was called to the bar and practiced law in Sarnia, Ont., where he handled much business for the oil interests. He was elected to the Ontario Legislature in 1902, and three years later became Provincial Secretary, retaining that position until 1916. He afterward served as food controller for Canada for seven months, retiring from public life to devote his attention to his business interests. About a year ago he succeeded W. C. Teagle as president of the Imperial Oil Co. He is survived by his widow and two daughters.

H. R. Hancock, for many years prominent in the mining industry of South Australia, died on Jan. 15 at the age of 83 years. Captain Hancock, as he was familiarly known, was born in Devon in 1836 and come to Australia in 1859, being engaged with the Wheal Ellen Copper Mining Co., and three years thereafter went to the Yorke Peninsula, where he assumed control of the Moonta mine. Later Captain Hancock became superintendent for the Wallaroo Mines also, and for 22 years retained complete charge of these properties. He was deeply interested in social, philanthropic and religious institutions and helped to establish the Moonta School of Mines and the Moonta Mines Institute, and for many years he was superintendent of the Moonta Mines Sunday school, besides being connected with various other organizations. Captain Hancock was the inventor of the Hancock rock drill and the Hancock jig, which are well known.

Societies

Engineers' Club of Northern Minnesota held the regular meeting on Mar. 29 in Virginia, Minn. The program was on the subject of vocational education.

Mining and Metallurgical Society of America will hold a special meeting on May 1, at 5 p.m., at the Columbia University Club, New York, for further consideration of the proposed amendments to the bylaws.

American Society of Civil Engineers held a regular business meeting at which Col. Dabney H. Maury, U. S. A., advisory engineer on water supply, construction division, war department, addressed the members on "Water Supply at Camps and Cantonments and All Other Government Enterprises."

American Society for Testing Materials will hold the 22nd annual meeting at Atlantic City on June 24-27, with headquarters at the Hotel Traymore. A topical discussion on "Magnetic Analysis" will be held. A number of committees have announced their intention of recommending proposed new standards for publication as tentative, and several important investigations being conducted will be reported on. The Executive Committee has accepted on behalf of the society an invitation to become a member of Engineering Council.

National Safety Council, Chicago, at a meeting held by the executive committee on Feb. 24, unanimously elected as general manager C. W. Price, who has been the council's field secretary for a number of years and is a pioneer in safety work, having spent 13 years with the International Harvester Co., the last four years of which he was in complete charge of all safety work for all the plants. He was assistant to the Wisconsin Industrial Commission, and director of the safety survey made by the U. S. Employment Compensation Commission, which embraced all arsenals and navy yards The retiring general manager, W. H. Cameron, will become manager of industrial relations for the Eastman Kodak Company.

American Society of Mechanical Engineers, New York Section, and the Society of Automotive Engineers, Metropolitan Section, held a symposium on the heavy-oil engine on the evening of Apr. 9, at the Automobile Club of America. The program was arranged to give to the membership of the two societies the most complete and comprehensive presentation of the heavy-oil engine that has yet been made. The topics discussed were: Adapting fuel to the engine vs. adapting the engine to the fuel, and the scope and limitations of present designs of heavy-oil engine. The application to the following types was also discussed: Carburetor type heavy-oil engines, engines with hot-metal ignition, and Diesel-type engines. Papers were presented by the following: E. W. Dean, U. S. Bureau of Mines; J. H. Hunt, experimental engineer, Dayton Engineering Laboratories Co.; A. H. Goldingham, De La Vergne Machine Co.; T. O. Lisle, editor, "Motorship," and others. Dr. Charles E. Lucke, Dean of the School of Mechanical Engineering, Columbia University, and late Director of the U. S. Naval Gas Engine School, presided.

Industrial News

Aspromet Company announces name of company has been changed to the H. H. Robertson Company.

The Dust Recovering and Conveying Co., Cleveland, Ohio, has removed the main office to the factory at 1710-14 Woodland ave., Cleveland.

Edison Storage Battery Co., Orange, N. J., has a new price list effective Mar. 1, reducing the price of Types A, B, and G Edison cells approximately 16 per cent.

Chicago Pneumatic Tool Co. announces the discontinuance of its office at Wichita, Kan., and transfer of the company's stock to Eldorado, Kan., where an office and warehouse have been established.

Charles F. Ames & Co., 90 West St., New York, have been appointed to act as the New York sales department of the Platt Iron Works, of Dayton, Ohio, manufacturers of pumping and power-plant equipment.

Stephens-Adamson Manufacturing Co., of Aurora, Ill., has recently established a new sales office in Cincinnati, Ohio, to give personal engineering attention to this particular territory. John G. Stewart, who has been associated with the company for 15 years, has been appointed district manager.

Carlisle Mason, Incorporated, consulting engineers, No. 207 Broadway, N. Y., and 81 Rue St. Lazare, Paris, announce the return from France of Carlisle Mason, president, who has resigned his commission as a major in the U. S. Army and will resume the practice of general consulting engineering with the firm.

Walter A. Zelnicker Supply Co., St. Louis, announces the return of H. J. Elson, who has served during the war as Lieutenant Commander, U. S. N., to his former position as secretary-treasurer of the company. He will assume charge of the internal management and manufacturing operations.

Advance Machinery and Supply Co., Denver, Colo., announces the appointment of S. A. Koenig, until recently a first lieutenant in the Coast Artillery Corps, as sales engineer. Mr. Koenig was formerly employed in the experimental department of the General Electric Co., at Schenectady, N. Y.

The Ideal Engine Company of Lansing, Mich., manufacturer of Ideal power equipment, which includes hoists and pumping outfits for general contracting, road building and excavating work, was recently fortunate in adding H. H. Lucas to the company's sales force. Mr. Lucas, before joining the U. S. Navy, where he became an ensign, was with the Lansing company.

Epping-Carpenter Pump Co., Pittsburgh, announces the appointment of F. S. Healey as sales manager, to be in addition to his present duties as chief engineer, vice R. F. Woods, who is now situated in New York as Eastern sales manager. Albert A. Schenck has been appointed assistant sales manager and Paul D. Goodman, formerly of McClary Jemison Machinery Co., of Birmingham, Ala., has been added to the sales personnel.

Powdered Coal Engineering and Equipment Co., of Chicago, announces the appointment of A. U. Wetherbee, who recently received his discharge as captain in the chemical warfare branch of the service, to the position of chief mechanical engineer. The appointment of C. C. Wallace, formerly manager of the loading of munitions section of the Stenotype company, Indianapolis, to be director of development and service, is also announced.

Becker & Smyth, Chicago, contracting engineers, and sales agents for Layne & Bowler Co., have recently organized under that title. C. R. Smyth has been special engineer for some time with the Layne & Bowler Corporation, and previously was connected with the York Engineering and Supply Co., of Houston, Tex.; sales engineer for Bush, Sulz & Bros. and for the Diesel Engine Co. W. E. Becker, president, has been with the York Engineering and Supply Co. for the last 12 years.

Electric Furnace Association is being organized to promote the use of electric-furnace products. A meeting was called by Acheson Smith, vice-president and general manager of the Acheson Graphite Co., at Niagara Falls, on Mar. 21 and 22. Representatives of a large number of manufacturers were present, and officers and directors of a permanent organization were elected. Committees on publicity, data and fields were appointed. Acheson Smith was elected president and C. C. Schluederberg, of the Westinghouse Electric Manufacturing Co., Pittsburgh, was elected treasurer.

American Manufacturers' Export Association has been informed of the appointment of George P. Toby, as Executive Secretary of the American Chamber of Commerce in London, and he will sail for his new post on May 12. Mr. Toby will attend the coming meetings of the National Foreign Trade Council and the U. S. Chamber of Commerce prior to date of sailing, for the purpose of conferring with American merchants as to the service which the American Chamber in London can render them. He will also confer with the editors of McGraw-Hill publications to obtain increased coöperation in serving American manufacturers.

Sullivan Machinery Co., Chicago, has published the March issue of the company's magazine, "Mine and Quarry," which directs attention to the establishment of a Foreign Trade Department and the desire of the company for extension of its export business. In this connection the following branches have been established with the company's own organization: At London, Salisbury House; at Paris, 18 Avenue Parmentier; at Santiago, Chile, Casilla No. 27; and at Sydney, N. S. W., Australasia, Chambers, Martin Place. Engineering agencies of established standing handle Sullivan products in Christiania, Amsterdam, Gijon, Spain; Turin, Italy; Algiers, Tunis, Johannesburg and Durban, Shanghai and Tokyo, Lima and Buenos Ayres.

The Railway and Power Equipment Co., Woolworth Bldg., New York, has received an inquiry from Belgium for $200,000 worth of machine tools, including lathes, planers, shapers, turning and boring machines, slotters, radial drills, steam hammers, punches and shears, machinery for manufacturing springs and four 16-ton traveling cranes. The company also has the following export inquiries: New steel rails for a French colony to the amount of 120,000 tons; five tons of portable track for France; electric power and lighting machinery for Japan; slotters, hammers, presses, cranes and locomotives for Bombay, India; railway, mining, sugar plantation and factory equipment for Panama; air compressors for Chile; derricks and electrical machinery for Hong Kong, China; contractors' supplies, machinery and equipment for France; machine tools and hammers for England; railroad equipment for Spain; machinery and tools for Antofagasta, Chile, S. A.; a large quantity of electric motors for Bombay, India; machinery and tools for Brazil; railway equipment and machinery for Argentina; three new steam locomotives for Japan and 40 pairs of steel car trucks for electric railways for Italy. This company also reports active inquiries from buyers throughout the United States, indicating that considerable buying is being done and that plans are maturing for more in the near future.

Trade Catalogs

Gasoline Locomotives. J. D. Fate Co., Plymouth, Ohio. Catalog No. 4, Bulletin H.; 8½ x 11; 16 pp.; illustrated. Describes the use of Plymouth gasoline locomotives in general mining work, on the surface and underground, at properties of well-known mining companies.

Concentrating Tables. The Deister Concentrator Co. Fort Wayne, Ind. Bulletin No. 3; 6 x 9; 21 pp.; illustrated. Descriptive of Deister-Overstrom diagonal-deck types of ore concentrators, outlining the theory of concentration and describing the materials and construction of these tables. Sand, slime, and rougher tables are also described.

Hoists. United Iron Works Co., Kansas City, Mo. Catalog H-19; 10 x 7; 76 pp.; illustrated. Descriptive of "United" built hoists, including belt, steam and electric-driven and horse- and hand-operated types. Specifications covering weight, rope pull and speed, power required and types of clutch and brake, are given in each case The last eight pages are devoted to "Handy Rules on Gearing," which are particularly informative, and tables of data on wire ropes and required horsepower for lifting different loads.

Perforated Metals. Hendrick Manufacturing Co., 30 Church St., New York; 6 x 9½; 127 pp.; illustrated. Describes the uses of perforated metals of all kinds in a large number of industries, devoting the majority of pages to excellent illustrations and tables on all gages of standard perforated screen plates. Special screens for particular purposes are also described, as are straight and conical revolving screens, Other pages are devoted to elevator buckets, conveyor troughs, stacks, hoppers, and loading chutes. Useful tables are included in the back pages. On account of the nature and value of the data contained, the company requests that the catalog be regarded as a work of reference.

Insulators, Overhead Materials, Rail Bonds, Car Equipment Specialties. The Ohio Brass Co., Mansfield, Ohio. Catalog No. 17; 6 x 9; 671 pp.; thumb-indexed. illustrated. A complete catalog of high-tension porcelain insulators, suspension insulator hardware, bus-bar installation, porcelain wall or roof insulators up to 150,000 v., arc-lamp hangers and anchor or guy rods. Under the overhead-line material section a complete description is given of strain insulators, rigid and flexible pole brackets, mine hangers of various types, I-beam clamps and insulators for mine-feeder wires. The catenary materials section contains formulæ and numerous line sketches for all types of the catenary system of line construction for electric traction, of much value to the engineer. Tables are included giving materials required per mile of tangent. Other sections are devoted to rail bonds and tools; third-rail insulators and to car equipment. The last section contains a number of tables and formula for copper wire, steel strand and aluminum wire, giving dimensions, weight, and resistance.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Alloy of Aluminum, Zinc and Copper. David J. Hauss, Aurora, Ind.; Barbara Hauss, administratrix of said David J. Hauss, deceased, assignor to F. W. Galbraith. (U. S. No. 1,293,426. Feb. 4, 1919.)

Antifriction Bearing. Melvin A. Yeakley, Canton, Ohio. (U. S. No. 1,293,605; Feb. 4, 1919.)

Drill Tool. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,293,081; Feb. 4, 1919.)

Furnace, Electrical Metallurgical. William E. Moore, Pittsburgh, Penn. (U. S. No. 1,293,164; Feb. 4, 1919.)

Manganese — Polymerized Manganese-Dioxide Depolarizer. Alfred A. Wells, Montclair, N. J., assignor, by mesne assignments, to National Carbon Co., Inc., Cleveland, Ohio. (U. S. No. 1,293,272; Feb. 4, 1919.)

Metal-Casting Apparatus. Edward L. Wolff, Waterbury, Conn., assignor to Scovill Manufacturing Co., Waterbury, Conn. (U. S. No. 1,294,742; Feb. 18, 1919.)

Metallic Oxides, Process of Treating. James W. Moffat, Toronto, Ontario, Canada. (U. S. No. 1,294,514; Feb. 18, 1919.)

Mine Shafts, Steel Framing for. Ora D. McClure, Ishpeming, Mich. (U. S. No. 1,294,814; Feb. 18, 1919.)

Rock Drill. William A. Smith, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,293,225; Feb. 4, 1919.)

Sintering Ores, Process of. Adelbert H. Richards, Salt Lake City, Utah, assignor to American Smelting and Refining Co. (U. S. No. 1,292,059; Jan. 21, 1919.)

Sulphuric Acid, Process of and Apparatus for Concentrating. Henry G. Klink, Moundsville, W. Va. (U. S. No. 1,276,377; Aug. 20, 1918.)

Tungsten, Process of Extracting Tungsten and Similar Metals From Their Ores. David John Giles and James Esrl Giles, McKeesport, Penn. (U. S. No. 1,293,402-3-4; Feb. 4, 1918.)

Zinc Ore, Method of Treating. David B. Jones, Chicago, Ill. (U. S. No. 1,292,330; Jan. 21, 1919.)

Editorial Correspondence

SAN FRANCISCO—Apr. 5

United Mine Workers of America will not participate in any general strike on July 4, as planned by the convention held in Chicago last January in behalf of Thomas Mooney, the "United Mine Workers' Journal" announces, in its April issue. This was definitely decided by the international executive board at its meeting in Indianapolis on Mar. 25, by the adoption of a report of the committee on the Mooney case.

Mother Lode Mines are discussed by Thorald F. Field, a mining engineer, and T. C. Gorrie, general manager of the Old Eureka mine, in a report on that mine dated Feb. 26, 1919, which was the result of an investigation to determine what level should be opened next in the property. The report states: "The general experience of different mines on the Mother Lode throws no definite light on this property. At the horizon where the ore is lean for one, that same horizon in another mine may be particularly good. For instance, the Kennedy mine had a lean zone between 1800 and 2300 levels, whereas this zone was good in the South Eureka. It seems that the Kennedy had good ore from the grass roots almost down to the 600; from the 600 to the 800 it was lean; from 800 to 1200 it improved gradually; from the 1200 to 1600 it was good; from 1600 to 1800 it became poorer, and from the 1800 to the 2300 it was very lean. If the 2300 level had been driven 10 feet deeper, it would have disclosed a lot of good ore. From a little below the 2300 level down to the present bottom of the mine, which is about 4000 ft. deep, the ore has been good. As far as indications in the Old Eureka mine are concerned, it is impossible to say which level should be opened next, except that on general principles the vein should be developed at least every 500 or 600 ft. Otherwise some valuable ore might be missed entirely. At the present writing, the 2100 level is the deepest working. It does not follow from this, however, that the 2600 level should be opened before a 3200 level, for instance. In fact, it seems advisable to open a deeper one first, on account of the recent find at the Central Eureka." It is stated further that the Central Eureka has made a valuable find, and it is probable that this ore will extend into the Old Eureka, at depth. In the latter, all small streaks of ore in the upper workings are being sampled.

BUTTE, MONT.—Apr. 7

Curtailment in Copper Production by the Anaconda Copper Mining Co. was further increased this week by the closing of the Silver Bow, West Gray Rock, and the Butte-Alex Scott shaft of the West Colusa mine. The closing of these properties throws out of work about 450 men and decreases the output of copper ore by approximately 600 tons a day.

Accidents in the Anaconda Mines, according to the official report of the company for the month of January, as to mine conditions, amounted to 32, of which four were fatal. The accidents were in 16 different mines, and, though a few were due to falls of ground, the greater number resulted from carelessness on the part of the men.

DENVER, COLO.—Apr. 5

National Association of Potash Producers was organized when representatives of 21 potash-producing companies met here on Apr. 3, and discussed plans for making the United States independent of Germany in this industry. It was said that 95% of the potash industry in this country was represented. Various speakers asserted that if protection from German competition was furnished for two years' time, the American industry could produce a surplus and make America independent of the foreign supply.

Snowslides seem to be accomplishing their customary amount of damage to mining property. In San Juan County, between Eureka and the Midway mill of the Sunnyside Mining and Milling Co., in Eureka Gulch, a new slide destroyed eight tramway towers. The cables were torn down and the bull wheel of the tramway was displaced, causing a shutdown of the new mill. The towers were from 40 to 60 ft. high, and their reconstruction at this season of the year is difficult. The work of repairing the damage is under way. Near Telluride, in San Miguel County, the Hanging Rock slide, on the west side of Ajax Peak, struck the Smuggler-Union tramway tension station and the electric power line which delivers power to the Bullion tunnel. Both tramway and power line were out of operation until necessary repairs could be made. A small slide ran off the cliffs above the Stilwell tunnel of the Liberty Bell Gold Mining Co. and damaged part of the boarding house, and covered some of the men who were in the building at the time. A rescue party did its usual good work, and no permanent injuries are recorded. A slide at Windy Point, on the Rio Grande Southern Ry., covered the track for a distance of 300 ft., and delayed traffic for about 24 hours. Several large slides ran near Ophir Loop, and covered the railroad tracks near that point. These were removed by rotary snowplows. Numerous slides occurred in other parts of the district, but did no material damage, although in some cases inconvenience was caused owing to the blocking of wagon roads.

SALT LAKE CITY, UTAH—Apr. 3

Tax Assessments on mining properties according to the law just passed by the Utah Legislature, will be made by the State Board of Equalization, whose scope has been considerably extended. For example, the rating of mills and other mining property not situated at the mines as a part of the mining properties with which they are connected places the matter of their assessment—hitherto in the hands of the county assessors for the counties in which they are situated—under the jurisdiction of the State Board of Equalization. This is the case, also, with mine dumps and accumulated tailings. In regard to non-metalliferous mines—coal mines and properties carrying asphalt, gypsum, salt, building and other stone, sulphur, alunite and hydrocarbons—these are to be assessed by the board according to their actual cash valuation. For the year 1919—the law requiring all mining property to be assessed by the first Monday in May—tentative assessment will be made from the work of Prof. W. G. Peterson, of the State Agricultural College. During the coming summer, Professor Peterson, with a surveying party of three, will be occupied in the field gathering data upon which to base future assessments. The data will include the probable mineral content of the land and the probable cost of extraction.

DULUTH, MINN.—Apr. 6

The International Harvester Co., at its Hawkins mine, at Nashwauk, has recently put into effect a welfare plan which is known as the company's "works council plan." Under the operation of the plan each department elects a member to the council and these meet with a representative of the company. This council is the final court of appeal in all matters which come up pertaining to the employees of the mine.

The Tonnage Tax Issue in Minnesota was laid away until 1921 at least when it failed to pass the House by a narrow margin of two votes. The tonnage tax has appeared before every Minnesota Legislature except one since 1907, and has always been the center of a severe fight. None of the contests has been more strenuously fought than the one just ended, and it is noteworthy that none has been more free from hard feeling and recrimination.

Maintenance of Iron-Ore Prices and the present wage scale as decided by the recent iron and steel conference at Washington has greatly clarified the mining situation on the Minnesota ranges. The smaller independents and employees generally will benefit particularly, and though present indications point to a production considerably smaller than last year's, all elements of the community face the coming season in a more hopeful spirit.

WALLACE, IDAHO—Apr. 7

The Coeur d'Alene District shows a decided tendency toward a revival. This, however, applies to development companies rather than to the large producing mines, some of which are closed entirely, and those still running are doing so under adverse conditions, owing to the absence of a stable market for lead and zinc. But development companies, those that depend upon assessment of stockholders to carry on their work, are beginning operations to an extent that at least lends a more cheerful aspect to the mining situation. Most of these companies were forced to suspend during the war, on account of the excessive costs and shortage of men, and also for the purpose of directing their energies in lines that would contribute to the support of the government in winning the war. With the coming of peace and the prospect of a long period of prosperity for the mining industry, these companies are eager to begin the work of developing new mines, but have been delayed in doing so partly on account of the heavy snow in the mountains and partly because of the continued high prices after the armistice was signed. These conditions have now undergone a change. There has been a substantial reduction in wages and a cut of $2 per hundred in the price of powder, following a similar cut last December, and further reduction in the price of explosives is reasonably to be expected. Under these circumstances some companies have felt justified in resuming operations during the last few weeks, and others are planning to follow.

HOUGHTON, MICH.—Apr. 3

The Copper Situation presents several phases worthy of present consideration, in regard to production. Notwithstanding the fact that stocks of copper are accumulating and have been accumulating on the smeltery docks of this district since last December, and that sales have been few and far between and practically no deliveries have been made excepting on old orders, hurry-up orders for immediate shipment of copper came in this week. One shipment called for express service. Carload lots by fast freight went out Friday and more cars have been ordered up for filling. In view of the fact that water shipments can reasonably be expected to be made within a few weeks, and the further fact that the difference between rail freight charges and Lake freight is heavier than ever before, rail shipments must indicate one thing—an immediate necessity for copper from the Michigan district. That is the brightest spot in the metal situation.

Little change is to be recorded in the mining situation of the Michigan district. There has been a substantial exodus of workingmen, many going to Detroit, during the last two weeks. The mines continue to curtail output where it can be done. At the Calumet & Hecla, No. 18 has been closed. There is a likelihood that the Point Mills stamp mill, a Calumet & Hecla plant operating under the name of the Lake Milling Co., may be closed. This big plant handled the Hancock Consolidated, Centennial, Allouez, and overflow from Isle Royale. Hancock was the first mine to shut down. Isle Royale output will be confined to the complete capacity of the mill at Houghton. Centennial and Allouez rock will be handled at the smaller mill adjoining the old Tamarack mill. This means the saving of the additional freight charge which the longer haul to the Point Mills plant necessitated.

PHOENIX, ARIZ.—Apr. 3

The State Supreme Court has reinstated on its calendar the suits of the State of Arizona and County of Gila against the International Smelting Co. and Inspiration Consolidated Copper Co., which had been dismissed Mar. 10 for lack of prosecution on the part of the state. The dismissal was the cause of a local political sensation, based upon the indication of negligence on the part of the Attorney General, as the cases involved about $180,000 in excess taxes protested by the companies and also, to a degree, the question whether intangible values, based upon profits, are to be assessed at all. The lower court had decided for the companies, "that they recover from Gila County the amount paid as taxes on a valuation in excess of the full cash value so found. No abstract of record had been filed by the state, and nine months had been allowed to elapse without action or representation in the appellate court. There is denial that the Supreme Court has any jurisdiction in this class of suit, after settlement in the Superior Court. By permission of the Legislature the State Tax Commission has appointed a special attorney for the case, and the Attorney General also has added an extra member to his staff, particularly for prosecution of this hitherto-neglected case. Both special attorneys are acting independently. It is thought that the cases will not be heard till autumn. In the meantime, there may be a decision affecting the matter from the Circuit Court of Appeals at San Francisco, which is hearing an appeal from Tucson affecting the right of the state to tax outside and intangible values of the Standard Oil Company.

JOPLIN, MO.—Apr. 3

Tri-State Safety and Sanitation Association, the largest mine operators' association of the district at present, may be merged into the American Zinc Institute. Preliminary steps toward this end were taken at a meeting at Picher on Mar. 26, and the final vote on the consolidation or transfer is to be taken Apr. 2. The move followed an appeal from Charles T. Orr, of Webb City, president of the Zinc Institute.

EL PASO, TEX.—Apr. 5

Oil Leases Are Being Drilled over a large area by the Cities Service Company through subsidiaries. It is probable that the total acreage held under lease by this company in Texas is over 1,500,000 acres. About 25,000 acres are in the Ranger Field, which covers parts of various counties, namely, Stevens, Palopinto, Erath, Shackelford, Comanche, Coleman, Callahan, Brown, and Eastland. One well being drilled is on the Allen lease, in Eastland County, which is about a mile east of the well-known Norwood well, which had an initial production of 13,000 bbl. daily. Also, another is being drilled close to the Knowles & Duke well, in Comanche County, one of the big producers of the Ranger field. Drilling is also being done in Coleman and Stephens counties.

SPOKANE, WASH.—Apr. 7

Dividends Paid by Mining Companies of the Northwest for the first quarter of 1919 amounted to $1,484,711, as compared with $2,629,307 paid for the first quarter of 1918. The decrease is largely due to the shut-down of two of the big producers of the Cœur d'Alenes. British Columbia mines paid $695,711, which is only about $77,000 less than was paid by the producers of the province for the first quarter of last year.

TORONTO, ONT.—Apr. 3

The Imperial Oil Co. has formed plans for extensive development of the oil fields of Northern Alberta this season, involving the expenditure of upward of $500,000. Dr. Bosworth, the chief geologist of the company, who will have charge of the work, has already engaged 10 geologists. Five parties at least will start out from Edmonton. The company has already two drilling rigs in Alberta, and four more of a highly powerful type are being brought in from Ohio. Charles E. Taylor, who has been appointed western manager of the development branch of the company, states that two of these rigs are going further north than any drilling rig has yet gone in Canada, and that, before the summer is over, either the theories upon which the company is working will be disproved, or a large territory added to the oil area of North America.

VICTORIA, B. C.—Apr. 3

Consolidated Mining and Smelting Co.'s attitude toward its employees is indicated in a statement made by S. G. Blaylock, assistant general manager, referring to the issue of 10-year convertible gold debenture bonds recently authorized by the directors and endorsed by the shareholders. Mr. Blaylock said: "It has been decided to allow employees of two or more years' standing to subscribe for these bonds without insisting on the stockholding qualification. They may have their payments extended over a period of 10 months. The interest charged on back payments will be at the same rate as is paid on the bonds, namely, 7%." It is further explained that when the list of subscriptions was closed at Toronto on Feb. 3, it was found that shareholders had agreed to take up the entire issue of $3,000,000, but it was decided by the management to accept subscriptions from such employees as desired to take advantage of the offer. Accordingly, the list is now open at Trail for that purpose for a limited time. The bonds are issued at par in denominations of $100, $500, and $1000, and are dated Jan. 1, 1919, carrying 7 per cent.

The Mining News

ARIZONA

Cochise County

DRAGOON COPPER LEASE (Dragoon)—Hoist, tools, and buildings purchased by John Gleeson, of Courtland, and removed there for use on Gleeson lease.

JOHNSON DEVELOPMENT CO. (Johnson)—Reported strike of a good-grade copper ore, in drift on 650 level running southeast from shaft, toward property of Arizona United.

KEYSTONE COPPER (Johnson)—O. K. shaft will start work Apr. 1 after a two-month shutdown, owing to the breakage of machinery.

CALUMET AND ARIZONA (Warren)—Smeltery production of copper for March amounted to 4,602,000 lb., of which 3,736,000 lb. was from company properties.

Pima County

NEW CORNELIA (Ajo)—Production for March was 2,434,000 lb. Cathodes, 1,980,000; smelting ores, 12,000 lb.; cement copper, 442,000 pounds.

SILVER MINING is active in smaller mines; silver shipments to El Paso increasing, especially from Silver Bell, where 25 shippers have been listed. Silver lenses in Twin Buttes, Quijotoa, and Gunsight sections are being explored. South of Tucson, the Empire Zinc Co. reported about to resume on zinc and lead-silver ores.

SULLIVAN (Ajo)—Test run on rich surface gold ores started in small mill at Gunsight.

STRATTON (Tucson)—Option held by W. H. Daily taken by C. N. Wilson, who will settle with E. O. Stratton and terminate litigation. Consists of 26 claims in Catalina mountains.

Yavapai County

DUNDEE-ARIZONA (Jerome)—Upraising from tunnel into surface carbonate blanket at several points. Manager W. E. Defty states that ore developed averages about 7%. Further shaft work suspended till extension haulage tunnel is cut through and backed-up water released. Jerome high school may be placed on Dundee ground. A. J. Smith states that he remains secretary-treasurer for the Mackay-Stephen interests and that C. L. Nabers, reported as resident director, is only agent for the Dundee townsite.

GADSON (Jerome)—Black sulphide in solid vein 12 in. wide being followed in south drift on 1200 level, which is being driven through soft schist, flecked with native copper and chalcopyrite.

JEROME VERDE (Jerome)—Taking ore from Maintop body; shipping resumed of 15% ore to Humboldt smeltery. Ore taken by wagon to Clarkdale to railroad.

UNITED VERDE EXTENSION (Jerome)—Haulage tunnel, 12,384 ft. long, completed after several years' work.

ANVIL (Prescott)—One of first local gold-lode mines taken on option from Samuel Wadsworth by Daniel H. Lockett, of Aspen, Colorado.

PECK (Prescott) — Wagon road from Bradshaw Mountain railroad near Middletown, is open now, after snow blockade of two months, and machinery is going in. Frank W. Giroux, in charge, with W. W. Elliott superintending mill construction, which may be finished about May 1. Old dumps believed to contain 30,000 tons of good silver ore, the contents to be recovered by cyanide. Development work started in mine in new territory.

CALIFORNIA

Amador County

ARGONAUT MINING (Jackson)—Fire which occurred on Mar. 27 originated in 4000 level about 300 ft. from main station. First skipload of night shift men reached 3900 level, smelled smoke, and gave the alarm. Muldoon upcast shaft, used chiefly for ventilation, indirectly connected by crosscuts and winzes with 4000 level was immediately sealed by bulkheading at the top and 3300 level, which required the use of apparatus by workmen, on account of escaping gases. The main Argonaut shaft was bulkheaded at drain tunnel about 200 ft. below collar. This method successfully cut off the fire, and it is expected that it will be completely smothered soon.

San Bernardino County

ATOLIA (Atolia)—Mine and mill shut down, and operations will not be resumed until tungsten market becomes stabilized. Company states it is impossible to compete with cheap labor of China, Japan and Corea, from which countries large importations are brought in free of duty and taxes.

Shasta County

NOBLE ELECTRIC (Heroult)—Was taken over temporarily by the court on Feb. 28, awaiting adjustment of affairs of the company. W. H. French, former vice-president and general manager, appointed receiver. Plant entirely closed.

MOUNTAIN COPPER CO. (Keswick)—Reported that Iron Mountain mine closed down temporarily on order of London directorate. Hornet mine will produce and ship pyrites to various plants on San Francisco Bay for the manufacture of sulphuric acid. Railroad crews and other surface men number about 60. These and the underground crew of the Hornet mine, to a total of 150 out of 450 men formerly employed, will be retained. Soldiers and married men formerly employed at the Iron Mountain will be transferred to the Hornet.

COLORADO

Boulder County

COLORADO PITCHBLEND CO. (Jamestown)—Purchased Wano mines and mills at Jamestown, thereby obtaining control of practically all of the fluorspar deposits of the neighborhood. Plan to remodel mill at once for concentration of fluorspar, and enlargement of plant to treat 300 tons a day is under consideration. Golden Age mill increased from 60 to 100 tons a day.

Clear Creek County

EDGAR (Idaho Springs)—Will be developed under lease above Big Five tunnel level by Al Freedman, who plans to advance drift on this level several hundred feet.

LITTLE MATTIE (Idaho Springs)—Milling equipment being installed, including two flotation machines. Lessees plan to repair old workings and resume development.

San Miguel County

CARBONERO (Ophir)—Lessees operating in second level opened good ore carrying gold, silver and lead. The ore is being packed on mules to railroad, and shipped crude to Durango smeltery.

WESTERN COLORADO POWER CO. (Telluride)—Supplies bulk of hydroëlectric power for San Juan district, now suffering from water shortage owing to delay in melting of snow in upper basins above its storage reservoirs. Has been compelled to reduce amount of power delivered to large operators by about 50%. This condition will obtain probably for about 30 days. Smuggler-Union, Tomboy, Liberty Bell, and Black Bear will be compelled to reduce production. Smuggler-Union has own electric power plant, with almost sufficient capacity for its mine and mill. Other companies will temporarily reduce their working forces until relief is obtained.

San Juan County

SHIPMENTS FROM SILVERTON during February as follows: Sunnyside, 23 cars; Iowa-Tiger, 14; Mayflower Leasing Co., 6; Dives Leasing Co., 1; miscellaneous, 17; total, 61 cars.

LACKAWANNA (Silverton)—Compressor plant and blacksmith shop recently destroyed by fire caused by overheated stove. Loss estimated at $7000, not covered by insurance. Plans to repair damage when snow conditions permit. Underground development will continue.

KANSAS

Joplin District

LUCKY JEW MINING (Commerce, Okla.)—Situated at Westville, Kan. Will start to erect concentrating plant of 300-ton capacity per shift on May 1. Ed. Depee, superintendent.

BENDELARI (Joplin)—Preparing to install four electric pumps in shaft now going down on lease northwest of Treece, Kan. One 8-in. electric pump now in use insufficient. Situated just north of Broomcorn mine, where pumping has been under way for two years.

BIG ELK MINING (Treece)—Will move and erect Doris mill from Quapaw soon. Expect to purchase gas engine, rolls, rock drills, and tables.

MICHIGAN

Copper District

MASS CONSOLIDATED (Houghton)—Retimbering B shaft from top to bottom. Operations confined to output from other working shaft. Physical conditions unchanged in newer openings. Operations are costing approximately $40,000 a month, the bulk of which is for labor. Copper output curtailed 14 per cent.

MICHIGAN (Houghton)—During January shipped 5630 tons of rock to the mill. Smelter returns showed 28 lb. fine copper per ton of rock stamped. During February, shipped 3977 tons of rock, showing 33 lb. on the average secured.

MINNESOTA

Mesabi Range

SELLERS (Hibbing)—Stripping operations encountering caves of old underground workings. Model 90 shovel being used for this work, in addition to big shovel which has been operating all winter.

WEBB (Hibbing)—Winston-Dear Co. resuming work of stripping pit for Shenango Furnace Co. Small shovel removing taconite at north end.

PILOT (Mountain Iron)—Preparing for complete electrification. Bulk of stripping completed and one shovel soon to start on final clean-up.

MISSOURI

Joplin District

CHARLES WINDBIGLER (Joplin)—Situated at Waco. Moving and erecting old Jasper County mill from Prosperity. Capacity of new plant to be 250 tons per shift. Will purchase pumps, rock drills, belting, and hoist. Work to be completed May 1. Charles Windbigler, owner and manager. W. O. Cardin, contractor.

ORANGE (Joplin)—Preparing to install flotation plant and Dorr equipment at sheet ground mine in Carterville. One of two sheet-ground mines of district that has survived present conditions. Dirt gives recovery of only 2½ to 3%, but mining is done in open pit. F. C. Wallower, of Joplin, is manager and owner.

FREEHOLD OIL AND GAS CO. (Waco)—Moving and erecting second-hand mill at No. 3 shaft of estimated capacity of 200 tons per shift. W. S. Marquiss, manager.

CARLAT MINING (Webb City)—Remodelling and enlarging plant to 200-ton capacity per shift. Expect to purchase boilers, gas engine, rolls and belting. C. Cornett, manager.

MONTANA

Broadwater County

IRON MASK (Hassel)—New crosscut tunnel started to tap vein at depth of 700 ft. Silver, lead and manganese ore from 360-ft. shaft and drifts.

KEATING MINE (Radersburg)—New roll mill for treating large tonnage of gold-bearing ore on dump. Electrical power. Not yet determined whether concentrates will be shipped to smeltery, or leaching process used on ground.

Deer Lodge County

THE WASHOE SMELTERY at Anaconda is operating with about 60% of its force, notwithstanding that the company mines in this district are not hoisting 60% of normal capacity. The smeltery is also handling some custom ores and treating a considerable quantity of flue dust from stack.

Lewis and Clark County

HELENA MINE (Helena)—Drifting on silver-lead ore on 400 level and crosscutting to contact vein. Carload ready for shipment.

LEBANON GROUP (Helena)—Four claims sold for $20,000; substantial cash payment; balance due in 12 months. Gold ore.

Silver Bow County

BUTTE MAIN RANGE (Butte)—After 10 days' close-down through labor trobules this property of the Tuolumne company is again shipping ore to Washoe smeltery. Shipments average 150 tons a day.

NORTH BUTTE (Butte)—Still crosscutting from 900 level of Sarsfield claim in eastern section. Some mineral ground gone through, but no indications so far of valuable orebody.

NEVADA

Nye County

VICTORY DIVIDE (Divide)—Owns Jew and Jewess group, adjoining Brougher Divide on west. Starting work. Peter Clark agent.

TONOPAH SHIPMENTS for week ended Mar. 22 were 7190 tons, having gross milling value of $122,230. Shippers were: Tonopah Belmont, 2429 tons, Tonopah Mining, 1050 tons; Tonopah Extension, 1963 tons; West End, 899 tons; Montana, 143 tons; Tonopah Divide, 245 tons; Jim Butler, 152 tons; MacNamara, 210 tons; Midway, 44 tons; North Star, 55 tons.

TONOPAH BELMONT (Tonopah)—Company's statement of operations for seven months ended Dec. 31, 1918, shows $1,023,874 received and receivable for ore, with expenses for mining, milling, and administration of $659,953. A total net income of $384,727 was earned. The net earnings in this period of the Belmont Surf Inlet Mines, Ltd., was $227,992.

NEW MEXICO

Grant County

CO-OPERATIVE MINING (Lordsburg)—Silver property situated at Gold Hill will start erection of flotation mill at estimated cost of $25,000, with 18,000-ton yearly capacity. Equipment will consist of ball mill, crusher, classifier, elevators, float mill, thickener, filter, concentrating table, hoist, compressor, and pump.

85 MINE (Lordsburg)—Shipping 300 tons daily to C. & A. smeltery at Douglas, Ariz. Working mill two shifts daily. Has ordered 1000-hp. boiler and 760-kw. generator. Construction will begin at once.

HIGHTOWER (Lordsburg)—This Gold Hill property, under lease and option from N. Troya by Coöperative Mining Co., now being organized here. Capital, $250,000; $5000 paid in. Shaft, 200 ft.; vein 4 ft. with good grade silver contents; 500 tons estimated on dump. Erection of buildings started and development will begin soon. A $25,000 flotation mill planned. John Walters, who built the 85 and Last Chance mills is interested.

Dona Ana County

DODD-WARREN-CHAPMAN (Tres Hermanas)—Large low-grade lead-silver deposit now under examination. Shaft down 100 ft. in ore on all four sides.

OKLAHOMA

Joplin District

UNDERWRITERS' (Joplin)—Recent drilling proved new deposits on northwest portion of lease near Douthat, Okla., at No. 1 mine, and new shaft will be sunk at once. Good strikes also being made between No. 2 and No. 3 properties at St. Louis, Okla., but this ore can be handled from one of the two mills. F. N. Bendelari is manager.

BECK (Miami)—Has installed five hand jigs on lease northwest of Picher and mining successfully at 203 ft. Erecting 250-ton mill on lease immediately south, using gas engine for mill power and steam for ore hoisting. G. W. Beck, Miami, is manager.

REDSKIN (Miami)—Shut down mill to permit sinking of mill shaft through orebody, which heretofore has been impossible on account heavy water. Expected mill will be down three or four weeks.

KELTNER (Picher)—Sinking third shaft. Butchard flotation plant with Dorr thickener turning out carload of ore weekly. F. W. Evans, Joplin, is manager.

UTAH

Juab County

TINTIC SHIPMENTS during March amounted to 584 cars, or about 29,000 tons, of an estimated value of $1,000,000. Twenty-five shippers. February shipments, 690 cars, and January, five weeks, 668 cars. Dragon Consolidated shipping fluxing and other ores, first on list, followed by Chief Consolidated and Tintic Standard.

EUREKA LILLY (Eureka)—Shaft down about 1300 ft. vertically. Station being cut, and drifting for extension of Tintic Standard ore to be started.

TINTIC STANDARD (Eureka)—During March shipped 100 cars. Trucks used to reach railroad.

Salt Lake County

LOUISE (Alta)—Adjoining South Hecla. Reopened for spring work.

SELLS (Alta)—Development being done and ore accumulated in this work. Car shipped from time to time, roads permitting.

SILVER SHIELD (Bingham)—Tunnel being retimbered and air pipe-line installed to run machine drills.

CARDIFF (Salt Lake)—Work practically suspended until hauling season opening about May 15, when trucks will start down Big Cottonwood Canyon.

Summit County

PARK CITY SHIPMENTS during March, according to preliminary figures, amount to 7566 tons of crude ore, concentrates, and spelter, of estimated value of about $500,000.

SILVER KING CONSOLIDATED (Park City)—Tunnel to develop Thaynes Canyon section in about 9700 ft. Face in softer and more siliceous limestone. Water coming in in greater volume. Lead-silver concentrates from mill being held at present, owing to softness of road from mine to loading station.

Washington County

SILVER REEF CONSOLIDATED (St. George)—Holdings in Silver Reef district, which has record of silver production in early days. Assessment of 1c. per share levied for development. Delinquent May 16.

CANADA

British Columbia

SHIPMENTS OF ORE to Trail smeltery during third week in March aggregated 8208 tons, comparing with 7546 tons in the same period in 1918. The heaviest shipments were made by the Sullivan mine, at Kimberley, and Centre Star, at Rossland.

FLORENCE SILVER (Ainsworth)—Reported operating concentrating mill 20 hours daily and planning for 24 after Apr. 8 to allow production of 600 tons of concentrates monthly, as compared with 170 tons in February and 420 in March. Concentrates average 70% lead and 24 oz. silver per ton. Improvements during last two months believed will increase extraction by at least 10%.

GRANBY (Anyox)—Operations resumed; expect to employ 1200 men soon.

Ontario

ADANAC (Cobalt)—Considering erection of mill.

PRINCESS (Cobalt)—Being reopened by La Rose.

COLLINS (Gowganda)—Is installing steam plant to carry on underground operations.

ELLIOTT KIRKLAND (Kirkland Lake)—Has stopped work.

KIRKLAND LAKE GOLD (Kirkland Lake)—New mill running, and results to date satisfactory.

WRIGHT HARGRAVES (Kirkland Lake)—Sold the remainder of treasury stock. Funds needed to complete mill.

DOME LAKE (Porcupine)—Will start milling again. Results of development on 600 level satisfactory.

QUEBEC

CISCO (Hurricanaw)—Reports promising gold discovery.

MEXICO

GREENE CANANEA (Cananea)—Production for March was 3,200,000 lb. copper; 116,670 oz. silver; 690 oz. gold.

AUSTRALIA

GREAT COBAR copper mines, New South Wales, have been closed, owing to the continuance of the embargo on export of copper, according to a Canadian press dispatch from Reuters, Ltd.

The Market Report

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver		Apr.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
3	4.6450	101⅛	48⅞	7	4 6500	101⅛	48 13/16
4	4 6800	101⅛	48 9/16	8	4 6600	101⅛	48⅞
5	4.6700	101⅛	48¾	9	4.6500	101⅛	48 11/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
3	15.30 @15.40	†72½	5 17½ @5.22½	4.97½ @5 00	6 25 @6.30
4	15.30 @15.40	†72½	5.15 @5.20	4.90 @5.00	6.25 @6.30
5	15.30 @15.40	†72½	5.15 @5.20	4 90 @5.00	6.25 @6.30
7	15¼ @15½	†72½	5.12½ 5.17½	4.90 @4.95	6.25 @6.30
8	15¼ @15½	†72½	5.00	4 75	6.22½ @6.27½
9	15¼ @15½	†72½	4 95 @5 00	4.75	6.22½ @6.27½

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0 125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Apr.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
3	80	79	84	223	221	26	24	37
4	78½	78	84½	226½	224	25	23½	37
5								
7	79	79	84½	227	225½	25	23	37
8	78½	78½	84½	226½	225	25	23½	37½
9	77	77	84	227½	225	25	24	37

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK, Apr. 9, 1919

The metal markets of this week have been characterized by dullness in copper, which was not unnatural in view of the large business in several weeks previous. There was emphatic pressure to sell lead, which consequently declined, following which a drastic cut was made. Zinc showed a little strength, on the strength of the smelters' strike, but relapsed.

Advices from Europe respecting the metal situation over there are not encouraging. Great Britain has adopted the policy of liquidating its stocks at the market, and, consequently, will undersell the offerings of new products. The French at first had some different ideas, but according to latest reports the Ministry of Finance is advertising the sale of copper and zinc at prices based on the London market.

In view of the general industrial unrest throughout Europe and the almost complete cessation of business in some parts of it, the outlook for consumption is not rosy. However, the composition of labor troubles in Great Britain, although it practically amounts to an industrial revolution, may pave the way for getting to work in that country.

Copper—During the first three days of the week there was some substantial buying at 15½c., delivered, but there was no general participation in this business, some producers failing to get much inquiry. With the beginning of the calendar week, demand dwindled to small proportions, and there was some cutting of prices, which was not, however, much advertised.

An error was made in the computation of the March average price of electrolytic copper in New York. The erroneous report was 14.855c.; the corrected report is 14.856c.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17¾c. per lb. f.o.b. mill, carload lots.

Tin—There is nothing new to report in this market. It is stated that the last of the tin purchased by the U. S. Steel Products Co. has now arrived in this country.

Lead—Right from the beginning of the week there was a distinct pressure to sell lead, and a considerable tonnage was placed at prices ranging downward from 5.20 to 5.15c. The prime cause for this was the discernment of a distinct threat to our market resulting from the situation in London. At 5.15c. sellers halted, or rather found their market taken away from them. About noon on Apr. 9 it became known that the American Smelting and Refining Co. had reduced its prices to 5c., New York, and 4¾c., St. Louis. In fact, the reduction was made on Apr. 8, but few persons in the trade became aware of it until the following day. Upon the news becoming public, other producers offered at 4.95c., New York.

Zinc—With the strike in progress at some Oklahoma works, and with a meeting in Washington to consider the liquidation of the Government stock, the market exhibited a shade more of strength, some sales for future delivery being made as high as 6.30c., while prompt was done for 5c. or less. However, there was no snap to the market, and since Monday it has eased off. No very large business was done during the week.

Belgium will soon be a producer of spelter to a considerable extent.

An interesting feature of our market during the last week or two has been business in high-grade zinc at 6¾c. With common zinc at 6¼c., the differential has thus contracted to ½c. per pound.

A committee of zinc producers, consisting of W. A. Ogg, president, American Zinc, Lead and Smelting Co.; Edgar Palmer, president, New Jersey Zinc Co.; C. M. Loeb, president, American Metal Co.; Edward Mosehauer, Anaconda Copper Mining Co.; and S. S. Tuthill, secretary, American Zinc Institute, met the Director of Sales in the War Department on Apr. 3 for consideration of the liquidation of the stocks of spelter held by the Government. Figures were presented showing that the stock is not so large as previously had been supposed. Nevertheless, it is large enough and is a serious matter. It is probable that some arrangement will be made for the liquidation of this stock similar to what was effected in the case of copper.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—There was a little more business done, under the influence of which there was a slight firming of prices. At the close we quote spot at 6¾@7c., and futures at 6⅝@6¾c.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—This market was steady at $67@70. San Francisco telegraphs $70, with a firmer tone.

Silver and Platinum

Silver—As the fluctuations in London exchange have not been so erratic this week, the fixed price for silver in London has not changed much; opening Apr. 3 at 48⅞d. and closing at 48 11/16d. Shipments the last week as reported were 300,000 oz. for France and 779,000 oz. for London.

Mexican dollars at New York: Apr. 3, 77½; Apr. 4, 77½; Apr. 5, 77½; Apr. 7, 77½; Apr. 8, 77½; Apr. 9, 77½.

Platinum—Unchanged at $99@100 for refined ingot.

Palladium—We quote $115@120. A round lot was sold at $117.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 5—Blende, per ton, high, $42.90; basis 60% zinc, premium grade, $40; Prime Western, $40@39; sludge, $37.50; flotation, $35; calamine, basis 40% zinc, $25@26. Average settling prices, blende, $39.82; calamine, $28; all zinc ores, $39.34.

Lead, high, $64.10; basis 80% lead, $62@60; average settling price, all grades of lead, $60.78 per ton.

Shipments the week: Blende, 11,512; calamine, 498; lead, 1542 tons. Value, all ores the week, $567,210.

A light tonnage of blende, assaying 50% to 54% zinc and carrying 6 to 8% iron, was sold on a basis of $42 for 60% zinc, but not carried as a price quotation, as the settling price will be about $30 per ton.

A marked appreciation in blende prices came this week, to the gratification of sellers, Prime Western and lower grades getting a raise of $1@2.50 per ton.

Platteville, Wis., Apr. 5—Blende, basis 60% zinc, $42.50 base for premium grade and $40 base for high-lead blende. Lead ore, basis 80% lead, $58 per ton. Shipments reported for the week are 2819 tons blende, 149 tons galena, and 374 tons sulphur ore. For the year to date the totals are 26,298 tons blende, 1182 tons lead, and 447 tons sulphur ore. During the week 2586 tons blende was shipped to separating plants.

Other Ores

Tungsten Ore—Charles Hardy reports as follows under date of Apr. 8: "The activity reported during the previous week in tungsten ore continued during the present week, and a fair tonnage has changed hands. While at one time Chinese ore could be had at almost any price, and business was done at very low prices, it has been exceedingly difficult during the last week to do business even at prices ranging around $6. At the time of writing there are more buyers than sellers at this figure. The prospects of the market, while not just now for much higher prices, are certainly for a firmer market, and a moderate advance should be looked forward to even in the near future. No new arrivals of ore have been reported. There are several inquiries for ferrotungsten for export in the market, and while the quantities are still small, the number of inquiries coming from many quarters show the prospects of business in that direction to be good."

Molybdenum Ore—No business reported. The nominal quotation is 80c. per lb. of molybdenum sulphide, but it is probable that ore can actually be bought for less.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Unchanged.

Iron Trade Review

PITTSBURGH—Apr. 8

An open market for pig iron is a probability for the near future, while an open market for steel products is a distinct possibility. The criticism of the Railroad Administration for refusing to buy steel products at the Redfield board prices comes chiefly from poorly informed quarters. Too many earnings reports of steel companies for 1918 have been published to leave room for doubt that large reductions in prices could be made and still leave large profits, provided there is the necessary tonnage. For instance, the Steel Corporation's profits could be cut in half from 1918 to 1919 and still leave larger earnings applicable to bond interest and dividends, because of the large deductions that had to be made from 1918 profits and will have to be made from this year's profits. The corporation's total profits in 1918 were about $550,000,000, while if its profits in 1919 were $275,000,000 the Federal taxes would be only between $55,000,000 and $60,000,000, against $274,000,000 allowed by the corporation report for 1918. As to the small producers, for whose benefit it is said steel prices must be maintained, many are already closed for lack of orders and others are closing. The large mills are running chiefly on old orders. Rails, the largest bone of contention between the Industrial Board and the Railroad Administration, are not made by small concerns, only by the Steel Corporation, Midvale, Bethlehem, Lackawanna and Colorado.

Buying of steel products continues very restricted in character, showing that the general public agrees with the Railroad Administration in refusing to take hold. Large reductions in steel prices, alone, would hardly produce much construction activity, as other commodities must be liquidated also, as well as many items of labor. As to common labor, it is doubtful whether the rate will ever decline very much. Sellers of the other building materials are indisposed to reduce prices, taking their cue from the steel industry rather than from the copper industry. The well-meant plan of Secretary Redfield for stimulating industry has failed because stabilization by reducing prices to a fair and safe level was abandoned in favor of an attempt to stabilize by making slight reductions and then regarding them as guaranteed for the remainder of the year. Even such a period, three times that for which the War Industries Board used to set prices, would not induce the capitalist to invest his money this year instead of next year.

At this writing the Industrial Board is still endeavoring to induce the Railroad Administration to pay its suggested prices, and shows no inclination to approach the steel industry for further reductions. The chances are the whole effort will fade away and the steel market drift, with light demand and occasional recessions as one producer or another cuts prices.

Pig Iron—Sentiment among the merchant blast furnaces is very strong against the situation created by the Industrial Board. Demand for pig iron is not stimulated, and furnaces receive less for what little they do sell. Lower steel prices, the furnaces contend, would make more pig iron demand and eventually pig-iron prices and cost of production would establish themselves in proper relation with each other. The fixed price system is not working well, as for a proper distribution of business the pig iron districts need to compete with each other. There is no inquiry locally. Last week the Standard Sanitary Mfg. Co., Pittsburgh, bought 1750 tons of foundry iron for April delivery to its Louisville plant, paying the recognized price, f.o.b. the respective furnaces, this representing a concession on the part of those furnaces that had less freight than the Birmingham rate. We quote: Bessemer, $27.95; basic, $25.75; foundry, $26.75, malleable, $26.25; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh.

Steel—There is no new buying. Sheet mills are specifying from hand to mouth on sheet bar contracts, involving a fair tonnage. There is no demand for forging billets, as the forge shops have hardly any business. We quote: Billets, $38.50; sheet bars and 2-inch billets, $42; slabs, $41; rods, $52.

Ferromanganese—The market continues very quiet and in control of resale material, available at $130, delivered, for 80%. Any considerable demand would absorb the resale material and put the market in the hands of producers, who now ask $150, delivered, for 80%. Resale spiegeleisen remains at about $42, shipping point, for 18%, and there is practically no demand.

Coke

Coke—Settlements for April shipments of furnace coke on adjustment contracts have generally been made at $4.25, or about the same as for March. Consumption continues to decline, several furnaces that had been using Connellsville coke having blown out in the past week, while several more are on the verge of going out. Odd lots of spot coke are occasionally offered down to $3.75. Foundry coke can be had at $4.50, with good grades at $5.25, while a few operators are holding to $6. Production has been running lighter and lighter and in the Connellsville and Lower Connellsville region will probably be 175,000 to 180,000 tons this week.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	......
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125	......	50.920	49.500	......
Oct.	87.332	101.125	......	44.324	49.500	......
Nov.	85.891	101.125	......	43.584	48.969	......
Dec.	85.960	101.125	......	43.052	48.492	......
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic		London Standard		London Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	......	110.000	......	125.000	......
May	23.500	......	110.000	......	125.000	......
June	23.500	......	110.000	......	125.000	......
July	25.904	......	119.913	......	134.913	......
Aug.	26.000	......	122.000	......	137.000	......
Sept.	26.000	......	122.000	......	137.000	......
Oct.	26.000	......	122.000	......	137.000	......
Nov.	26.000	......	122.000	......	137.000	......
Dec.	(a)	......	118.447	......	133.167	......
Year	24.628	......	115.530	......	130.507	......

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	......	329.905	......
May	(a)	......	364.217	......
June	(a)	......	331.925	......
July	(a)	......	360.347	......
August	(a)	......	380.900	......
September	(a)	......	343.905	......
October	(a)	......	335.543	......
November	(a)	......	323.550	......
December	(a)	......	267.736	......
Av. year	(a)	......	330.138	......

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	......	6.701	......	29.00	......
May	6.818	......	6.704	......	29.00	......
June	7.611	......	7.511	......	29.00	......
July	8.033	......	7.750	......	29.00	......
August	8.050	......	7.750	......	29.00	......
September	8.050	......	7.750	......	29.00	......
October	8.050	......	7.750	......	29.00	......
November	8.050	......	7.750	......	31.20	......
December	6.564	......	6.324	......	40.00	......
Year	7.413	......	7.222	......	30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	40.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15		32.95		33.95	
May	36.20		33.00		34.00	
June	36.36		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.46	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 8
Alaska Gold M.	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	71
Am.Sm. & Ref., pf.	105
Am.Sm.Sec., pf., A	91
Am. Zinc	13
Am. Zinc, pf.	44
Anaconda	62
Batopilas Min.	1
Bethlehem Steel	72
Butte & Superior	21
Butte Cop. & Zinc	7
Cerro de Pasco	39
Chile Cop	23
Chino	37
Colo. Fuel & Iron	44
Crucible Steel	67
Crucible Steel, pf.	94
Dome Mines	12
Federal M. & S.	9
Federal M. & S., pf.	35
Great Nor., ore ctf.	42
Greene Cananea	43
Gulf States Steel	55
Homestake	98
Inspiration Con.	51
International Nickel	27
Kennecott	32
Lackawanna Steel	71
Mexican Petrol.	184
Miami Copper	23
Nat'l Lead, com	68
National Lead, pf.	108
Nev. Consol.	16
Ontario Min.	6
Ray Con	21
Republic I.&S.,com	83
Republic I.&S., pf.	102
Sloss-Sheffield	54
Tennessee C. & C.	14
U. S. Steel, com.	98
U. S. Steel, pf.	116
Utah Copper	76
Va. Iron C. & C.	56
Worthington Pump	65

BOSTON CURB*	Apr. 8
Alaska Mines Corp.	‡.12
Boston Ely	1
Boston & Mont.	62
Butte & Lon'n Dev.	.11
Calaveras	1
Chief Con	3
Contact	05
Corbin	‡ 25
Cortez	.12
Crown Reserve	.37
Crystal Cop.	27
Eagle & Blue Bell	2
First Nat. Cop	1
Houghton Copper	.20
Intermountain	‡.05
Iron Blossom	.35
Iron Cap	11
Majestic	.09
Mexican Metals	23
Mines of America	‡ 05
Mojave Tungsten	05
Nat. Zinc & Lead	08
Nevada-Douglas	13
New Baltic	1
Oneco	20
Pacific Mines	‡ 25
Rex Cons	05
Yukon Gold	70

SAN FRAN.*	Apr. 8
Alta	01
Andes	07
Best & Belcher	04
Caledonia	10
Challenge Con.	‡ 03
Confidence	‡ 03
Con. Virginia	51
Gould & Curry	03
Hale & Norcross	12
Jacket-Cr. Pt.	05
Mexican	‡ 17
Occidental	40
Ophir	47
Overman	02
Savage	05
Sierra Nevada	15
Union Con	13
Utah Con	‡ 02
Belmont	3 00
Jim Butler	38
MacNamara	76
Midway	44
Mont.-Tonopah	20
North Star	08
Rescue Eula	08
West End Con	1 82
Atlanta	05
Booth	25
Comb. Frac.	‡ 03
Florence	40
Jumbo Extension	13
Kewanas	04
Nevada Hills	03
Nevada Packard	25
Round Mountain	39
Silver Pick	08
White Caps	13

COLO. SPRINGS*	Apr. 8
Cresson Con	5 00
Doctor Jack Pot	06
Elkton Con	04
El Paso	15
Gold Sovereign	‡ 02
Golden Cycle	89
Granite	15
Isabella	05
Mary McKinney	06
Portland	95
United Gold M.	18
Vindicator	40

BOSTON EXCH.†	Apr. 8
Adventure	175
Ahmeek	73
Algomah	.30
Allouez	39
Ariz. Com.	12
Arnold	‡ 20
Bingham Mines	‡8
Bonanza	‡ 10
Butte-Balaklava	.30
Calumet & Ariz.	61
Calumet & Hecla	415
Centennial	‡12
Copper Range	44
Daly West	2
Davis-Daly	5
East Butte	8
Franklin	3
Granby	‡70
Hancock	‡5
Hedley	‡12
Helvetia	‡ 25
Indiana	‡.50
Isle Royale	26
Keweenaw	1
Lake	4
La Salle	‡2
Mason Valley	‡2
Mass	4
Mayflower	3
Michigan	3
Mohawk	58
New Arcadian	‡1
New Cornelia	17
New Idria	‡9
North Butte	11
North Lake	‡ 50
Ojibway	‡1
Old Dominion	35
Osceola	51
Quincy	58
St. Mary's M. L.	‡40
Santa Fe	‡ 25
Seneca	14
Shannon	2
Shattuck-Ariz.	‡14
So. Lake	.99
So. Utah	‡ 12
Superior	5
Superior & Bost.	2
Trinity	2
Tuolumne	‡.75
U. S. Smelting	50
U. S. Smelting, pf.	47
Utah Apex	2
Utah Con	8
Utah Metal	2
Victoria	2
Winona	.80
Wolverine	16

N. Y. CURB†	Apr. 8
Big Ledge	.75
Butte & N. Y.	1
Butte Detroit	.05
Caledonia	.39
Calumet & Jerome	[illegible]
Can. Cop. Corpn.	1
Carlisle	‡2
Cashboy	‡ 13
Con. Ariz. Sm.	1
Con. Coppermines	‡5
Goldfield Con.	19
Goldfield Merger	.07
Greenmonster	‡
Hecla Min.	5
Howe Sound	‡3
Jerome Verde	‡
Louisiana	[illegible]
Magma	31
Marsh	.07
McKinley-Dar-Sa.	.50
Milford	‡ 75
Mother Lode	.38
Nixon Nevada	.30
Ohio Cop.	[illegible]
Rawley	‡2
Ray Hercules	2
Richmond	‡ 56
Rochester Mines	21
St. Joseph Lead	‡12
Standard S. L.	[illegible]
Stewart	.16
Success	.04
Tonopah	‡3
Tonopah Ex.	2
Tribullion	25
Troy Arizona	‡.10
United Eastern	6
United Verde Ext.	‡32
United Zinc	‡
Utica Mines	‡.08

TORONTO*	Apr. 8
Adanac	.17
Bailey	.04
Beaver Con	.43
Chambers Ferland	‡.10
Coniagas	2.00
Hargraves	.02
Kerr Lake	5 00
La Rose	.25
Lake Shore	94
Min. Corp. of Can.	2 00
Nipissing	‡8 75
Peterson Lake	.07
Temiskaming	.32
Wettlaufer-Lor.	.04
Davidson	.68
Dome Exten.	25
Dome Lake	24
Hollinger	6 12
McIntyre	1 62
Newray	12
Porc. Crown	26
Teck-Hughes	26
Vipond	20
West Dome	13

* Bid prices. † Closing prices. ‡ Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	3 55	4 29	4 57	5 80	4 57	5 45
No. 12	3 60	4 34	4 62	5 85	4 62	5 50
No. 14	3 65	4 39	4 67	5 90	4 67	5 55
Black						
Nos. 18 and 20	4 15	5.04	5 17	6 75	5 42	6 25
Nos. 22 and 24	4 20	5.14	5 22	6 80	5 47	6 30
No. 26	4 25	5 19	5 27	6 95	5 52	6 40
No. 28	4 35	5 29	5 37	7 05	5.62	6 45
Galvanized:						
No. 10	4.70	5 64	5 72	.	5 97	6 70
No. 12	4.80	5 64	5 82	7 30	6 02	6 80
No. 14	4 80	5 64	5 82	7 30	6 02	6 80
Nos. 18 and 20	5 10	5 84	6 12	7 60	6.37	7 10
Nos. 22 and 24	5 25	5 99	6 25	7 75	6 52	7 25
No. 26	5 40	5 69	6 42	7 90	6 67	7 40
No. 28	5 70	6 44	6 72	8 20	6.97	7 70

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$45 00	$55.00	$45 00	$65.00
Standard openhearth rails	47 00	57 00	47 00	67 00
Light rails, 8 to 10 lb	2 58½*	3.13½*	2 83½*	3.13½*
Light rails, 12 to 14 lb	2 44*	3.09*	2 79*	3 09*
Light rails, 25 to 45 lb	2 45*	3.00*	2 70*	3 00*

* Per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger	$3 25	$3.90	$4 27	$5 04	$6 15
Track bolts	4 90	4 90	5 17	Premium	7 20
Standard section angle bars	3.00	3 25	4 22	Premium	4 95

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago
Beams, 3 to 15 in	$2 45	$3 47	$4 19½	$3 39	$3 47
Channels, 3 to 15 in	2 45	3 47	4.19½	3 39	3.47
Angles, 3 to 6 in. ¼ in. thick	2 45	3 47	4 19½	3 39	3 47
Tees, 3 in. and larger	2 45	3 52	4 19½	3 39	3 47
Plates	2 66	3 67	4 44½	3 39	3 67

STEEL SHEET PILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2 55	$3 50	$4–5

RIVETS—The following quotations are per 100 lb.:

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
STRUCTURAL							
¾-in. and larger	$4 20	$5 05	$6 095	$4 87	$4 94	$6 70	$6 75
CONE HEAD BOILER							
¾ in. and larger	4 30	5 15	6 195	4 97	5 04	6 80	6 75
⅝ and 11/16	4 45	5 30	6 345	5 12	5 19	6.95	6 90
½ and 9/16	4 70	5 55	6 695	6 47	5.44	7 30	7.15

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+12½%
Galvanized cast steel rigging	7½%
Bright plow steel	35%
Bright cast steel	22½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5 75	$7 50	$6 50	$6.25	$8 50	$7 35
Assorted	...	7 50	6 50	6.40	8 75	7 60

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars	2.75c.	Steel bars	2 35c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0 16½	$0 18	$0 19	$0 18½	$0.16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	14c.	14c.	15c.	16c.
Hollow	21c.	25c.	...	28c.

STEEL AND IRON PIPE—The following discounts are for carload lots f. o. b. Pittsburgh, basing card of Jan. 1 for steel pipe and iron pipe:

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
BUTT WELD					
¾ to 3	57½	44	¾ to 1½	39	23½
LAP WELD					
2	50½	38	1¼	24½	9½
2½ to 6	53½	41	1½	31½	17½
7 to 12	50½	37	2	32½	18½
13 and 14	41	.	2½ to 6	34½	21½
15	38½		7 to 12	31½	18½
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛, ¼ and ⅜	46½	29	⅛, ¼ and ⅜	28½	11½
½	51½	39	½	33½	20½
¾ to 1½	55½	43	¾ to 1½	39½	24½
2 to 3	56½	44			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	48½	37	1¼	25½	10½
2½ to 4	51½	40	1½	31½	17½
4½ to 6	50½	39	2	33½	20½
7 to 8	46½	33	2½ to 4	35½	23½
9 to 12	41½	28	4½ to 6	34½	22½
			7 to 8	26½	14½
			9 to 12	21½	9½

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	47%	46½%	51½%
3½ to 6 in. lap welded	42%	42½%	53½%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	31%	31%	44%
3½ to 6 in. lap welded	27%	37½%	41%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 5%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0 25	$1 00	$1.90	$1.40	$1.28	$1.05
Hot pressed hexagon	25	1 00	1 90	1.20	1.08	.85
Cold punched square	2 25	1.00	1 90	.75	1.30	1.50
Cold punched hexagon	2 25	1.00	1 90	.75	1.30	1.50

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	40%
Chicago	50%	50%
Cleveland	50–30%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	40%	50%	45–5%
Larger and longer up to 1 in. by 30 in.	50%	40%	40%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York	$2 00	Cleveland	$2 00	Chicago	$2 25

For cast-iron washers the base price per 100 lb. is as follows:

New York	$5 00	Cleveland	$4 00	Chicago	$4 00

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f. o. b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$52.00	$52.50	$53 00	$53 50
Tar pitch (in 400-lb. bbl.)	19 00	16 00	20 00	17 00
Asphalt pitch (in barrels)	36 00	36 00	41 50	41 50
Asphalt felt	67.50	67.50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.35	$1 60	$1.70	$1.95	$2.05	$2.30
No. 2 grade	1.20	1.45	1.50	1.75	1.80	2 05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.10 per roll in carload lots and $2.35 for smaller quantities.

Shingles, red and green slate finish, cost $5.50 per square in carloads, $5.75 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$0.056	$0.11	$0 162
Seattle	.09	175	.30
Los Angeles*	082	.154	.23
New Orleans	17	23	.34

* F.o.b. factory, 4, 8 and 10 inch.

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	P	Fir	Hemlock	Spruce	P	Fir
Boston	$46 50	$45 00	$45 00	$46 00	$52 00	$46 00
Cincinnati	37 00		36 00		41 00	......
Kansas City	40 50	41 50	41 50	$39 50	45 50	43 50
Seattle	17 50	12 50	17 50	17 50	17 50	17 50
New Orleans	31 50				36 50	
St. Paul	46.00	50 00	46 00	46 00		53 00
Denver	44 00	34 50	34 50		49 00	39 00
Atlanta	35 50	.....	......	......	48.00	....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr 10 In. x 16 Ft.	
	P.	Fir	Hemlock	Y P.	Fir
Boston	$50.00	$45 00	$40 00	$45.00	$48.50
St. Paul	50 50	40 00	40 00	48 50	44 50
Kansas City	50 00	55 75	55 75	53 50	61 00
Seattle	17 50	17 50	17 50	17 50	17 50
New Orleans	34 00			31 50	
Cincinnati	43 00	39 00	39 00	42 00	38 00
Denver	45 00	33 50	33 50	38 00	30 00
Atlanta	32 50	....	....	32 50	.....
Los Angeles		29 00	28 00	.	.....

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 25	$4 00	$4 37	$5 00	$4 75
Cut	3 45	6 50	6.50	5 75	. .

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags.

	Current	One Month Ago	One Year Ago with Bags
New York	$2 90	$2 45	$2 5[illegible]
Jersey City	2 [illegible]7	2 62	2 50
Boston	2 52	2 52	2 87
Chicago	2 00	2 05	2 36
Pittsburgh	2 10	2 15	2 71
Cleveland	2 27	2 32	2 84
Denver	2 62	2 62	3 20

Note—Bag charge is generally 15c. each.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17 50	$14 50	$2 90	$2 65
Kansas City	22 80		2 35*	2 20*
Chicago	18 00	17 50	1 80*	1 10*
St. Louis	22 00	18 00		1 75*
Boston	22 50	18 25	3.65	3 30
Dallas	2 25*	1 25*	. . .	. .
San Francisco	19 00	. . .	. . . .	2 00†
St. Paul	25 00	19 50	1.97†	1 93†
New Orleans	....	1 90	....	.
Atlanta	....	....	19 00‡	2 50*
Denver		.	26.25‡	2 50*
Los Angeles		3 05†	. . .	2 80†

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton.

Note—Refund of 10c. per barrel.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1 55	$1 55	$1 68	$1 65	$1 66	$1 65
5-gal. cans	1 70	1 65	1 85	1 80	1 86	1 75

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13 00	14 50	11 25	11 50	13 00	12 50
25- and 50-lb. kegs	13 25	14 75	11 50	11 75	13 25	12 75
12½-lb. keg	13 50	15 00	11 75	12 00	13.50	13 00
5-lb. cans	15 00	16 50	13 25	13 00	15 00	14 50
1-lb. cans	16 00	12 50	13 25	13 50	16 00	14 50

MINING AND MILLING SUPPLIES

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in.	75c. per ft.
Common, 2½-in.	30%

Air	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0 55	$0 40	$0 30

Steam—Discounts from List

First grade	25%	Second grade	35%	Third grade	40%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40-5%	35%
St. Louis	45%	50%
Chicago	45%	40+5%
Birmingham	30%	35%
Denver	35-5%	30%
Cincinnati	40-10%	40%

RAWHIDE LACING—50c. for cut; 45c. per sq.ft. for ordinary.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra, while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; ½-in., 6; ⅝-in., 4½; 1-in., 3⅓; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0 26	Denver	$0 32
New York	29	Kansas City	29
Cincinnati	29	New Orleans	28½
Chicago	26½	Seattle	27½
St. Paul	30	St. Louis	27
San Francisco	26	Atlanta	34

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1 60
Duck and rubber for piston packing	1 00
Flax, regular	1 20
Flax, waterproofed	1 60
Compressed asbestos sheet	1 00
Wire insertion asbestos sheet	1 20
Rubber sheet	60
Rubber sheet, wire insertion	80
Rubber sheet, duck insertion	50
Rubber sheet, cloth insertion	.30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1 20
Asbestos wick, ½- and 1-lb. balls	85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120 00 at Chester, Penn.
Chrome cement	net ton	65 00 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30 at Clearfield, Penn.
Clay brick, 2nd quality	net ton	38–48 at Clearfield, Penn.
Magnesite, dead burned	net ton	37 50 at Chewalah, Penn
Magnesite brick, 9 x 4½ x 2½ in.	net ton	90 00 at Chester, Penn.
Silica brick	net ton	45–55 at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.

Birmingham—Fire clay, $40–$45; silica, $40–$50; magnesite, $90; chrome, $120

Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1.48	1 33
San Francisco	Douglas Fir—Green	1 35	96
San Francisco	Douglas Fir—Creosoted	2 70	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0 70	No. 1	$0.55
No. 2	80	No. 2	65
No. 3	.90	No. 3	.75
No. 4	.98		
7x9x8 white oak	.		1.05
7x9x8 red oak, No. 4	.80	No. 5	.87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels

	New York	Chicago In Bbl.	Chicago Carloads	Denver In Bbl. Lots.
Pure steam-distilled pine oil, sp. gr. 0.925–0.94	$0.58	$0.71	$0.69	$ 0.81
Pure destructively distilled pine oil	.58	.68†	.66†	.55–.65
Pine tar oil, sp.gr. 1 02=1.035	.35	.36	.34	60
Crude turpentine	.45	.68	.66	.60–.65
*Hardwood creosote, sp.gr. 0.96–0.99	.23	.....	.....	.42–.45

* F.o.b. Cadillac, Mich. † Very scarce.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11 00 to 13 00	13 00	16 50	12 00 to 16.50
Colored mixed	8 50 to 12 00	10 00	13 00	11 50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58 00
Chicago	48 00	50.00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York		$0 27½	$0 30		$2 40
Boston	$0 22¼	.24½	26¾	$0 31	2 40
Cincinnati	19¼	.21¾	23½		2.35
Kansas City	20¼	.25¾	30¼	38¾	2.45
New Orleans		.24½	28½	..	. ...
Seattle	..	18¼	21	......	. .
Chicago	18¼	.21¾	25½	29¾	2.35
St. Paul	19	.25¼	30¾	.	2.45
St. Louis	19	.23¼	25¾	.30	2 35
Denver	17¼	.24	.29	.35	2 60
Dallas	21	.27¾	.32	.38	
Los Angeles	23	.30	.37	......	2.95

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb.; Denver, 42c.; Chicago, 31½c.; St. Louis, 31c.

SODIUM SULPHIDE—In New York the price per pound is 4½c. for concentrated, 2c. for crystals. The St. Louis price is 6c. for concentrated, 5½c. for fused, 3½c. for crystals. The Chicago price is 6c. for concentrated, 3½c. for crystals. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 12c. per lb.; Chicago, 13c.; Denver, 13½c. f. o. b. Pueblo; St. Louis, 12½c., less than car lots 13c.

ALUMINUM DUST—Chicago price is 1 30 per lb.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drum Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101 00	$1 52
Southeastern portion U. S. A.	115 50	110 50	1.63
Texas (except El Paso)	124 00	119 00	1.74
El Paso, Texas	126 00	121.00	1.77
Denver, Colo.	124 00	119 00	1.74
West Coast	129 00	124 00	1.81

Engineering and Mining Journal

April 19, 1919

Volume 107 *Number* 16

QUINN-HARRISON 7500-TON STEEL-BUILT CONCENTRATOR AT NASHWAUK, MINNESOTA

Iron-Ore Concentration on the Mesabi Range

BY F. A. KENNEDY*

The washing of iron ores in the Mesabi district of Minnesota has resulted in the recovery of a large tonnage which would otherwise have been unmerchantable, owing to its excess silica content. Modifications in machinery and methods have been introduced at some of the plants, but, for the most part, concentration is fairly simple, and consists generally of screening, log washing, and jigging. Tables and curves relating to the performances of washeries accompany the article, and several pertinent and practicable suggestions are made for the betterment of present methods.

THE wash-ore area on the Mesabi iron range covers a region of the iron-bearing formation extending from Grand Rapids on the west to the Hibbing district, about 40 miles eastward. Not all of the developed orebodies are of wash structure; some are of such grades that they can be shipped direct as merchantable ore. It is safe to say, however, that 65% of the ore is of a possible wash structure and of too high a silica content to be classified as merchantable ore. The increase in the number of washing plants completed each year on the western Mesabi shows that the product must be of a structure desirable for furnace operation. The following is a list of plants which were in operation, under construction, or with plans completed at the end of 1918:

IRON-ORE WASHING PLANTS ON MESABI RANGE

Plant	No. of Units	Plant	No. of Units
Trout Lake	6	Harrison	1
Danube	1	Mace No. 2	1
Hill Annex	2(*a*)	York	1
Majorca	½	Shada	1
Draper	½	La Rue	1
Patrick	1	Crosby	1

(*a*) Planned.

A one-unit plant contains two 25-ft. and four 18-ft. log washers, with the necessary tables for the fines. In general it may be said that 12 double-deck tables are required for each unit. The mills are all of the same general type, having in most cases been patterned after the Oliver Iron Mining Co.'s plant at Trout Lake. Minor changes have been made to some extent. Fig. 1 shows a flow sheet that is applicable to almost any one-unit plant now under operation. According to the flow sheet, the coarse material (taconite) is separated by use of grizzly bars, whereas at some plants it is removed by hand either before or after entering the screen; but hand-picking the taconite seems preferable where the crude ore contains any large hematite boulders or a small percentage of oversize, although a careful study of the orebody will indicate which is the better method. I have seen ore taken from a large pit which, when washed, gave but one 20-yd. car of rock to 45 cars of concentrates, whereas treatment of other material from the same pit has yielded one car of rock to every car of concentrates. In the latter case it would be impossible to pick the rock out by hand and make any headway.

---

*Consulting engineer, 1007 Alworth Bldg., Duluth, Minnesota.

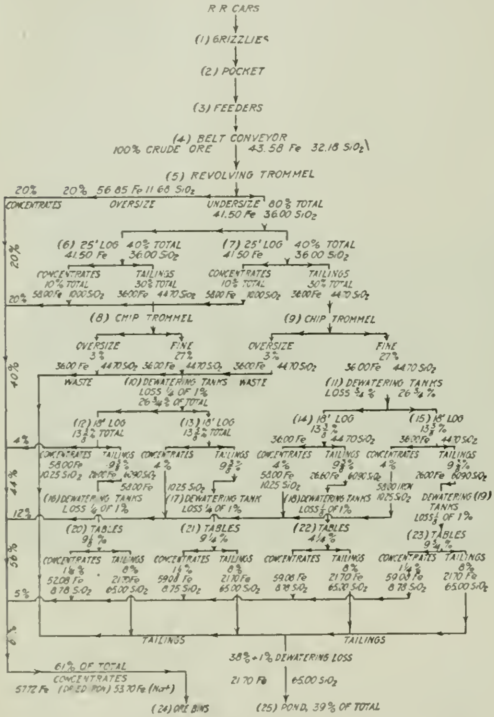


FIG. 1. FLOW SHEET OF ONE-UNIT IRON-ORE WASHING PLANT, SHOWING APPROXIMATE PERCENTAGES AND ANALYSES

STANDARD GRIZZLY BARS BEST SUITED TO LOCAL CONDITIONS

Most of the grizzlies now in use in Minnesota washing plants consist of inverted standard 80-lb. railroad steel, spaced 6-in. apart, but it is better to use standard extra-heavy grizzly bars with 4-in. spacing, because the former gives only 54% of the total area as screening space, resulting in a considerable quantity of fines being retained in the oversize. The grizzly bars shown in Fig. 2 (see detail), spaced at 4 in., give 71% screening area, only 29% being blanked by steel. An actual demonstration, made at the Harrison plant, where the inverted steel rails would not work, proved clearly that the use of bars was advantageous.

Fig. 2 shows a cross-section, through the receiving hoppers and grizzlies, of a six-section screening plant. Objection may be made to the hopper design, but the bars in this position and slope will work well on any ordinary wash ore, and these factors were determined after various experiences at several plants. However, a somewhat steeper slope should be given the upper bars if the crude ore contains many large flat rocks. The design was of extra heavy construction to enable a train to dump its several 35-ton cars one after another and without delay.

CHANGE IN BELT FEEDER SECURES GREATER OUTPUT THAN FORMERLY ACHIEVED

The ore is fed to the belt conveyor *A* by means of a steel belt feeder, which is made with plates lapping to the front, so that any small stones or pieces of taconite that wedge in between the edges of the plates will fall out as the latter open up in going over the front roller. However, from experience in operating a number of feeders, I found that it was better to change the plates with the laps to the back. Small stones will drop in while passing over the front roller, but will also drop out on coming up over the back roller. This particular change resulted in a larger output than it was formerly possible to achieve. This comment is not intended as a criticism of the manufacturers, but as an aid to those who have experienced trouble as a result of the breakage of plates, bolts, and binding plates, thus causing a stoppage of the entire plant. I know of two plants where the use of feeders was condemned, and where they were removed on account of the above-mentioned

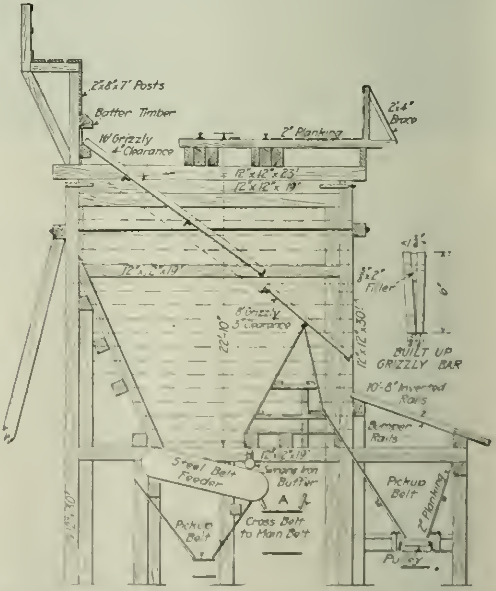
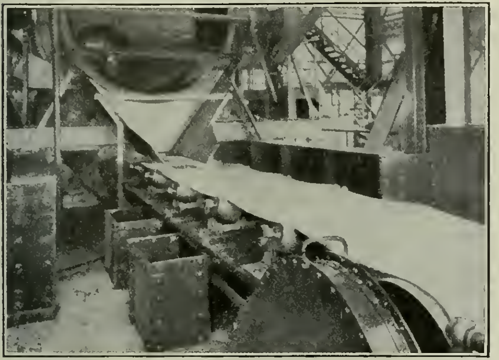


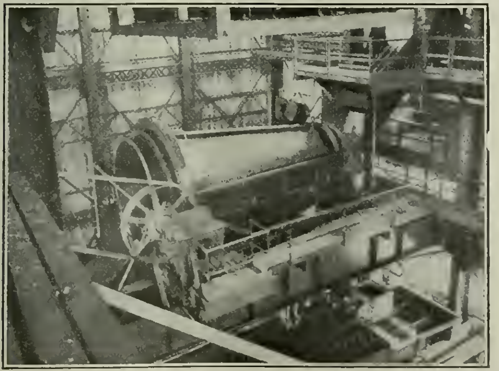
FIG. 2. CROSS-SECTION THROUGH RECEIVING HOPPER AND GRIZZLIES OF A TYPICAL SIX-SECTION SCREENING PLANT

trouble, merely because the users did not know how to remedy the difficulty. Feeders are essential adjuncts in any concentrating plant and for use in connection with washing machinery. For efficient work and to secure the maximum tonnage, it is necessary to have a continuous, even feed going onto the upper screen.

In a one-unit plant the main conveyor belt that carries the ore up to the head of the belt is usually 36 in. wide, and should have a speed of about 240 ft. per min., on favorable ore. It is hardly possible to carry all the ore the plant can handle on a 36-in. belt with a speed of 180 ft. per min., which was the original speed adopted in a number of plants. A higher speed than 240 ft. per min. is unnecessary, and shortens the life of the belt. Examinations of several discarded belts showed that the material was only partly worn out, although in most cases it was torn or ripped by either a sharp piece of taconite or steel. Such damage can be prevented by allowing plenty of clearance along the return part of the belt and plenty of headroom underneath the lower pulley.



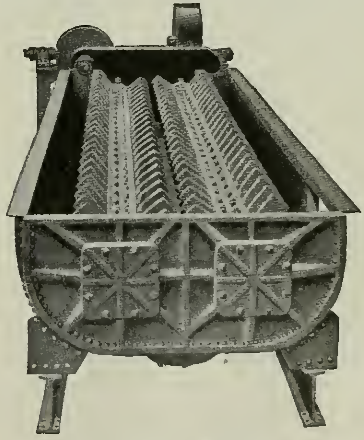
PICKING BELT WITH CHUTES FOR WASTE DISPOSAL AT IRON-ORE WASHERY.



CONICAL TROMMEL SCREEN

There is a variation in the size of openings in screens or trommels, but the average size for such work is a full punch, ⅜-in. plate with 1½-in. holes. On the average wash ore, however, this is too large an opening; and at some of the newer plants, such as the Draper and the Mace No. 2, 1¼ in. screen openings are provided. For a good grade of wash ore, it would be well to use screens with ⅞-in. openings, as the former sizes put too heavy a load on the log washers, with the result that the oversize is but a small proportion of the total, whereas it should equal about 20%. By bolting a 1½-in. screen inside of another and staggering the holes, it is possible to double the oversize without varying the grade of the concentrates, and by doing so I increased the capacity of one of the plants about 25%. A full-punched ⅞-in. screen has since been purchased to replace the above-mentioned apparatus. At another plant, instead of altering the screen temporarily, the undersize from the first half of the screen went directly to the 25-ft. logs and the remaining half to the concentrate bins. This change did not make an appreciable difference in the grade, but resulted in the addition of a considerable volume of water to the concentrates. A close study of the character and structure of the ore should be made before determining the screen mesh to be used. From results obtained at several plants it appears that it is better to have the large screens driven by a gear placed parallel to the axis of the screen, than by one at right angles and on the front face.

The undersize passes directly to the 25-ft. log washers. The first half of the screen should discharge in the center of the log and in a manner that will not wear out the shaft angles. This may be done by placing a baffle so as to produce a spray. The second half of the undersize should enter near the head of the log, as there is usually but a small amount of remaining sand to be washed out, and by this arrangement the work on the log is lightened. Both the 25-ft. and the 18-ft. logs should be provided with friction-clutch pulleys, which are essential, for if the power is suddenly cut off or the belt breaks it is a two- or three-hour job to clean out the washer before it is possible to turn the log over again. A 2½-in. hose with a nozzle is found useful for cleaning out and can be handled best through a manhole in the bottom, near the tail end of the log.



AN 18-FT. LOG WASHER

The tailings pass into a chip screen or trommel (the oversize going to the waste pond and the undersize to the 18-ft. logs) provided for the purpose of removing chips, cinders, and all coarse particles that would otherwise plug up the spigots of the machinery subsequently employed. It seems better practice to use a ⅜-in. wire screen instead of full-punched screens. No doubt there is a larger loss on fines with the ⅜-in. punched screen, commonly used, than in any other part of the mill, so that, if it is necessary to use punched screens of that size, a longer screen should be installed. The oversize is 50% good ore, which should be saved, for the loss probably amounts to 20 or 40 tons per day and could be recovered by putting in a two- or three-cell jig.

The undersize from the two chip screens is dewatered and the products from the spigots go directly into the four 18-ft. log washers. These operate at a lower speed than the 25-ft. log washers and require less repair work. The heads from this operation run into the concentrate bins, and the tailings, after being dewatered, are distributed over 12 double-deck tables. Single-deck tables were used at first at all the iron-ore washeries, but, later, the double-deck table was adopted as an economy.

Opinion Regarding Use of Single- and Double-Deck Tables

In iron-ore concentration, a larger load is put on a table than would ordinarily be carried if any other ore were being treated. The supporting frame and working parts of the type adopted were designed from notes taken on the concentration of minor-metal ores; and it was found upon adding another deck that the tables did not stand up under the increased load. I am aware that heavier parts are being placed in double-deck tables that failed owing to faulty design, but from tests and daily observation I am convinced that it is far better to use single-deck tables. From the data I am able to obtain I learn that approximately 85% of the total material that a double deck can handle can be carried easily by a single deck. Tables should be placed on a solid foundation, preferably on a ground floor, and the concentrates carried to the ore bins by means of a 7-in. x 12-in. bucket elevator.

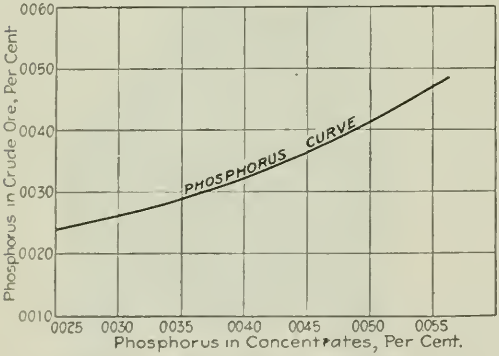


FIG. 3. CURVE SHOWING RELATIVE PERCENTAGES OF PHOSPHORUS IN CRUDE ORE AND CONCENTRATES.

Advantages of Classifiers in Wash Practice

The Hawkins plant, at Nashwauk, uses classifiers in the bottom of a small tank at the tail end of the 18-ft. logs. A coarse concentrate is drawn off, thereby lightening the load on the tables. This is good practice, and should be followed by other plants. In mills where the concentrates run extremely low in silica, as at the Patrick, it seems advisable to replace the tables by classifiers, but the product from the last two spigots of the classifiers should be run over tables. In this way not only as many iron units go into the concentrates as formerly, but an additional tonnage of silica is added, which does not influence the grade to the extent of more than 2%. However, for those not familiar with the use of classifiers, I believe it best to use them in conjunction with tables. In other words, it is advisable to treat on a separate table every spigot discharge from a classifier that is not clean, as outlined on the flow sheet in Fig. 4.

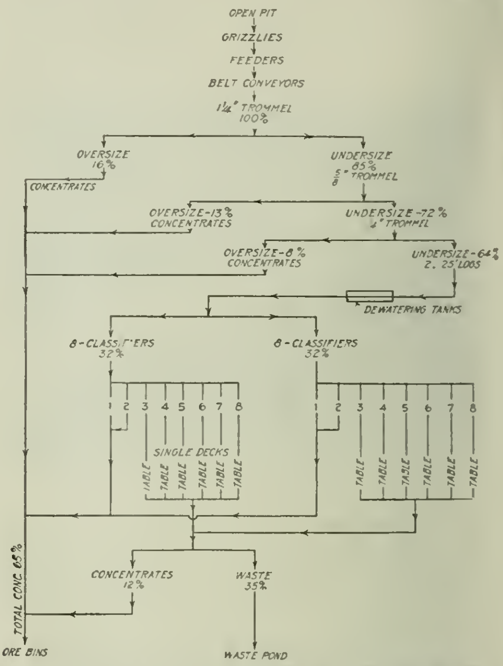


FIG. 4. FLOW SHEET FOR IRON ORES WHICH SHOW A COMMERCIAL CONCENTRATION BY A SCREEN ANALYSIS

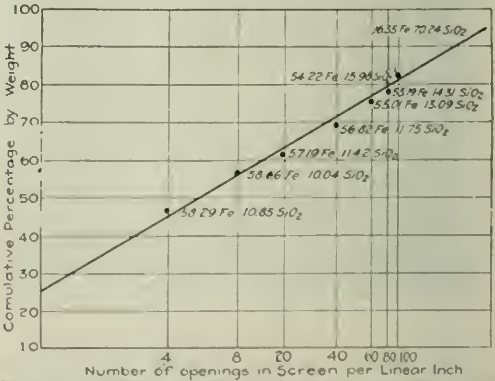


FIG. 5. CURVE SHOWING SCREEN ANALYSIS ON SEVERAL SAMPLES TAKEN IN THE NASHWAUK, MINNESOTA, DISTRICT

The Draper mill is installing a dewatering device for all the fine concentrates. Should this prove as successful as hoped, it will no doubt be adopted by other mills, as the present method results in too much water being sent to the railroad cars. The water readily drains out, but in filling the cars a large loss of fine ore results. Some mills have installed a sloping platform underneath the loading track which has an outlet into a large elevator boot. The fine ore and water that drips from the cars is then hoisted up to a dewatering tank by means of a belt elevator, and the process not only saves the fine ore but reduces the number of men needed in front. From experience it is found best to use a fairly large pulley, 48-in. at the bottom and top; 7-in. x 12-in. buckets, spaced at 16-in., will handle the overflow from a one-unit plant.

Necessity for a Continuous and Sufficient Water Supply

The most important and essential factor for the operation of a washing plant is an ample, continuous supply of water. It is far better to be safe on the water question, in every possible manner, than to be near the limit of just having enough. In some instances pumps have been installed with ample capacity, but the discharge line was of such size that it was almost impossible to run the mill at full capacity. Automatic stopping and starting devices should be installed not only on the pump motors but on all mill motors, and they should be as nearly "fool proof" as possible. Pumping more water than needed is wasteful. A discharge pipe of ample capacity should be provided, together with a check valve and a safety valve, preferably of the spring type. If the discharge line is long, an air-inlet valve should be placed in the discharge pipe. The automatic stopping device should be so arranged that when any concentrating machine or motor stops in the mill, all the machinery controlling preliminary operations will cease automatically. Proper lines of communication by both bells and telephones should also be provided.

The figures in Table I cover a monthly report on a one-unit plant. The percentage of concentrate to crude ore washed is 67.51%, and this is somewhat higher than is usual with average wash ores of the district in which the silica in the concentrates is below 10 per cent.

Fig. 3 is a curve diagram in which the phosphorus in the crude ore is represented by the absciss and in the concentrates by the ordinates. Knowing the phosphorus content in the crude ore, the approximate phosphorus percent in the concentrates can be determined.

Table II is a delay sheet showing the loss of time for each day as well as the total delay for the month

TABLE I. MONTHLY REPORT ON PERFORMANCE OF A ONE-UNIT WASHING PLANT

Date, July 1918	Crude Ore Tons Washed	Crude Ore Fe, %	Crude Ore P, %	Crude Ore SiO₂, %	Concentrates Tons	Concentrates Fe, %	Concentrates P, %	Concentrates SiO₂ %	Per Cent. of Weight of Concentrate to Crude Ore Washed	Per Cent. Extraction of Iron in Ore
1	5548 4	44 48	0 026	29 62	3111 0	57 39	0 038	10 42	70 46	90 10
2	3997 6	46 77	0 028	27 62	2243 0	52 24	0 036	12 03	56.11	68 67
3	4452.1	47 46	0.030	27 58	2022 0	59.51	0 037	10.35	45 42	56 94
4	......	.....	.....	.....	......				..	
5	4640 2	39 51	0 034	37 03	2866 0	57 30	0 038	11.26	61.75	89 58
6	4840 0	43 47	0 030	31 19	3288 0	57 10	0 038	11.23	67.93	89 23
7	3145 0	48 30	0 032	24 85	1678 0	58 29	0.038	8.91	53.35	64 94
8	5340 0	48 99	0 032	23.59	3983 0	59.15	0 037	9.04	74.59	90 05
9	5700 0	48 52	0 032	24 80	3581 0	59 85	0 039	8 40	62 82	77 51
10	5967 0	47 81	0 037	27 02	3480 0	61.19	0 046	7 88	58.32	74 65
11	5613 0	46 89	0 040	27 48	3041 0	60.55	0 049	8 71	54 18	69 96
12	4231 0	49 98	0 046	23 17	2660 0	60 58	0 053	8.86	62.87	76.20
13	4762 0	46.12	0 034	28.07	2633 0	57 42	0 042	12.52	55 29	68 83
14	2932 0	45 55	0 031	29 35	1540 0	58 42	0 039	10 38	52 52	67 36
15	5898 0	45 38	0 038	29 03	3212 0	58 43	0 043	10.19	54 46	70.12
16	5507 0	42 95	0 038	32 79	3402 0	56 61	0 043	12.63	61.78	81.43
17	5470 0	44 54	0.035	30 75	2982 0	57 99	0 042	11.78	54 52	70 97
18	3778 0	48.39	0.029	25 32	2133.0	59 57	0 034	9 42	56.46	69 51
19	3396 0	43.58	0.033	31 12	2403 0	58 42	0 045	10.64	70 76	94 85
20	3720 0	46.47	0.035	29 17	2416 0	57 80	0 046	10.94	64.95	80 78
21	880 0	44 48	0.026	29 62	528.0	57 39	0 038	10.42	70 46	90 92
22	2930 0	45 15	0.020	36 21	1989 0	57 24	0 036	8.92	60 11	86 09
23	4539 0	45.78	0.029	28.00	3068 0	58.08	0 037	10.23	67 59	85 75
24	5254 0	48 87	0 035	25 00	3050 0	58 55	0 041	9 21	58 05	69 56
25	7212 0	48 10	0.031	24 86	4928 0	58 74	0 038	9.50	68.33	63.44
26	7559 0	47.18	0 034	26 59	5387.0	59 98	0 041	8 46	71 27	90 60
27	6877 0	47.25	0.034	26 85	4606 0	59 77	0 042	8.84	66.98	84 73
28	2333 0	49.14	0 032	24 11	1549 0	59 23	0 042	9 52	66 40	80.03
29	4669 0	48.17	0.037	26 04	3330 0	60 41	0 046	8 56	71.32	89 45
30	5240.0	49 44	0.038	23 91	3711 0	60 78	0.044	7.72	70 82	87 06
31	3752.0	43 77	0 033	31 24	2533 0	59.01	0.041	9.54	67.51	91.02

	Tons	Per Cent. Fe Dried	Per Cent. Natural Fe	Per Cent. P	Per Cent. Mn	Per Cent. SiO₂	Per Cent. Al	Per Cent. H₂O
Crude ore washed.	140,228	46 62	43.34	0.034	0 16	25.54	0.88	7.02
Concentrates recovered.. .. .	88,552	58.89	54 59	0 041	0.17	9.79	0.75	7.30

Weight of concentrate to crude ore washed, 67.80%.
Extraction of iron in ore, 78.46%.

TABLE II. DELAY SHEET USED AT IRON-ORE WASHERY

Name of Plant... .... Month of July, 1918.................................

CAUSE OF DELAYS

Date	Crude Ore Day H.	Crude Ore Day M.	Crude Ore Month H.	Crude Ore Month M.	Crude Ore Season H.	Crude Ore Season M.	R.R. Cars Day H.	R.R. Cars Day M.	R.R. Cars Month H.	R.R. Cars Month M.	R.R. Cars Season H.	R.R. Cars Season M.	Plant Day H.	Plant Day M.	Plant Month H.	Plant Month M.	Plant Season H	Plant Season M.	Power Day H.	Power Day M.	Power Month H.	Power Month M.	Power Season H.	Power Season M.
1	..	..	..	..	.	..	5	45	5	45	.	.	5	.	5		100	40	.	..	..	..	..	
2	..	30	..	30	61	45	3	55	9	40	106	30	2	50	7	50	103	30	2	.	2	..	46	05
3	3	10	3	40	64	55	..	.	..	..	..	.	..	35	8	25	104	05	.	..		..	..	.
4	.	.	..	.	.	..	..	.	..	.	.	..			..				..	..	.	..	.	.
5	1	30	5	10	66	25	..	45	10	25	107	15	1	..	9	25	105	05	..	..	..	..		..
6	..	40	5	50	67	05	5	50	16	15	113	05	1	45	11	10	106	50	..	..		..		
7	..	..	..	..	..	.	1	25	17	40	114	30	8	35	19	45	115	50	..	..				
8	..	..	..	..	.		4	10	21	50	118	40	.	50	20	35	116	15	..	20	2	20	46	25
9	1	05	6	55	68	10	5	35	27	25	124	15	1		21	35	117	15	..	.				
10	..	50	7	45	69	..	.		.	..	..	..	2	..	23	35	119	15	..	.				
11	..	.	..	..		..	6	20	33	45	130	15	1	55	25	30	121	10	..	.				..
12	..	10	7	55	69	10	..	..	..	..	..	.	4	50	30	20	126	.	3	55	6	15	50	20
13	..	..	..	..	.	..	1	25	35	10	132	.		..					..	10	6	25	50	30
14	..	..	..	..	..	..	..	.			.	.												
15	..	..	..	..	..	..	..	..	..	.	..	..	1	15	31	35	127	15	1	55	8	20	52	25
16	..		..	..	.	..	1	30	36	40	133	30		45	32	20	128		..	25	8	45	52	50
17	..	20	8	15	69	30		55	37	35	134	25	1	10	33	30	129	10	..	15	9		53	05
18	..	20	8	35	69	50	3	30	41	05	137	55	2	.	35	30	131	10	..				.	
19	.	10	8	45	70	..	2	15	43	20	140	10	..	20	35	50	131	30	..	..	..	..	..	
20	1	40	10	15	71	40		15	43	35	140	25		40	36	30	132	10	..					
21	1	55	12	10	73	35	.						2	50	39	20	135		6	15	15	15	59	20
22	..	35	12	45	74	10	3	05	46	40	143	30		40	40		135	40	..	.	..	..	..	
23	..	35	13	20	74	45	1	40	48	20	145	10	1	40	41	40	137	20	..	..	..	..	.	..
24	..	..		..	..	.	2	05	50	25	147	15	2	40	44	20	140		..	..	..	..	..	..
25	..	45	14	05	75	30	.	.		.			.	15	44	35	140	15	..	..	..	..	..	..
26	1	10	15	15	76	40	2	55	53	20	150	10	..	40	45	15	140	55	..	..	..	..	..	..
27	..	30	15	45	77	10	2	50	56	10	153	.	2	10					..	..	..	..	..	..
28	1	55	17	40	79	05	3	30	59	40	156	30	2	10	47	25	143	05	..	..	..	..	..	..
29	.	..	.	.		..	..	..	..			.	6	05	53	30	149	10	..	..	..	..	..	..
30		30	18	10	79	35	.	.	..	.		.	4		57	30	153	10	..	..	..	..	..	..
31			..	.			24	..	83	40	180	30	3	10	60	40	156	20	..	..	..	..	..	..
Total	13	10	18	10	79	35	83	40	83	40	180	40	60	40	60	40	156	20	15	15	15	15	59	20

and season. The figures on this particular sheet represent the delays during three months of operation. The power delays were higher than they should be, due to poor installations at the transformer house. Loss of time represents a big item in tonnage equivalent, and in the plant I have mentioned each 15 min. of delay represents a decrease of one car of concentrates (45 tons) in production. If the delays for the three months could have been cut down 50%, the result would have been to increase the capacity of the plant by 10 carloads, or 450 tons per day. The time lost in delays was 22% of the total operating time, of which 12% was due to the hindrances in not supplying crude ore to the plant, and to plant stoppages. The remaining 10% was caused by lack of ample supply of railroad cars and by shutdowns, resulting from electric-power troubles. The delay figures appear unusually large, yet records from another plant show 30% of the total time was consumed in delays, of which 17% was charged to crude ore and plant, and the remaining 13% to outside trouble. However, this was a new plant, which experienced considerable trouble in getting started. Another plant reports 20% delay, of which 11% was attributable to crude ore and plant, and only 9% to outside troubles.

GENERAL VIEW OF QUINN-HARRISON MINE, NASHWAUK, MINN., SHOWING BANKS OF WASH ORE

The flow sheet reproduced in Fig. 4 is a possible treatment scheme for ores that show by a screen analysis that a commercial concentration can be made. I have not attempted to give the exact size screens that should be used, but have given the approximate size openings and the percentage of total material that each would necessarily have to handle.

The curve shown in Fig. 5 represents the average analysis of a number of samples taken from different mines, and indicates that all oversize on a 40-mesh screen will analyze approximately 56.82% dried iron, and 11.75% silica, which is a good grade of concentrate. Considering this, it would appear that a plant constructed after such a screen flow sheet would be satisfactory, but it is doubtful whether any operating company on the iron ranges would look with favor on such a radical change. In making up the flow sheet in Fig. 4, I have carried out the screen idea down to the ¼-in. size. Instead of using four 18-ft. logs, such as were used to handle the fine material passing through the chip screen, I have shown two 25-ft. logs only. In the present plants a study of the 25-ft. logs shows that they will handle from 50 to 60% of the total concentrates. This product will contain from 60 to 75% of the concentrate that screens between 20 mesh and 100 mesh. In other words, the 25-ft. logs show a good recovery on the larger percentage of the fines. For treating the remaining fines or tailings from the 25-ft. logs, which represent from 40 to 48% of the total crude ore, I have placed a series of eight classifiers following each 25-ft. log. One or two spigots could be drawn off and each following spigot treated on a separate table.

There is not much material difference in the headroom required for either plant. There is, however, a difference in the cost, and this is due largely to the fact that the flow sheet in Fig. 1 requires more machinery than the plant represented by the flow sheet in Fig. 4. The first plant has four 18-ft. logs, two chip trommels and 12 double-deck tables, and this equipment in the latter is replaced by two screens (⅜-in. and ¼-in.) one 25-ft. log, sixteen 6-in. classifiers and two single-deck tables.

For small ore deposits where the installation would not warrant a standard ½-unit plant, another ¼-in. screen could be added below screen No. 3 in the flow sheet in Fig. 4, and this can be followed by classifiers and tables. There are a number of small wash deposits on the Mesabi range that can be treated profitably by means of such an installation.

In the matter of costs, at one plant crude ore was treated for 5¾c. per ton, the cost including operating, repairs, and office expenses, but not depreciation. Another one-unit plant, exclusive of depreciation, shows the highest cost per month for one season to be 9.41c. per ton of concentrates. In making estimates on probable costs per ton, including depreciation (which is determined by the tonnage of ore to be treated), it should not run over 15c. per ton of concentrate, or 9¾c. per ton of crude ore.

Copper-Schist Deposits of Arizona

By Theo. H. M. Crampton*

Considerable activity is to be noted in the development of certain copper-schist deposits in Arizona situated along what is known as the "schist belt." Some years ago attention was called to the porphyry-copper deposits, which were exploited and found to be far more extensive than had been thought. Today more attention is being paid to the schist deposits, and their development is opening up new and extensive reserves of copper.

The United Verde copper mine was one of the first of the schist deposits to be extensively exploited. The so-called schist belt in Arizona, as previously described, can be traced from central Arizona to the southeastern part of the state and conforms roughly to the trend of the Bradshaw Mountains. At Jerome the schist is prominent and plays an important part in the deposits of the district. Many important mines, which include the Blue Belle, Arizona-Binghamton, De Soto, Swastika and others typical of the copper-schist deposits, are situated at Mayer.

E LIGHT AND DARK LAYERS SHOW, RESPECTIVELY, THE SAND AND HIGH-GRADE ORE STRATA

The schist in the vicinity of Mayer, and the associated copper deposits, were considered of local occurrence, but this opinion has been refuted in the last few years, as the schist belt has been proved to extend further to the southeast, and to correspond to formations at Miami and Ray, indicating that the schist of the Bradshaw Mountains may be correlated to the Pinal schist occurring at these two places.

At Cañon, a stage station at the mouth of Black Cañon, and on the main road from Mayer to Phoenix, is situated the Kay copper mine and also the Orizaba copper mine. These mines are wholly within the schist, and deposits are typical of this class. Further to the south are to be found deposits of copper in the schist, in the vicinity of Cave Creek. The Pinal schist becomes prominent a little further to the southeast and forms an important part of the deposits around Miami and Ray.

The Pinal schist is practically continuous between Ray and Miami. The Gibson mine is within the schist belt to the south of Miami, and the Cole-Goodwin mine, about half way between Ray and Miami, is typical of the copper-schist deposits. Most of the copper mines convenient to transportation have received attention during the period of high prices of copper which recently prevailed. These mines have produced to such an extent that their reserves have been affected, and it is not surprising to note the development of deposits which in the past have not had the advantage of cheap transportation. The Orizaba and the Kay mines, at Cañon, have reached such a state of development that it is possible that a railroad may be built into the district. The same can be said of the country to the south of Miami and to the east of Ray, where the development of the Cole-Goodwin mine has attracted attention.

On the surface the copper-schist deposits in Arizona are leached, due to the porous nature of the formation in which they occur. The surface indications are in many cases far from attractive. The leaching action at many of the properties has been extensive, and considerable depth had to be attained before the secondary enrichments were encountered or the primary ores were found in place. The depth to which the leached zone reaches has retarded this class of deposit, but depth has proved that the copper deposits within the belt are generally of sufficient extent to warrant extensive exploitation. The copper-schist deposits are invariably accompanied by diabase intrusions, and occur along major fault and shear zones. The strike of the faults does not usually conform to the direction of schistosity.

The characteristic ores of the Arizona copper-schist belt are sulphides, with a gangue of quartz, calcite, and sericitic schist, which combination makes them suitable to gravity concentration, or to concentration by flotation. They do not show to any great extent the carbonates which appear in the porphyry-copper deposits. The metallurgical difficulties met in the treatment of the porphyry-copper ores are not encountered in the treatment of the copper-schist ores.

---

*Mining engineer, 1501 West Monroe St., Phoenix, Arizona.

Heavy Drilling at Sacramento Hill[*]

By ROBERT T. BANKS[†]

The operation of stripping the overburden from Sacramento Hill is a difficult undertaking, inasmuch as it requires the removal of solid rock capping. The method adopted provides for a series of benches, which are operated simultaneously, steam shovels being used to load the rock into cars after it has been drilled and blasted. In drilling the overburden, churn-drill holes are first put down from the various benches and blasted. Supplementary work, consisting of flat holes drilled by means of piston drills and blasted, serves to reduce the rock to such size that it may be handled by steam shovels.

SYSTEMATIC prospect drilling on Sacramento Hill, at Bisbee, Ariz., by the Copper Queen branch of the Phelps Dodge Corporation has developed orebodies estimated to contain about 15,000,000 tons of copper ore averaging more than 1½% copper. The ore occurs in two bodies, known as the east and the west, which are separated by a comparatively barren strip of ground from 400 to 500 ft. wide. The west orebody, which is to be mined first, is accurately defined, and it is estimated that subsequent mining will produce over 6,000,000 tons of ore. Drilling is still in progress on the east orebody, but sufficient exploration has been done to assure a mine production of over 10,000,000 tons of ore. The west orebody averages over 2% in copper content; that of the east body is lower.

A BLAST ON SACRAMENTO HILL, BISBEE, ARIZONA
Firing four churn-drill holes and 12 toe holes by electricity

Sacramento Hill, the most prominent physical and geological feature of the Warren district, is a massive granite porphyry stock. Around its southern base, in a semicircle, are grouped the mines of the Copper Queen and the Calumet and Arizona companies. The hill itself, with reference to the newly developed orebodies, is a capping of overburden or waste, and a large part of the hill must be removed before mining operations can begin. The stripping operations on the west orebody will include the removal of approximately 15,000,000 tons of waste, and the completion of this work will require about two years, so that the undertaking is necessarily an expensive one. Every ton of waste is solid rock, which must be drilled and blasted before it can be handled by the steam shovels.

Bench Method of Excavation

To carry on stripping operations, the hill has been laid off in a series of benches. The lower or machine-shop bench is immediately over the orebody, and three benches above this are 60 ft. apart vertically. Each bench is provided with its own steam shovel and trackage system, and the broken waste is placed on 20-ton side-dump, standard-gage cars. Because of the heavy grades required to reach the dumping ground, four cars constitute a train, which is drawn by an oil-burning locomotive.

Both churn drills and tripod drills are used in the rock-breaking operations. From the bench above, 60-ft. churn-drill holes are put down. These are first "sprung," then loaded and fired by electricity. To relieve the churn-drill holes, 22-ft. flat holes are drilled at the base of the bench by means of tripod drills. These also are

---

[*] From *Mine and Quarry* for March, 1919.

[†] Mining engineer, Mills Bldg., El Paso, Texas.

"sprung" first and then each hole is loaded with two to three boxes of dynamite. Because of extremely variable rock conditions, no set rule can be applied to the spacing of churn-drill holes. It is simply a case of "the harder the ground, the closer the holes and the heavier the charge."

Piston Drills Used in Drilling Toe Holes

After experimenting with several types of drills on the "toe-hole" work, including heavy piston machines and the hammer type with independent rotation, the Sullivan "Hyspeed" piston drill with 3¼-in. cylinder diameter was selected, and is now used exclusively for this work. These drills have seen extremely hard service, and their operation has been most satisfactory and efficient.

The air for the piston drills is supplied from the Copper Queen power plant. Each machine's crew consists of a Mexican runner and helper. Toe holes are spaced approximately 6 ft. apart when drilled in hard ground and from 8 to 15 ft. apart in the medium and broken ground. All holes are drilled nearly flat, with just enough down pitch to permit water to run into the hole. Solid steel with a crossbit is used, and blow pipes are employed to help clean the holes.

EXCAVATING FOR CONCENTRATOR NEAR SACRAMENTO HILL

Rock Structure Makes Drilling Difficult

In many places extremely difficult drilling ground has been encountered, the rock being unusually hard and at the same time "fitchery" and "cavey." Consequently, many holes, after reaching a depth of 15 ft. or more, caved behind the bit, making recovery of the latter difficult. The extremely variable ground has made the keeping of accurate drilling records impracticable, but in hard ground one 22-ft. hole is considered a shift's work for a runner and helper. When drilling conditions are reasonably good a crew will drill two of the 22-ft. holes in a shift. All machines are mounted on heavy tripods, and as the ground is usually rough and covered with boulders, considerable time is consumed in setting up and moving.

New Millsite Being Cleared

Coincident with the stripping operations on Sacramento Hill, the Copper Queen company is preparing a millsite for the erection of a 4000-ton concentrator, the work being so planned that the concentrator will be finished about the time the stripping operations over the west orebody are completed. A small test mill has been in operation for some time, and satisfactory results have been obtained by the use of the latest practices in gravity concentration and flotation.

A millsite has been selected on the southern slope of the Mule Mountains, facing the international border, about two miles south of the Sacramento Hill operations and ½ mile southwest of Warren. Ample tailings storage is provided for on the sloping mesa to the south. In preparing the terraces for the mill floors, extremely hard, close-grained quartzite and limestone were encountered almost at the surface. Sullivan "DP-33" hollow-piston rotators were selected for drilling operations in this connection, the air being supplied through a 5-in. air line from the Copper Queen power plant. Sixteen of the Sullivan rotators have been in constant use since this work started. Hollow hexagon rotator steel, with a crossbit, is used, and holes are drilled from 4 to 6 ft. deep. The drill steel is sharpened at the Copper Queen central shop.

The management has been exceptionally careful in considering the safety of the workmen at the millsite. In blasting, it has been found good practice to fire from 200 to 300 holes at a time, giving the workmen ample opportunity to get out of range of flying rock. It is worthy of note that only one man has been injured on the works, and this injury consisted of a slight scalp cut. This is probably a record, inasmuch as the work on the millsite has been in progress more than six months and no fewer than 125 men are employed.

Stripping operations on Sacramento Hill and the work on the concentrator are in capable hands, as is customary in the Phelps Dodge organization. To these officials acknowledgment is tendered for their courtesy and assistance in securing the photographs and the above information.

A New Composite Fuel

The executive committee of the Submarine Defence Association has authorized the release of a statement concerning the new fuel developed under its auspices since the United States entered the war. The assistance of the U. S. Navy Department was extended, and constant facilities were thus provided for working tests of the fuel at sea.

In 1917 and 1918 the situation in England, France, and Italy was so serious as to threaten a possible paralysis of naval movements. The emergency mobility of the Grand Fleet that stood watch and ward through nearly four and a half years of sea guardianship depended on oil fuel, yet the liquid fuel supply was put in constant jeopardy by submarines. In 1918 the British Admiralty widely advertised a reward for a means of mixing oil and coal tar for naval fuel use. Out of persistent peril and menace grew the renewed search for a mixed fuel in the United States. With the assurance that ample liquid fuel reserves could be made available within the borders of England, would come the certainty that no submarine successes could be won which would keep the Allied fleets from the exercise of the sea power which would make victory on land ultimately certain. Lindon W. Bates has had the personal direction of the development of an oil-and-coal composite which has now been fully tested and its value demonstrated. The problem, it is maintained, has been solved.

In making an oil-and-coal composite an insuperable difficulty heretofore has been the persistent settling out or sedimentation of the heavy coal and tar particles. This destroyed the value and utility of all mechanical mixtures. Today it is possible to suspend for months in oil 30% to 40% of coal, pulverized so that about 95% passes through a 200-mesh screen, assisting the suspension with a special fixateur. It is now possible to combine in a stable liquid fuel about 45% oil, 20% tar and 35% pulverized coal, thereby replacing over one-half of the oil, securing equal or greater heat values per barrel and saving considerable cost.

Pulverized coal burned alone cannot in many cases replace oil. Especially is this true on shipboard. Radical changes in oil-burning installations become necessary, and its storage requires too much space and thus limits the cruising radius of war vessels. The new fuel has received thorough investigation on land and sea. The vessel assigned by the U. S. Navy Department for experimental and demonstration purposes was equipped with Normand boilers. With practically no changes in the oil-burning equipment, the new composite fuel has been burned and stored for months on this ship. Trials in Long Island Sound have been made, and for land use a fuel plant has been installed at one of the large refineries, and results confirm all claims.

Pulverized coal can now be successfully held in suspension so that the liquid flows freely through the pipes, preheaters, and burners of ships, and power, heating, and industrial plants equipped to burn fuel oil. Months after mixing, the composites show little or no deposit. A fixateur, which comprises about 1%, or 20 lb., per ton, acts to stabilize the particles of pulverized coal dispersed in the oil. The fixateur and fixated oil are readily made and may be shipped anywhere. The manufacture or distribution of the new fuels incorporating solid carbons in fixated oils involves no doubtful process or industrial problem. On burning, the combustion is so complete that with fair coal there is left no slag and little ash, what there is being light as pumice and granular as sand.

Each locality may have its special composite containing the cheapest available coal, oil, and other ingredients. Each duty will be best accomplished by a brand to some determined specification. Ships may thus obtain the cheapest liquid fuel in any port. Land plants and railroads may buy from refineries any grade of the new fuel they desire to the prescription wanted, or they may obtain the appropriate fixated oil and make the final composite themselves as and when required. No change in the oil-storage or oil-burning equipment is necessary.

A demonstration test unit, to manufacture and use the new fuel on land, is installed in Brooklyn. The fuel made is burned for power purposes in the works. In addition to those taken on the naval vessel, precise evaporative and efficiency tests have been made according to the rules prescribed by the Codes of 1915 issued by the American Society of Mechanical Engineers. It is now to be tested at several steel-making plants.

Fuel made with pressure-still residuals—oil, wax tailings, crude-oil coke—is another gratifying success. These residuals are the cinderella products of refining. Liquid fuel so made may add many millions of barrels in this country to each year's stock of available fuel oil without increase of oil-well production or strain on rail or sea transport. From these residuals, a fuel is prepared so low in sulphur that it will command a premium because valuable in making higher-grade alloy-steel.

As world wants exist and grow, a serious scarcity of oil may develop. There are five things only that may be done to meet this:

1. Increase the production of oil.
2. Save waste.
3. Diminish use.
4. Conserve the oil supply by incorporating coal to make the new fuel.
5. Augment the supply of fluid fuel by finding new sources in tar and pressure-still oil and fluidized coal.

These last two means are accomplished by the new fuel. Shortages may be obviated thereby, not alone without industrial hardships, but in most cases with less cost, and the steel products will have higher tensile strength and better qualities.

Heretofore dependence has been placed exclusively on three classes of fuel:

1. Fuels solid at ordinary temperatures, including coal and derivatives—brown, lignite, bituminous, anthracite, and cannel coals, coke and pitch, vegetable growths and derivatives, like charcoal, pitch, and sawdust; petroleum-asphalts and allied solid substances.
2. Fuels liquid at ordinary temperatures, including petroleum and derivatives, principally "fuel oils"; liquid derivatives of the distillations by various processes of coal and woods, asphalts and allied substances into light oils, middle fraction oils and tars; alcohol and similar substances; vegetable oils, animal oils, and molasses.
3. Gaseous fuels, either artificial or natural.

Of the liquid class practically only "fuel oils," tars, and alcohol are used for heat and power production—alcohols and animal and vegetable oils only for small domestic purposes—and molasses as an emergency fuel in sugar making.

To these three classes may now be added a fourth—the composite fuel, uniting the solid and the liquid and consisting of synthetic fuels in three sub-classes—liquid composite fuels; mobile composite fuels; and solid composite fuels.

To produce the new fuels it is necessary to adopt certain processes modified to suit the blend or grade desired; and certain fixateurs, primarily to stabilize synthetic fuels the separate elements of which are of different specific gravities and characters, so that the finished products have each a homogeneous and definite nature.

Rgarding the nature of the fixateurs and special incorporation and treatment process, it will suffice to say that the fixateurs and treatments produce a state in which the settling force of gravity is overcome. Certain substances are also incorporated during the main process or when forming the fixateur, which is itself incorporated. Some of these may remain in the composite fuel product in whole or part, or, having performed their duty, may be distilled and recovered, and so used again and again.

An Improvement in the Method of Manufacturing Cyanide has been patented in England. Iron carbonyl is used as a means of effectively producing and distributing the iron catalyst in the reaction mass, in the case where cyanide is manufactured by the reaction of an alkali metal or salt, carbon and introgen. One application of the invention involves the introduction of the iron carbonyl as a vapor.

Army Gas Masks in Sulphur-Dioxide Atmospheres*

By A. C. FIELDNER and S. H. KATZ

The use of toxic gases in warfare has led to the development of a new type of mask, which promises to fill a long-felt want in the chemical and metallurgical industries. Heretofore, workmen around plants using processes in which acid fumes are given off made shift to protect themselves, in a more or less inadequate manner, by wearing moistened handkerchiefs, or respirators containing wet sponges, over the mouth and nose. The close of the war now makes available the Army-type gas mask, which is admirably adapted to filtering out many chemical fumes and acid vapors from inspired air, provided the concentration of gas is less than 1 or 2 per cent.

THE possibility of using Army masks around smelteries and sulphide roasters for protecting the workmen from sulphur-dioxide fumes was suggested, almost a year ago, by George S. Rice, of the Bureau of Mines, and at his request several patterns of Army masks were tested in various concentrations of sulphur dioxide to determine the degree of protection afforded.

Sulphur dioxide is an irritating, irrespirable gas, relatively non-toxic as compared to carbon monoxide or oxides of nitrogen. There is little danger from sulphur-dioxide poisoning, because the fumes are so irritating that the victim is compelled to seek air at once. In extreme cases[1] of high concentrations, when the victim cannot retire from the fumes, death may result from respiratory spasms and asphyxia. Ordinarily, however, workmen exposed for some time to a mild degree of sulphur-dioxide poisoning complain of headache, anorexia, spasmodic cough, sneezing, hernoptysis, bronchitis, constriction of chest, gastro-intestinal disorders, conjunctivitis, smarting of eyes, lachrymation, and anemia. For these symptoms workmen soon acquire toleration. The inhalation of large quantities of sulphur dioxide produces ulceration of the mucous membrane.

The Selby Smelter Commission[2] made a thorough investigation of the effect of various concentrations of sulphur dioxide on the senses of a number of persons. The average results of these tests were:

Physiological Effect of Various Concentrations of Sulphur Dioxide

Three to five parts per million (by volume): Plainly or faintly detectable by smell or taste.

Eight to twelve parts per million (by volume): Slight throat irritation and tendency to cough.

Twenty parts per million (by volume): Very distinct throat irritation, coughing, constriction of chest, lacrymation, and smarting of eyes.

Fifty parts per million (by volume): More pronounced irritation of eyes, throat and chest, but possible to breathe several minutes.

One hundred and fifty parts per million (by volume): Extremely disagreeable, but could be endured for several minutes.

Five hundred parts per million (by volume): So acutely pungent as to cause a sensation of suffocation, even with the first breath.

With no concentrations of less than 50 parts per million was there produced any feeling of nausea, and the tendency to nausea with the highest concentrations was only slight. Experiments made independently disclosed substantially the same results and indicated that 370 parts per million (0.037%) could be endured for only one-half minute.

Mouthpiece Type U. S. Army Mask

The standard U. S. Army gas mask of the mouthpiece type is shown herewith. It consists essentially of a facepiece of rubberized fabric, impermeable to gas, connected by a short length of flexible rubberized tubing to a canister containing the absorbents. The wearer breathes through a rubber mouthpiece, the nose being closed by a spring clip, mounted on the inside of the mask. Leakage through the facepiece will affect only the eyes of the wearer, as the gas cannot enter the lungs. The inhaled air enters the bottom of the canister through a disk valve that closes on exhalation; the expired air passes out through a rubber flutter valve, projecting downward from the metal elbow tube just outside the facepiece.

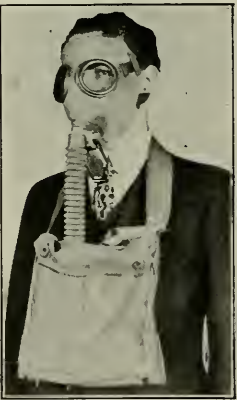


FIG. 1. U. S. ARMY GAS MASK, MOUTHPIECE TYPE

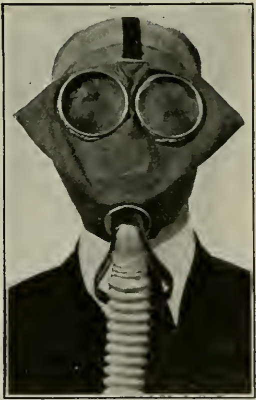


FIG. 3. TISSOT-TYPE GAS MASK

The Type "F" standard Army canister, shown in section in Fig. 2, is 5½ in. high and contains 42 cu.in. of a mixture of coconut charcoal and "purple" soda lime, and two cotton wadding filter pads, placed at one-third and two-thirds distance from the bottom, respectively. One of us, wearing this outfit, entered the gas chamber containing a concentration of 0.46% sulphur and remained one hour, without detecting any gas whatever, except on one occasion, when the mask was disarranged, and then sulphur dioxide penetrated to and irritated the eyes. On adjusting the mask and clearing the facepiece, the gas disappeared, and no discomfort whatever was experienced thereafter from that source. During a part of the time, work was done on a bicycle dynamotor.

---

*Published by permission of the Director, Bureau of Mines.

[1] Thompson D. Gilman, M. D., "The Occupational Diseases." D. Appleton & Co., New York, 1914, p. 360.

[2] Holmes, J. A., Franklin, E. C., and Gold, R. A., Report of the Selby Smelter Commission, Bureau of Mines, *Bull.* 98, pp. 172-175.

More sulphur was then burned, until a fog was produced in which objects could not be distinguished at distances beyond 4 ft. Analyses showed that the concentration was 1.17% sulphur dioxide. No discomfort of any kind could be felt by the wearer, other than that due to the mask itself.

LIFE OF CANISTERS IN HIGH CONCENTRATIONS

Tests were made to determine the life of the standard Type "F" Army canister in an atmosphere containing 5% sulphur dioxide. The gas was put up in the chamber from a cylinder of liquid sulphur dioxide, attached to the chamber. Analyses of the chamber gas were made by drawing two liters of gas through a standard iodine solution and titrating back with standard sodium-thiosulphate solution. Twenty canisters were tested, in lots of 10 each. The men did not enter the chamber, but were seated on the outside, wearing the facepieces, which were connected to iron pipes that passed through the walls of the chamber. The canisters were attached to the other end of these pipes on the inside of the chamber. As soon as a man detected gas coming through his canister, as shown by throat irritation, the time was taken, and the canister was considered exhausted.

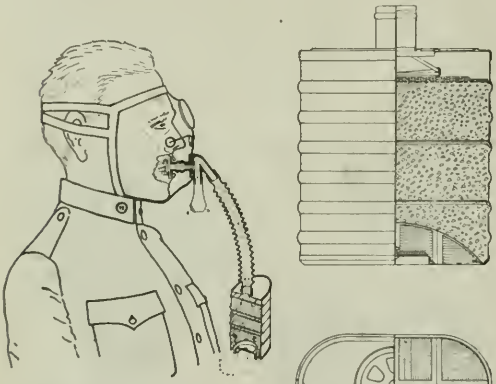


FIG. 2. SECTIONAL DIAGRAMS OF U. S. ARMY GAS MASK AND CANISTER

Tested under these conditions, the 20 canisters served to remove all sulphur dioxide for periods of time varying from 18 to 41 minutes. The average service time was 29 minutes. The large variation in service time for the individual canisters was due, in part, to differences in the canister fillings, but mostly to differences in the breathing rates of the men. Individuals breathe different amounts of air. A small man may breathe only 5 liters per min. when at rest, while a large individual may require 10 or 12 liters. The average rate of a number of men, when at rest, is approximately 8 liters per min. Moderate exercise increases the rate to approximately 30, and vigorous exercise causes a breathing rate of 60 to 70 liters. Hence, the efficient life of a gas mask canister is proportionately less when the wearer is engaged on continuous work.

In making these tests with high percentages (5.07%) of sulphur dioxide, the canisters became warm after 15 minutes' use. A temperature of 80° C. was noted in some of the canisters. This elevated temperature made breathing rather uncomfortable toward the end of the test; however, all the men were able to continue breathing through the canisters until the gas finally penetrated the absorbent.

PRACTICAL TESTS BY ANACONDA COPPER MINING COMPANY

Several Army masks of the mouthpiece type fitted with standard Type "F" canisters, containing soda lime and charcoal mixture with two cotton wadding filter pads, were tested under practical conditions by James Kane Murphy, assistant superintendent of the Washoe reduction works of the Anaconda Copper Mining Co., at Anaconda, Mont. The following paragraphs are quoted from his report:

> On Oct. 23, 24 and 25, we had considerable repair work to do on one of our Cottrell treaters. This treater takes one-quarter of the gas from Roaster No. 2. During the repair work, it was shut off as tight as possible, but there was such a leakage of SO_2 gas that it was impossible for a man to enter the treater to do any work. The iron workers repairing this treater were able, two at a time, to put on these masks, and do their repair work in the treater. The men stayed in about 20 min. at one time; by that time, the heat and dust caused them to come out, but the masks were very satisfactory and work could be done with them by proceeding slowly.
>
> One test on these masks was performed in the No. 2 roaster ventilating tunnels when flotation calcine was drawn into cars ahead of the man with the gas mask on. It is absolutely impossible for a man without a mask to even attempt to stay in this place. Most of the dust coming from the cars, which were being loaded ahead of the man with the gas mask, will pass through 200 mesh, but none of the men wearing a mask in this place had any trouble with dust.
>
> A third mask was tested in a high concentration of gas. The mask was carefully adjusted about the face, and the person making the test was in an atmosphere containing about 5% SO_2. E. A. Bernard, superintendent of calcining, personally put the mask on in this atmosphere, beside two other men. All decided that the gas came through the canister. This test was made on gas from the top hearth of an Anaconda-type roaster furnace. The hearths on this furnace are similar to a Wedge roasting furnace. A steady wind was blowing against the east side of the furnace, so all doors on the top floor were opened, thus forcing a considerable proportion of the furnace gases out of the west doors. The testers stood as close as possible to the doors through which the gas came. This gas contains some SO_3, much moisture, dust, and some As_2O_3, besides the SO_2.

This indicates that the simple Army gas mask is exceedingly valuable around sulphide roasters, and, in fact, in any operation in which sulphur dioxide is given off. The third test in which gas penetrated the canister illustrates the limitation of this type of protective appliance. It must not be used in too high a concentration of gas. In this case, the percentage of SO was probably higher than 5%, as tests at the American University Experiment Station of the Chemical Warfare Service have shown that the standard Army canister will remove 5% of sulphur dioxide for at least fifteen minutes.

SPECIAL CANISTER FILLING FOR SULPHUR DIOXIDE

The standard Army canister contains 40% soda lime and 60% charcoal. The charcoal is of less value in absorbing sulphur dioxide than soda lime. Hence, for use in sulphur dioxide and dust an all soda-lime canister with cotton-wadding filter pads will last from 50 to 100% longer than the standard canisters used in the Anaconda tests. This is shown in the comparative canister tests with different fillings against 0.5 per cent.

The life or service time of the canister is the time in minutes during which all traces of SO_2 are absorbed by the canister. The breakdown of the canister is shown by the change in color of a sensitive potassium iodide-starch solution through which the effluent air from the canister is bubbling during the test.

The standard Army canister described in the foregoing tests contains 42 cu.in. of absorbent, weighs 1⅝ lb. and has a resistance to flow of 3½ to 4 in. water column at 85 liters per min. flow. This high resistance obliges men to work rather slowly while wearing the mask. A second disadvantage to which Mr. Murphy has called special attention is the short service time of the absorbent. Both of these defects can easily be remedied by increasing the cross-sectional area of the canister without at the same time increasing the height in proportion.

Recommended Type Includes Tissot Gas Mask and Large Canister

Although the mouthpiece type of mask was found fairly satisfactory in practical use, it is believed that the later type of Tissot mask, Fig. 3, in combination with a 100 cu.in. soda-lime canister, will prove the best outfit for exclusive use in sulphur-dioxide and acid gases. The elimination of mouthpiece and nose clip increases the comfort materially, and enables the wearer to keep it on for hours at a time. The large eyepieces, held rigidly in proper position by the well-fitting substantial facepiece, afford a large angle of vision, thereby greatly increasing the efficiency of the workman wearing the mask. He should be able to do substantially the same amount of work as without the mask in a normal atmosphere.

Aside from the many metallurgical operations in which sulphur dioxide is given off, a respirator or gas mask designed for this purpose should be useful in sulphite-pulp and paper mills, in sulphuric-acid plants, and, in fact, for protection against any acid gas such as chlorine, phosgene, carbon dioxide, hydrocyanic acid, oxides of nitrogen and hydrochloric acid.

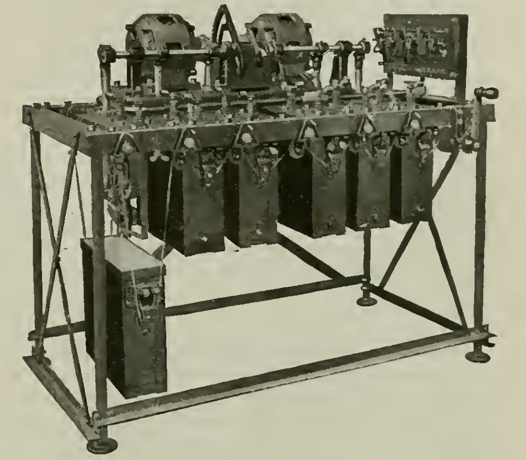
Gas Masks Limited to Low Concentrations and Situations Where Oxygen Content Is High

In closing this paper, we feel it necessary to issue an emphatic warning against the indiscriminate use of gas masks for any and all purposes. The soldiers in the Army have been taught that their gas mask will protect them absolutely against any gas the enemy may put up. These men, on returning to civil pursuits, carry this idea with them. They will not realize that the extremely poisonous gases used in warfare are chemically active, and, therefore, combine readily with the absorbents of the gas mask. Furthermore, outdoor gas concentrations seldom exceed a few hundredths of 1%. Some of the gases which are successfully absorbed by the mask at these battlefield concentrations will immediately penetrate it when present in quantities of 1 or 2%. In fact, the Army gas mask is useless against many of the most common industrial gases, as, for example, carbon monoxide, ammonia, natural gas, producer and blast-furnace gas, mine gases, coal and water gas, and probably any gas when occurring in concentrations exceding 5%. In such cases the self-contained oxygen breathing apparatus must be used, as the gas mask does not supply any oxygen whatever. In view of these limitations, the gas mask should be used only with the advice of an expert who has a thorough understanding of the limitations of the apparatus.

Reversing Switch for Hoist Motors

High-voltage slip-ring motors built for mine hoists require some form of switch to connect the primary winding to the lines, especially when the motor is used for reversing service. The accompanying illustration shows a new primary oil reverse switch which consists principally of two three-pole switch units, each operated by a high-torque motor.

Among the distinctive features of this switch are the unit-tank construction and the means of lowering the tanks for inspection, repairs, and renewal of oil. Unit-tank construction is used because it increases accessibility, and saves time and labor in identifying the causes of operating irregularities and making repairs. A double windlass with cables and pulleys permits easy lowering of one or more tanks. The rupture takes place near the top of the oil, so that it is well away from all sediment; and frequent inspections and renewals are unnecessary. The support for the stationary and movable members is bolted to a channel iron, which, in turn, is bolted to the main frame. In case of serious damage to any single-pole unit, the complete unit may be removed without disturbing any of the others. The tanks are lined with a heavy asbestos material, to prevent groundings of any live parts if the tank should be pushed out of place, and also as an additional safeguard in case of sludging of the oil.



PRIMARY OIL REVERSING SWITCH OPERATED BY TWO HIGH-TORQUE MOTORS

The contactor panel shown at the extreme right is controlled from a master switch or push buttons, and handles the motor currents. Little current is required, as the motors used have high-resistance rotors. The reversing switch shown was made by the Cutler-Hammer Manufacturing Co., of Milwaukee, for a 1200-hp. 200-volt mine-hoist motor. It may be used for two motors on non-reversing service, or, where only one non-reversing motor is required, the switch is made with only one three-pole unit and one motor.

"We All Like the Man who sticks through thick and thin." —(Lincoln). Sure! Our men didn't quit even when trapped in the Forest of Argonne. Will you, safe in America, quit in the midst of finishing up your job? Answer with Thrift and War Savings Stamps.

Colloid State From the Electrical Standpoint[*]

By W. C. McC. Lewis

As the author of this paper points out, the importance of colloidal chemistry in many problems in hydro- and electro-metallurgy is not realized to the extent that it should be. Many of the so-called proper working conditions aim at the elimination or reduction to a minimum of colloidal interference; or, on the other hand, require the isolation of material in the colloid state. There are, unfortunately, few general ideas which will serve to coördinate the various phenomena met in colloidal chemistry. Owing to lack of space, we are unable to do more than abstract a few details of one of the various problems which are discussed in an interesting and informing paper.

COLLOID chemistry as a science is in a relatively rudimentary state, somewhat in the same condition, in fact, in which the chemistry of solutions of crystalloids stood over 30 years ago, prior to the work of van't Hoff, Arrhenius, and their successors. There are relatively few broad inclusive principles. Information about colloidal systems is disjointed, and phenomena are encountered which cannot be explained.

From the scientific standpoint the chief problems of colloid chemistry are: The conditions which make for the stability of a colloid system. How are stability and electric charge related to one another? What part does the Brownian movement play in this state of stability? Is there such a thing as a stable two-phase system consisting of only two pure substances? What is the mechanism of flocculation? Can flocculation be reversed? Is there anything in common in these phenomena which would lead to a generalization, apart from the specific nature of the material? If specific nature of the material is a determining cause, how can this specific effect be expressed? Is it possible, in fact, to infer from a certain set of observations what the colloid behavior of any given substance will be? How are the effects referred to affected by the presence of other colloids which may act either as stabilizers, peptizers, or coagulants? Is there such a thing as a saturation limit to a colloidal solution? These and other questions readily occur. It is difficult to answer them, however, except in an incomplete manner.

Preferential Ion Adsorption

All are familiar with the electrostatic method of charging a body by friction. The conditions under which this can be effected suggest that it is simply a question of removal of electrons from one surface and their deposition upon the other. Is the electric charge on colloid particles brought about by the same process? An absolutely definite answer cannot be given, but the great bulk of the evidence available points strongly indeed to the conclusion that this is not the case; that, in fact, the charges met in colloid systems are due to preferential adsorption of ions from the surrounding medium. The well-known electrical behavior of albumin, for example, in acid and in alkaline solutions, respectively, is strong evidence for the ion-adsorption view of the origin of the charge on the colloid. Parenthetically, it may be pointed out that if the charge on the albumin sol is due to preferential adsorption of an ion, it should follow that in absolutely neutral solution the albumin particle would not necessarily be uncharged. If, in fact, the hydroxyl ion is preferentially adsorbed, then the point of electric neutrality of the colloid should be found in faintly acid solutions. Information upon this point would be interesting. Whether this effect occurs or not, it is not to be confused with the recent observations of Powis—namely, that coagulation does not coincide exactly with electrical neutrality. This is a new and unexpected result, for which no adequate explanation is as yet forthcoming.

Origin of Charge Due to Ion Adsorption

As further evidence for the adsorption view of the origin of the electric charge, certain other results obtained by Powis on the preparation of colloidal ferric hydroxide may be mentioned. As ordinarily prepared, colloidal ferric hydroxide is positively charged in aqueous solution. It is usually obtained in this form by dialyzing a solution of ferric chloride, the positive charge being attributed to adsorption of ferric ion from the solution, which is relatively rich in this ion. Powis has shown, however, that by allowing a dilute solution of ferric chloride to run slowly into a dilute solution of alkali hydroxide, with constant shaking, a negatively charged colloidal ferric hydroxide can be produced, the charge in this case being attributed to adsorption of the hydroxyl ions. Other evidence in favor of the adsorption view exists.

Certain Colloids Analogous to Electrolytes

In view of the existence of electrolytic colloids such as congo red, the proteins, and like substances, in which it appears that the colloid particle simply functions as an anion, one is led to regard such colloids as analogous to solutions of electrolytes as far as freedom of the positive and negative charges is concerned. But may not this be so in all cases? In this connection brief reference may be made to experiments made by Beans and Eastlack. The results have a direct bearing, at the same time, upon the question as to whether a stable colloid system can be realized with two absolutely pure components, as in the case of a colloidal solution of a metal such as platinum or gold in pure water. At first consideration, and more particularly in view of the mechanical manner in which such solutions can be prepared—namely the well-known Bredig sparking method—such a system appears to consist simply of particles of metal carrying a negative charge in contact with a solvent which is known under ordinary conditions to be chemically inactive toward the metal.

The conditions seem to be the simplest possible in this case. Nevertheless, Beans and Eastlack have succeeded in showing, I think, that the case is not really so simple. They approach the problem from the standpoint of the electrical conductivity which such a system should possess. A preliminary calculation based upon the known size, charge, and mobility of the particles in a colloidal solution of gold in water showed that the specific conductivity of the colloid itself should be of the order 10^{-10} reciprocal ohms. This is only 0.01% of the conductivity of pure water, so that if the colloidal solution consists simply of finely divided metal in suspension in unchanged water, the conductivity of the solution should not be distinguishable from that of the water itself. This, however, is not the case. The solution exhibits a higher conductivity than that of pure water. Further, there is a marked difference in the enhanced conductivity according to the metal employed. Thus, in the case of colloidal platinum the conductivity is eight times that observed in the case of colloidal gold. Beans and Eastlack connect this larger conductivity with the fact that colloidal platinum is more stable than colloidal gold, their conclusion being that the greater stability of the colloidal platinum is due to the presence of small amounts of electrolyte formed by the oxidation of the metal at the high temperature realized locally in the sparking process. The presence of traces of chloride, bromide, iodide, or hydroxyl ions has a marked stabilizing effect upon these colloidal metals, provided the ions are present already during the sparking process. The conclusion to be drawn from these experiments is that even when the medium is pure—no extraneous electrolyte being added—the stability of the colloid is dependent upon its power of adsorbing or combining with some negatively charged ion, probably, according to these authors, a complex anion containing the metallic atom itself, this complex being produced in the sparking process and conferring the enhanced conductivity upon the solution as a whole. It seems to me that there is no getting away from the conclusion reached by Beans and Eastlack, provided it is possible to be certain about the magnitude of the charge on the colloid particle. If their conclusions be accepted as substantially correct—and I am inclined to accept them —then one may conclude that the presence of a third substance—in the present case the complex anion produced in the sparking process—confers the charge and at the same time stabilizes the colloid particle.

---

[*] Abstracted from a paper on "Properties of the Colloid State and Their Application to Industry," presented at the Birmingham Section of the Society of Chemical Industry on Nov. 11, 1918, and reported in the Jan. 31 issue of that society's Journal.

THE HARDY-SCHULTZE LAW

It has long been known that the addition of small quantities of certain substances, chiefly electrolytes, to suspensions, emulsions, or colloidal solutions brings about an agglomeration and precipitation of the finely divided form. The important rule in this connection is that ions carrying a charge of sign opposite to that carried by the colloid particle are the most efficient coagulating agents, and, further, that the higher the valency of the ion, that is, the greater the number of unit charges upon it, the greater its precipitating action. This is known usually as the Hardy-Schultze law. It is one of the most useful generalizations which investigators possess. At the same time it must not be overlooked that there are certain exceptions to it. This has been emphasized particularly by Bancroft, who advances the not novel explanation that specific adsorption of ions is the real determining factor in bringing about coagulation, rather than the fact of opposite electrical sign. It happens, however, so frequently that the two go hand in hand as almost to justify the Hardy-Schultze rule as a general truth.

On the basis of this rule one would not expect precipitation to be brought about by the presence of a substance having the same sign as that of the colloid. Rather one would expect stabilization, and such, indeed, is generally the case. Thus peptizing agents and protective colloids have in general the same electrical sign as the substance they peptize and protect, that is, retain in the sol form. Nevertheless, there are exceptions. In at least one case a colloid brings about rapid coagulation of a suspension, although the sign of both is the same.

ACTIVE ION OF ELECTROLYTE IS ADSORBED BY COLLOID SOL

As regards the kind of union which takes place between the active ion—that is, the ion with coagulating power—and the colloid sol, practically nothing is known beyond the fact that it is a case of adsorption. That the union is a close one is illustrated by the classic experiment of Linder and Picton in connection with colloidal arsenious sulphide precipitated by barium chloride. In this case the active ion is the positively charged barium ion—the colloidal arsenious sulphide is negatively charged. On examining the precipitate there was found closely adhering to the arsenious sulphide a certain amount of barium in the form of barium hydroxide, which could not be separated by prolonged washing. Simultaneously a quantity of hydrochloric acid was discovered in the supernatant liquid or the filtrate. The whole effect is equivalent to the hydrolysis of the salt.

THE POPULAR CONCEPTION OF ELECTRICAL ACTION IN PREVENTING COAGULATION

The question now arises, Why is it that the partial or total removal of the electrical charge on a colloid particle should cause coagulation to take place? Mr. Hardy first made this clear, in the well-known experiments upon the iso-electric point. The particles are kept in agitation and in a certain spatial distribution throughout the medium, as Perrin has shown, as a result of the Brownian movement, that is, as a result of the unordered collisions with the molecules of the solvent or medium. Brownian movement, therefore, has a double function in colloidal chemistry. As a result of the bombardment of a single colloid particle by the molecules of the medium, the particle is kept in suspension; this effect is essential to the permanence of the colloid state. On the other hand, the movement so imparted to the colloid particles must cause the colloid particles themselves to collide with one another; and, if the conditions are favorable, the collisions will result in permanent union, ultimately producing coagulation when the particles have grown to sufficient size.

The function of the electric charge as a stabilizing agency for the sol form is supposed to consist simply in the fact that particles carrying electricity of the same sign repel one another. Coagulation is thereby prevented. This is an exceedingly plausible view of the case, but one is scarcely satisfied that it is comprehensive. It would be a decided advance if this qualitative idea could be formulated in a quantitative expression amenable to experimental test. The difficulty of accepting this simple view lies in the fact that peptization and protection—which depend upon adsorptive effects—occur between particles of the same electric sign, and therefore presumably repelling one another.

A further set of phenomena is associated with the existence of electric charges upon colloids and upon interfaces in general, namely, electrical endosmose and cataphoresis. A considerable amount of information respecting the origin of these phenomena is due to Perrin, Bancroft, Briggs, and others. Though selective adsorption again plays an essential part in these cases, it must be recognized that available information is rather qualitative than quantitative. The next development of colloid chemistry must be toward quantitative expression in general.

The real trouble in all this is the fact that scientific colloid chemistry has not advanced nearly enough to meet the requirements of present-day technical practice. Many of the technical operations in this field are consequently empirical—a state of affairs which no one can regard as satisfactory. I have indicated how the whole range of scientific colloid chemistry bristles with unanswered questions. The fact is that colloid chemistry is only beginning to be thought about seriously. Even at the present time it has not generally appeared as a distinct subject for instruction and research in British universities and colleges. One cannot hope for real advances in colloid technology until scientific colloid chemistry is put on a proper footing and receives the attention which its fundamental importance deserves.

Lead Plating*

According to a circular issued by the Bureau of Standards in collaboration with the Army Ordnance Department, lead plating is conducted similarly to any other plating operation, and can be readily achieved wherever there are plating facilities and an experienced plater. Wooden tanks, preferably lined with asphalt or bitumen, are suitable for the purpose; iron or lead linings should not be used. The solutions after mixing are not especially corrosive, nor so poisonous as many other plating solutions in common use. Danger of lead poisoning may be avoided by the use of the customary precautions. Briefly, the operation of lead plating consists in hanging the properly cleansed articles in the plating solution upon the cathode rods, and lead plates or sheets of suitable size upon the anode rods.

The only two lead-plating media in extensive commercial use are the fluosilicate and fluoborate solutions. The former is made by dissolving lead carbonate in fluosilicic acid, which in turn is prepared by the action of hydrofluoric acid on silica. As the preparation of the fluosilicate solution is a complicated process, it is customary for the platers to purchase this solution from the refineries in which it is used on a large scale for the refining of lead. Observation has shown that most of the platers using fluosilicate solutions make further additions to the solutions as purchased, such as glue, molasses, and oxalic acid. The fluoborate solution is prepared by dissolving boric acid in hydrofluoric acid, and then adding the lead carbonate (in the form of a paste), and the requisite amount of glue, after which the solution is diluted to the desired volume or density. Dense, satisfactory deposits of lead can be produced in either the fluosilicate or fluoborate solution, but it is believed that for new installations the fluoborate solution will be most satisfactory. The fluoborate solution may be used to plate directly on steel, whereas in the fluosilicate solution the steel must first be copper-plated or receive other special treatment.

Aluminum Alloys*

Aluminum was merely a scientific curiosity a generation ago, the production in 1883 having been but 83 lb.; but it is now one of the most common metals in use, with an annual production of hundreds of thousands of tons. It is most important in its alloys, especially in those with magnesium and copper. The alloy known as magnalium is a series of mixtures containing 10 to 30% of magnesium; it is silver-white in appearence, strong, ductile, easily cast, takes a fine polish, and has a specific gravity of only 2 to 2.5, somewhat less than that of aluminum itself. With 10% of magnesium the melting point is between 650° and 700° C. The metal is made harder, more brittle and finer in polish by additions of magnesium up to the practical limit of 30%; it may be given a dark color by maceration, or it may be nickeled or gilded. Duralumin, with 3.5 to 5.5% of copper and about 0.5% each of magnesium and manganese, has greater hardness, tensile strength and polish, and may be easily hardened, but it is given special value by its resistance to the action of sea water and dilute acids. It is a little heavier than aluminum, with a specific gravity of about 2.8. Other alloys, similar to magnalium, but adapted to special uses, contain small percentages of nickel, tin, lead, and iron.

Mining Partnership Rights

By A. L. H. Street†

Plaintiff and defendant became co-partners for the location of mines in the Sitka mining district, Alaska. They made discovery in 1911, and a location in plaintiff's name for the equal benefit of each. Together they did the assessment work for 1912, and plaintiff alone did it in 1913. As plaintiff was returning to Seattle, defendant promised to do the work for 1914, but failed to perform it. The claim being open to relocation, because of this default, defendant caused a third person to relocate it for defendant's own benefit, and became interested in adjacent claims which he located with a fourth person. Later all the claims were sold, and plaintiff, on discovering the facts, sued for an accounting.

In upholding plaintiff's right to recover on the basis of equal partnership with defendant, the Washington Supreme Court said in this late case (Kittilsby *vs.* Vevelstad, *173 Pacific Reporter, 744*):

> His [defendant's] failing to do the work as promised, and his secret method of obtaining the claim . . . cannot be sanctioned. Good faith would require him to notify his partner that the assessment work as promised by him would not be performed

Numerous authorities are cited by the court in support of the legal proposition that the existence of a partnership creates the highest fiduciary relationship between the members, precluding one partner from fraudulently deriving secret benefits at the expense of his associate or associates.

Quebec Chromite Production in 1918 was 35,749 tons, valued at $770,955, according to the preliminary report of the Quebec Bureau of Mines. The tonnage includes the shipments of crude ore and ore sent to concentrators. Actual shipments of crude ore and concentrates in 1918 amounted to about 21,500 tons.

---

*Abstracted from an article in the *Brass World*, and reprinted in the *Journ.* Franklin Institute, February, 1919.

*Abstracted from an article in the *Chemical Trade Journal and Chemical Engineer*, and reprinted in the *Journ.* Franklin Institute, February, 1919.

†Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Notes on Water-Power Development*

By D. H. Colcord

Certain economic and legislative factors have taught the uninitiated investor in "hydro-electrics" several costly lessons in recent years, and it seems worth while to review these considerations:

1. Load factors have been overestimated.
2. Drouth in summer and ice in winter have prevented the constant source of power counted upon. The initial cost for building impounding dams to overcome this difficulty has often been so great that, although companies might eventually have succeeded, during their establishment and initial operation they could not compete with steam-power companies.
3. The high cost of transmission systems in a mountainous country has been prohibitive in some cases.
4. The cost of installation is high. In 1914, the total cost of installing hydro-electric plants was estimated at $27,000,000, including distribution systems and auxiliary equipment. This gives an average cost per horsepower of $158. A general estimate of the cost complete, as given by a prominent engineering company, not including distribution or step-down transformers, has ranged from $75 to $150 per kilowatt installed. If the price of coal increases, in time it will compare favorably. At least the marginal difference in cost will demand increased efficiency in the operation of hydroelectric plants, which might make up for this difference. The best steam practice secures at the electric generator less than 20% of the energy stored in coal, though the efficiency of the water wheel frequently exceeds 90%, which is worth considering.
5. The rapid development of the steam turbine, with its increased efficiency, has discouraged the utilization of water power.
6. Distance from the market has been an adverse factor in many instances.
7. The value of land in industrial districts has restricted development.
8. Railroads have followed the streams, and in many instances would have to be rebuilt.
9. Many of the streams are of an interstate, interprovincial, or international character, and their use would involve legislative difficulties.
10. The fact that several projects have been started and abandoned has had a bad moral influence.
11. Long-term franchises held by municipal heating and lighting companies made competition impossible.
12. The forestry laws contain inadequate provisions for the leasing of land.
13. There is a scarcity of good head sites.
14. Not enough data are available on the geological features of stream beds.
15. The recent scarcity and high cost of labor and building material have prevented, since the war, the completion of developments already started.

The 1916 report of the Pennsylvania Water Commission contains data on hydro-electric projects that have been started and dropped for various reasons.

Projects were begun at a time when there was a marked scarcity of capital. The companies failed to realize the necessity for a complete engineering survey. Improper sites were chosen and then abandoned. Hydrographic conditions were overestimated, and in some cases there was not as much water available as counted upon. Commercial surveys were not always thorough, and companies in some cases overestimated their markets for power. In three instances uncertainty in regard to the legal rights possessed by the companies, and subsequent legislation, blocked their progress. In several projects, the blame for failure can be ascribed to financial misfortune.

The general advantages derived from water-power developments are:

1. The highest use of coal is to create heat to preserve man's life, and the term of man's existence may depend on the care of the supply. Fuel is not essentially reproductive. Water power for industry can save millions of tons of coal a year.
2. The industrial section depends primarily on fuel, and any effort to conserve fuel supplies will lengthen productive life.
3. The electrification of all railroads is inevitable, and provision must be made to supply the electric power. As railroads follow the streams, the natural source of power is that which is the most available—the stream itself.
4. Water power makes electric lighting possible wherever it is needed.
5. Where steam power is already used, it can be supplemented by water power.
6. Storage reservoirs used with hydro-electric plants are a protection against floods.
7. During the drouths in summer, the expulsion of water from impounding dams improves sanitary conditions along the stream below.
8. Impounding dams on rivers often improve navigation.
9. Thickly settled districts afford a large market for electric power, with reasonable transmission distances.
10. Old canals and dam sites often make it possible to install a plant at small cost.
11. There are many limestone streams in mountainous districts that have a high rate of flow during the dry seasons.
12. Labor released by the winning of the war can be used to build the plants.
13. Increased industrial efficiency is effected, because of labor saving and waste prevention in distributing power.

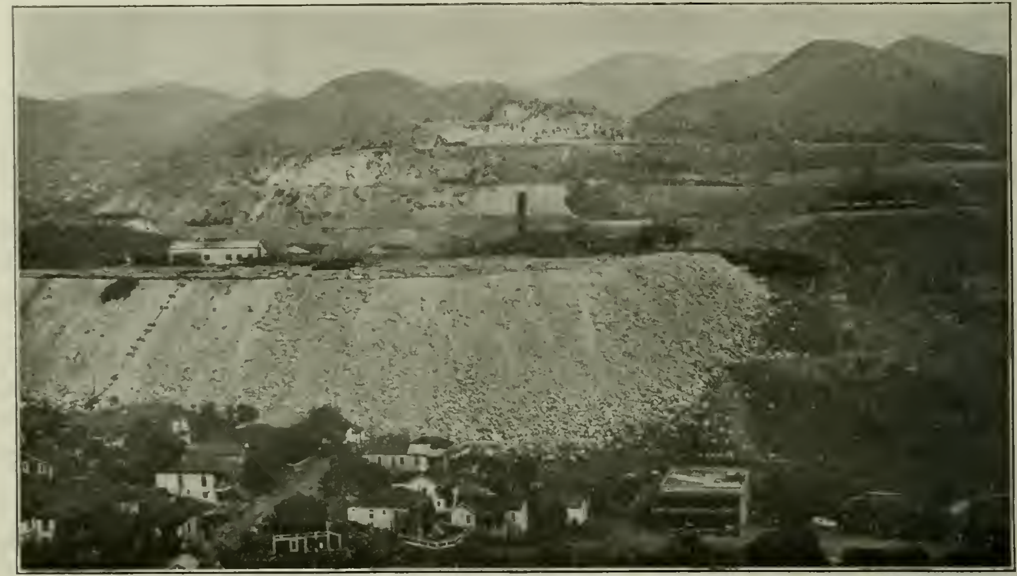
From a conservative and absolutely safe standpoint, considering immediate returns on the investment, the correct policy is to use water power only to supplement steam where coal is available at a fair price. But this policy is somewhat pinched and near-sighted from national, industrial, and economic standpoints, because the time is coming when the available coal will be gone.

In Great Britain, proposals have been set forth for vast central-station power plants, and computations and records are being made of all of the water powers of the British Isles. Since the outbreak of the war, the Italian government has proceeded with an active water-power policy. In 1917 and 1918 concessions have been granted for 1,024,000 hp. Norway has developed 1,120,000 turbine hp. and plans to sell hydro-electric power to Denmark. Barcelona, in Spain, is replacing steam power by hydro-electricity. In Switzerland, 25% of the 2,000,000 available hp. has been developed. A Canadian company has completed a large portion of an extensive system of reservoirs and hydro-electric stations on the Nogurea, Pallareasa, and Segre rivers. All this is indicative of the fact that people are laying a lasting foundation for power for years to some.

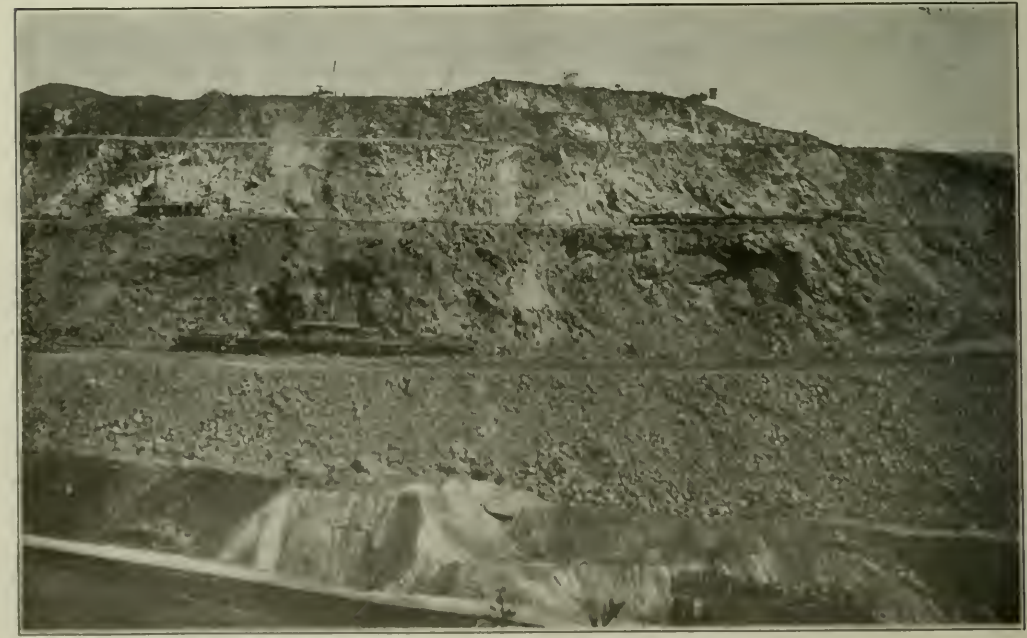
---

*Abstracted from the *Canadian Engineer*, Jan. 23, 1919, p. 170.

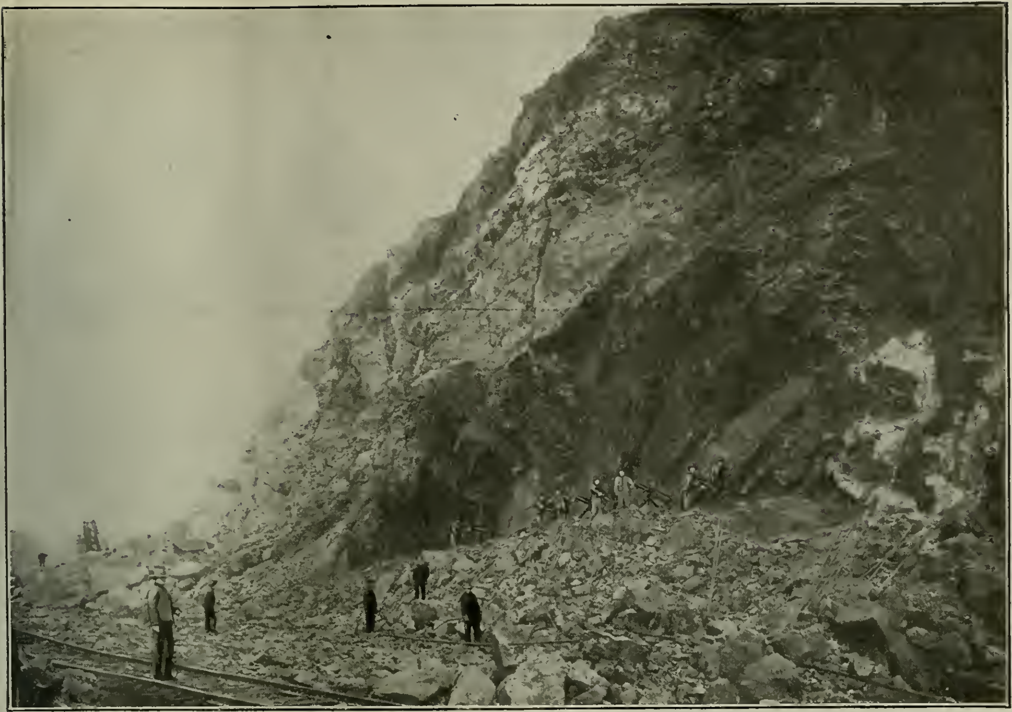
Stripping Operations at Sacramento Hill



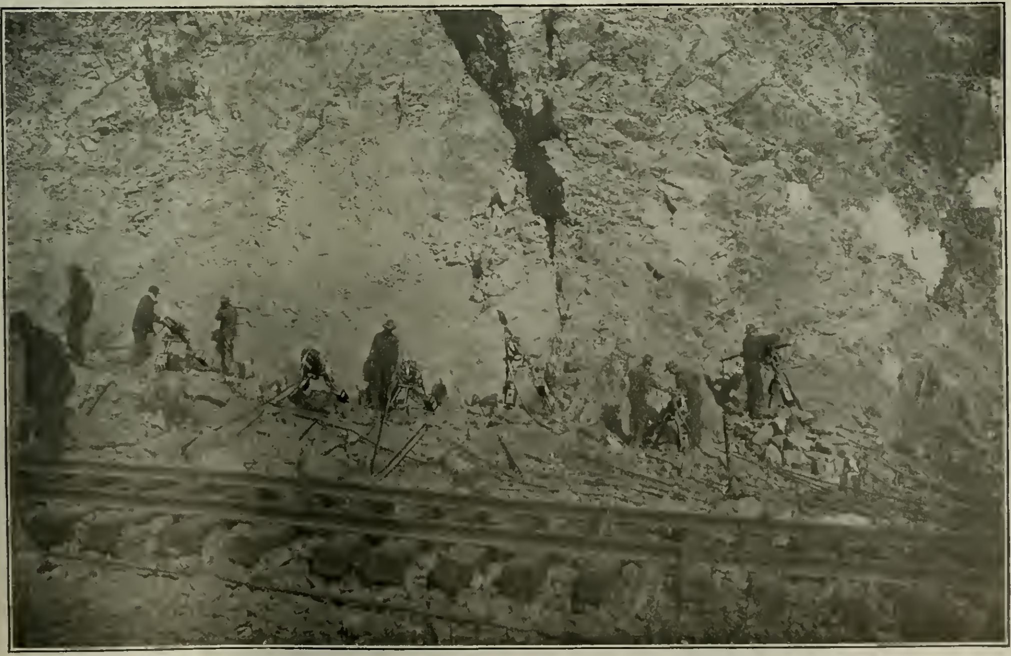
SACRAMENTO HILL, WHICH IS BEING STRIPPED BY THE PHELPS DODGE CORPORATION



ARRANGEMENT OF BENCHES AT SACRAMENTO HILL, BISBEE, ARIZONA



DRILLING OPERATIONS ON THE UPPER BENCH AT SACRAMENTO HILL



MACHINE DRILLING TOE HOLES AT SACRAMENTO HILL

Rand Mining in 1918

By A. COOPER KEY*

The operation of the Rand goldfield during the last year was hampered by exceptionally severe floods, high prices for labor and materials on account of the war, shortage of labor, and the influenza epidemic. In view of these many disabilities, the production has not dropped to an extent that might have been expected, but profits show a considerable decline. Data are given to show the past and present position of the industry; and the importance of the Far East Rand as the principal source of future yield is emphasized by illustrative chart, tables and figures.

Water troubles, due to excessive rains in the first two months of the year; the influenza scourge in September and October, and a consequent shortage of native labor attributable to the suspension of recruiting; and the influenza pandemic in Portuguese East Africa, which is a very important area of supply, combined to make the Rand's record for 1918 an indifferent one. Production has kept up fairly well, but the profits of the gold industry, which were £1,000,000 a month before the war and in 1915, and but little short of that figure in 1916, have fallen to an average of about £600,000, and November and December they approximated only £500,000. During these two months the shortage of labor was felt with full force, there having been a decrease of over 20,000 natives on the payrolls.

The Transvaal Gold Mines' Figures

The gold output of the Transvaal—and there are a few mines working outside the Rand—is given by the Chamber of Mines at £35,768,688, as against £38,323,921 in 1917, and £39,484,934 in 1916. There has thus been a shrinkage of over £2,500,000 in the year and of nearly £3,750,000 in two years. Several of the important mines of the Central and Near East sections of the Rand are nearing exhaustion, with consequent lowering of grade and reduced numbers of stope faces. The ore milled in 1918 aggregated 25,250,000 tons, in contrast with 27,750,000 and 29,250,000 tons, respectively, during the previous two years. But this decrease in tonnage is neutralized to some extent by the rise in grade, the recovery having steadily risen since 1915, when it stood at 26s. 3d., to 26s. 8d., 27s. 1d. and, now, 27s. 11d. In the three years there has been an improvement of 1s. 8d. in the value of the average amount of gold recovered on the Rand. This is attributable to the higher grade of ore being mined in the Far East Rand, where recovery ranges from 35s. to 40s. and even 45s. per ton. An advance of 20d. in grade (shown in the three years) means an increase of £2,000,000 in 1918.

Rand Figures Considered Separately

The Rand taken by itself yielded gold to the value of £34,823,017 in 1918. Production in 1918 was surpassed in the years 1912, 1913, 1915, 1916, and 1917, but it is higher than that for 1914, by £700,000. The Government Areas mine is now producing £200,000 worth of gold monthly, and making a profit of £85,000, about 45% of which goes to the Union government as royalty. Crushing was begun in November, 1914, whereas Modder Deep, now responsible for £85,000 gold and £50,000 profit a month, started milling in January, 1915. In the interim, Springs Mines (£85,000 output and £40,000 profit) entered the producing stage, and the new battery at the Circular shaft at the New Modderfontein has brought that company's monthly yield up to £167,500, giving a remarkably regular profit of £90,000. The average value of the gold recovered from the Rand mines last year was 27s. 11d.

Marked Rise in Working Costs

Working costs have averaged 21s. 7d. per ton, and December, on the lessened tonnage due to labor shortage, showed the somewhat alarming figure of 23s. True, November is the highest average for a dozen years, representing an advance of 2s. 6d. on the year, and of more than a pennyweight (say 4s. 6d.) compared with 1914. Stores at high prices, war bonus to married workers and to single men with dependents, payments to men in active service—these are the principal factors in the advance. It may be observed that, if the recovery were no higher than it was in 1914 (and the strength of a gold field lies in its ability to treat enormous tonnages of medium- and even low-grade ore at a profit), the profit on the abnormally high rate of December would be no more than 3s. 6d. per ton. The actual figure was 6s., as against 7s. 6d. in 1917 and 8s. 2d. in 1916.

Profit Drops Sharply to £7,500,000

The factors of decrease in tonnage and augmented costs have slumped the Rand profit to £7,500,000, as against £10,250,000 in 1917 and £11,500,000 in 1916. Never since the Chamber of Mines first started to collect the profit data from the companies had the amount previously dropped below £10,000,000. Last year's total is actually £5,000,000 less than that of 1912, and £4,500,000 below that of 1908, when the quantity of rock crushed was 6,750,000 tons less than in 1918. This is a poor result from the investor's standpoint, although the increased expenditure has brought enhanced prosperity to the Rand, the population of which is retaining an ever-increasing proportion of the gold which filters through the pockets of a comparatively small number of white people. The growth of expenditure in relation to output is shown herewith:

EXPENDITURE AND OUTPUT ON THE RAND

	Output	Expenditure	Per Cent. of Expense to Output
1914	£34,124,434	£21,943,692	64.2
1915	37,264,992	24,657,659	66.2
1916	38,107,909	25,763,270	67.6
1917 ..	37,017,613	26,129,156	70.6
1918...	34,823,017	26,848,547	77.1

The High Cost of Winning Gold

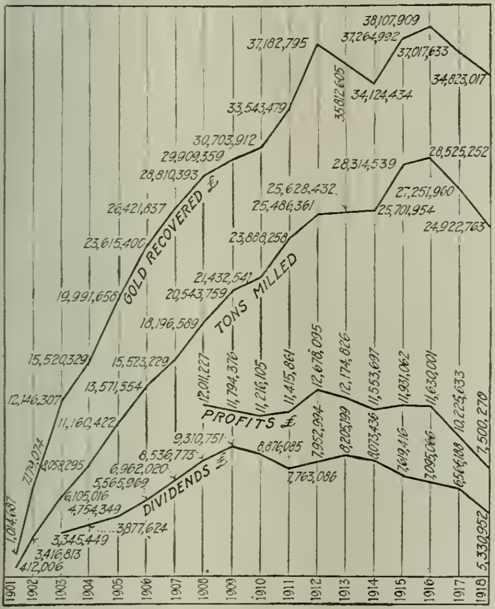
In the five years the gold output has advanced by £700,000, but the expenditure has increased no less than £4,900,000. A decade ago the mines of the Rand spent altogether only about £18,000,000 a year, but made much larger profits. In 1915 it cost 13s. 4d. to win gold worth £1, but the expenditure last year to achieve this was 15s. 5d. Thus it costs 77c. to procure $1 in gold. In some businesses in Johannesburg "profiteering" has gone on during the war unchecked. One wonders how a profit of only 4s. 7d. on every sovereign of turnover would appeal to these gentry. This is only after the vast expenditure of capital, and even that modicum of profit is subject to government taxation and contributions under the Miners' Phthisis Act.

---

*71 Permanent Buildings, Johannesburg, South Africa.

THE DIVIDEND ASPECT

The Chamber of Mines gives the amount of dividends actually declared during the year 1918 at £5,144,077, but to this it appears correct to add £115,000, the first dividend of Springs Mines paid on next spring's scrip, and convertible at par by the Anglo-American Corporation, and also £71,875, the second half-yearly dividend of the Geduld Proprietary Mines payment, deferred for a few weeks owing to issue of further capital. This brings the total to £5,330,952. The margin between profits and dividend distributions is narrower than usual, namely less than £2,250,000, compared with previous disbursements of £3,500,000, £4,000,000, and as much as £4,750,000 in 1912. There has latterly been less diversion of profits to capital expenditure.



OUTPUT, PROFITS AND DIVIDENDS (IN POUNDS STERLING) AND TONS MILLED ON THE RAND 1901-1918 (INCLUSIVE)

SPECTACULAR ADVANCE OF FAR EASTERN MINES

The companies of the Far East Rand (Benoni, Brakpan, and Springs districts) contributed no less than £3,401,500 of the dividends, representing 64% of the total, as against 43% in 1917. The dividend decline of the Central Rand was accentuated in the second half of the year, when the distribution was only £708,500, about £1,000,000 below the payments by the Far Eastern group. Three companies paid out over £500,000—New Modder, £726,250; Modder B £577,500, and Van Ryn Deep, £538,600. Modder Deep distributed £487,500, and Government Areas, £385,000, a somewhat similar sum accruing to the Union government. The comparison of Central and Western with the Far East is as follows:

	First Half 1918	Second Half 1918
Far East Mines	£1,632,270	£1,769,247
Central and Western	1,220,964	708,485
Totals	£2,853,234	£2,477,732

Though all the Far Eastern Mines except Modder B recorded an increase in dividends, the Modder an increase of no less than £236,250, and Government Areas £210,000 (two dividends instead of one), there were some serious declines in the Central section. Most noteworthy was a £218,750 decrease by the City Deep, on which at one time the mantle of the historic Robinson was said to have fallen; whereas that great amalgamation, the Crown Mines, paid only £188,000, exactly half the 1917 distribution. Old age, high costs and lower grade explain decreases of £150,000 at Simmer and Jack; £137,500 at the Robinson, and £110,000 at the City and Suburban. High costs and mining difficulties due to great depth account for a decrease of no less than £132,000 at the Village Deep. The dividends of what may be called the "Golden Four Miles" to paraphrase a western Australia appellation (from the Wolhuter to the Crown Mines), decreased practically £1,000,000 during the year. Sir Evelyn Wallers, President of the Chamber of Mines, at a recent inspection of the New Modderfontein circular-shaft plant, humorously remarked that the Wise Men of the Scriptures came from the East, but the wise people of the Rand had, on the contrary, gone to the East. And so it is.

Quicksilver in California

Bulletin 78 of the California State Mining Bureau, entitled "Quicksilver Resources of California," by Walter W. Bradley, is now ready for distribution. It is the first work published in 15 years dealing distinctly with quicksilver and its metallurgy and has had only two predecessors in this particular field—G. F. Becker's "Geology of the Quicksilver Deposits of the Pacific Slope" and William Forstner's "Quicksilver Resources of California."

California yields approximately 70% of the quicksilver output of the United States, and since 1850 has produced a total of 2,137,728 flasks (to the end of 1917), valued at $101,992,560. Bulletin 78 contains production and price charts, which show the annual fluctuations of values and quantities, and the entire work is illustrated with photographs, drawings, and geological maps. The section on metallurgy contains numerous photographic cuts and line drawings of furnaces, condensers, and other plant equipment. A drawing of the rotary furnaces of the New Idria Co. is included.

The metallurgical work detailed includes an account of the author's original investigations relative to concentration methods as applied to quicksilver ores, which included treatment on tables with water, flotation with oils, and solution by an alkaline sulphide.

The quicksilver industry, though, relatively speaking, not large or extensive, is, nevertheless, a vital one in peace times as well as in war. Under normal conditions 50% of the quicksilver consumption goes into fulminate for blasting caps for quarrying and mining, as well as for ammunition. In addition, a considerable amount goes into the manufacture of drugs. Some also is used in gold and silver mining.

United States Steel Corporation

THE United States Steel Corporation's report on operations during 1918 contains the record of a great industry and describes its many unusual activities made necessary by America's participation in the war. Deviating from its previous industrial course, the operations of the corporation during the period covered by the report have been multifarious, and the record that has been made under conditions of stress, high costs, and labor uncertainties reflects great credit on the various managements, whose foresight and business acumen have made the accomplishment possible.

The general balance sheet, condensed, is as follows:

GENERAL BALANCE SHEET U. S. STEEL CORPORATION
Year Ended Dec. 31, 1918

Assets	
Property account, less depreciation	$1,563,937,122.89
Advanced mining royalties	20,562,090.12
Mining royalties	33,912,076.17
Deferred charges	1,751,649.41
Investments	4,947,972.53
Sinking fund assets	63,370,182.27
Current assets	883,136,081.69
Total assets	$2,571,617,175.08
Liabilities	
Common stock	$508,302,500.00
Preferred stock	360,281,100.00
Stocks of subsidiary companies not held by U. S. Steel	434,642.50
Bonded debt, U. S. Steel Corporation	414,928,000.00
Bonded debt, subsidiary companies	167,718,168.74
Notes subsidiary companies	33,912,076.17
Mortgages and purchase money	651,952.15
Current liabilities	397,781,482.33
Reserve funds	109,819,917.71
Appropriated surplus	110,898,914.10
Undivided surplus	466,888,421.38
Total liabilities	$2,571,617,175.08

Of the current assets, materials and products on hand are represented by $274,753,600.02; accounts receivable, $113,810,679.39; and cash on hand, $173,806,259.41. The net income for 1918 amounted to $158,631,856.20, and is shown in condensed form in an accompanying table. From the net income is deducted $21,728,932.84 in interest and premiums, and an adjustment of $629,453.96 brings the balance to $137,532,377.32. Total dividends paid during 1918 amounted to $96,372,027, preferred stock receiving 7% and the common a 5% regular dividend and 9% extra. These total $25,219,677 for the preferred and $71,162,350 for the common stock. After deducting dividends and an additional allowance of $12,215,000 to cover amortization of proportion of cost of facilities installed for production of articles contributing to prosecution of the war, $28,935,350.32 remains as a balance carried forward to undivided surplus.

Total domestic shipments for 1918 were: Rolled steel and other products, 12,384,169 tons; pig iron, ingots, spiegel, ferro, and scrap, 307,482 tons; iron ore, coal and coke, 1,009,919 tons; and sundry materials and by-products, 192,925 tons. Universal portland cement shipped equalled 7,707,595 bbl., a decrease of 25.9% from shipments of 1917. Domestic business during 1918 was valued at $1,125,161,264, an increase of 9.6% over that of 1917.

The export business for the year was valued at $162,867,991, a decrease of 9.3% from that of 1917. Shipments were: Rolled steel and other finished products, 1,740,817 tons; pig iron, ingots, and scrap, 17,120 tons, and sundry materials and byproducts, 2305 tons. Total tons of all kinds of materials, 1,760,242, which is a decrease of 19% from shipments of 1917.

Operations of subsidiary companies during 1918 did not reach the totals for the preceding year, notwithstanding the large and constant demand for iron and steel products. About 65% of the entire steel-products output for the corporation was supplied to Government departments. The total production during 1918, in comparison with results in 1917, was as follows:

TOTAL PRODUCTION IN 1917 AND 1918

Products	1917 Tons	1918 Tons
Iron Ore Mined		
In the Lake Superior Region		
Mesabi Range	23,806,268	21,574,526
Vermilion Range	1,039,807	808,994
Gogebic Range	2,197,554	1,916,220
Menominee Range	1,120,382	1,172,319
Marquette Range	491,760	338,344
In the Southern Region		
Tennessee Coal, Iron & R.R. Co.'s Mines	3,125,998	2,522 536
Totals	31,781,769	28,332,939
Limestone quarried	6,494,917	5,141,365
Coal Mined		
For use in the manufacture of coke	24,554,525	25,393,155
For steam, gas and all other purposes	6,942,298	6,354,980
Totals	31,496,823	31,748,135
Coke Manufactured		
In bee-hive ovens	11,177,247	9,962,403
In byproduct ovens	6,284,428	7,795,233
Totals	17,461,675	17,757,636
Blast-Furnace Production		
Pig iron	15,460,638	15,700,561
Spiegel, ferromanganese and silicon	192,290	240,393
Totals	15,652,928	15,940,954
Steel-Ingot Production		
Bessemer ingots	6,405,390	5,630,246
Openhearth ingots	13,879,671	13,953,247
Totals	20,285,061	19,583,493
Rolled and Other Finished Steel Products for Sale		
Steel rails (heavy and light tee and girder)	1,594,196	1,471,508
Blooms, billets, slabs, sheet and tinplate bars	1,692,348	1,489,737
Plates	1,473,625	2,171,362
Heavy structural shapes	1,004,537	1,079,601
Merchant steel, bars, hoops, bands, skelp, etc	2,650,970	2,159,279
Tubing and pipe	1,234,129	1,190,594
Wire rods	267,071	209,350
Wire and products of wire	1,821,985	1,445,567
Sheets (black and galvanized) and tin plates	1,740,949	1,356,119
Finished structural work	550,744	503,380
Angle splice bars and all other rail joints	207,846	145,305
Spikes, bolts, nuts and rivets	91,980	67,514
Axles	220,291	141,480
Steel car wheels	110,014	84,331
Sundry steel and iron products	282,226	334,356
Totals	14,942,911	13,849,483
Spelter	67,418	41,715
Sulphate of iron	43,942	42,321
Fertilizer	11,574	12,022
	Bbls	Bbls
Universal portland cement	10,917,000	7,287,000

Unfilled orders of subsidiary companies on Dec. 31, 1918, totaled 7,379,152 tons of rolled-steel products, in comparison with 9,381,718 tons at the close of 1917.

Three general wage advances were made during 1918 to employees of the subsidiary manufacturing and iron-mining companies, as follows: Apr. 16, 15%; Aug. 1, 10%; and on Oct. 1 plants were placed on the basic eight-hour day, with time and one-half for overtime, which was in effect an increase in wage rates of about 10%. The number of employees and total payroll are shown in an accompanying table.

EMPLOYEES AND PAYROLLS

Employees of	1917 Number	1918 Number
Manufacturing properties	198,711	199,029
Coal and coke properties	26,189	28,378
Iron-ore properties	13,198	12,619
Transportation properties	26,210	25,055
Miscellaneous properties	3,750	3,629
Totals	268,058	268,710
Total salaries and wages paid	$347,370,400	$452,663,524
Average Salary or Wage per Employe per Day:		
All employees, exclusive of general administrative and selling force	$4.10	$5.33
Total employees, including general administrative and selling force	$4.16	$5.38

Expenditures made during the year for acquisitions of additional property, new plants, and for extensions and construction, including net stripping and development expense at mines, totaled $129,855,038. The greater part of the work was carried out for the purpose of increasing facilities and utilizing the existing capacity to its maximum to meet the demand for steel of the military and naval requirements, including the Government shipbuilding program. Among the important additions and improvements were: Construction of modern shipbuilding plants on the Hackensack River, near Newark, N. J., and on the Chickasaw River, near Mobile, Ala.; byproduct coke plants at Clairton, Penn., Lorain, Ohio, and at Cleveland, Ohio, each plant having also benzol departments; and at Gary, Ind., at Fairfield, Ala., (the latter involving additional byproduct coke ovens); and at Duluth, Minn., where a benzol-recovery department was installed. At the McDonald plant of the Carnegie Steel Co. large additional expenditures were made in the installation of merchant bar steel mills, four additional mills having been placed in operation during the year. At the Gary, Ind., plant of the Indiana Steel Co., two new merchant bar mills and a forged-steel wheel plant were completed. The American Bridge Co. erected at Gary a plant for the manufacture of gun forgings. The Christy Park plant of the National Tube Co. was materially enlarged, and equipment was installed for manufacture of torpedo air-flask forgings and other war materials. At the Worcester and New Haven plants of the American Steel and Wire Co., large additional expenditures were made for increasing the productive capacity of wire rope and cable and of wire for military and naval purposes. At several plants of the American Bridge Co. additional special equipment was installed for producing fabricated shapes for ships, and expenditures aggregating $9,578,774 were made at various places for acquirement of property, development of sites, and construction of dwellings for employees, and for installation of public utilities in connection therewith. Nearly 5000 houses were completed or under erection during the year. The outlays for these purposes were large, but necessary to the maintenance of a satisfactory and permanent force of employees.

INCOME 1918—U. S. STEEL CORPORATION

Gross receipts	$1,744,312,162.97
Operating charges	1,515,110,651.20
Balance	$229,201,511.77
Royalties and rentals	19,168,489.19
	$248,370,000.97
Other income	21,306,334 83
	$269,676,335.79
Less adjustments and charges	61,395,231.56
Total earnings	$208,281,104.23
Interest and depreciation	49,649,248.03
Net income for year ended Dec. 31, 1918	$158,631,856.20

During 1918. a total of $709,059.82 was disbursed in pensions among retired employees. The privilege of subscribing for shares of common stock was again offered to employees at the price of $92 a share, under substantially the same terms as those offered in past years. There was expended during 1918 for safety work, $1,110,064, and fatal and serious accidents showed a decrease of 7.64% from 1917. The total amount disbursed by all companies during 1918 in connection with accident relief was $3,336,459.

During 1918, the sum of $2,713,166.35 was spent by the iron-ore mining subsidiary of the corporation, and the amount includes the cost of exploring and opening new ore deposits, additional surface land at Hibbing, Minn., and the following additions to plant construction: Aragon mine: equipping mine for electric operation. Norrie-Aurora mines: equipping Norrie shaft "A," East Norrie shafts "C" and "D," Aurora shaft "E" and Pabst shaft "H"; underground pumping equipment at Norrie shaft "A"; central electric power plant at Pabst shaft "G"; equipment for sinking Pabst shaft "H." Canisteo district: additional boilers and electric generating equipment at power plant; extending power-transmission lines; equipping shops with electrically operated machinery. Canisteo mine: water-supply system; car-wheel lathe, account car-repair shop and locomotive crane. Arcturus mine: track spreader, track shifter and tie-tamping outfit. Chester mine: air compressor. Hartley mine: track spreader and track shifter. Hibbing district: car-repair shop; warehouse; hospital; 40-in. boring mill. Morris mine: ore-crushing and screening plants. Leonidas mine: car-repair shop; enlarging general repair shop; coaling station; additions to power plant; rearranging tracks from mine pit. Eastern Missabe district: new concentrator plant for washing ore; ore-crushing plant and yard tracks. Adams district: coaling station and water tank, account water-supply system; double-track bridge over Duluth and Iron Range R.R. tracks. Virginia district: car-repair shop; storage warehouse.

A part of the statement is devoted exclusively to the description of the corporation's war activities. The American Sheet and Tin Plate Co. furnished nearly all the steel sheets used by the War Department to make helmets; the National Tube Co. designed and delivered large quantities of gas shells; the American Bridge Co. fabricated a special railway mount for naval guns, sending technical experts to France to complete the work. The corporation's Lake fleet organization contracted with the Government to deliver at Montreal and Quebec the boats commandeered by the Shipping Board, some of which had to be cut in two before they could be sent through the locks. When the Government conceived the project for a giant ordnance plant near Pittsburgh, the corporation was put in charge of the construction and operation of these works. The corporation sent a special committee of engineers to study the projectile plants of England, France, and Italy, and, besides, released 64 of its trained experts for the task of erecting the new plant. The armistice brought the work to an end.

Use of Tractors in Ore Haulage*

The ore-hauling problem of the Phillipsburg Mining Co., Phillipsburg, Mont., was solved by the installation and operation of three caterpillar tractors. By this method of transportation the company has been able to overcome the handicap of bad roads and successfully move its ore from the mine to the shipping point. Each of the tractors handles six 35-ton wagons of manganese ore to a load, and hauling is done by day and night shifts throughout the year. At the completion of a round trip, each tractor is replenished with a supply of fuel and oil and carefully inspected to see that all bolts are tight and that every part of the mechanism is in proper working order. Periodically the cylinder oil is drained out, the crank case cleaned, and a new, fresh supply of oil put in. The operation of the tractors has proved highly successful.

---

*Abstract of an article, "Freighting Manganese Ore," which appeared in *Caterpillar Times*, March, 1919.

Correspondence and Discussion

Business Opportunities in France

Ever since the first appearance of the flaming publicity campaign in the United States regarding the opportunity for business in France the sentiment here has been frankly, *"France pour les Français."* Our American publicity was so pronounced that we seemed to consider France as our commercial colony. The result was that sentiment against importations developed to such an extent that it has not been possible for linen manufacturers in the north to import machinery from England which is manufactured nowhere else than in England.

Only lately has the pendulum begun to swing backward, and the authorities are naturally waiting for the expression of public opinion against the present policy of exclusion. A stable, normal condition will be reached when the equipment required for home industries is admitted freely and merchandise which is produced in France is heavily protected or even practically excluded. At the present moment this exclusion is carried so far that French industry itself is suffering greatly, but, as already explained, sentiment is changing.

In the meantime, and for several months—perhaps a year, and certainly not before peace is signed—the American exporter should expect little business from France. One of the straws which shows the change in the direction of thought here is the proposed permanent exhibit, near Passy. A syndicate of French capitalists has been formed to build a commercial center in which to house the sales offices and display rooms of both foreign and domestic manufacturers. The idea is to convince the foreign manufacturer that he should be represented in this permanent exposition; and certainly no such venture would succeed under the present restrictions as to imports. Another indicator is the fact that the owner of a large office building, which is about completed, is making it strictly modern and American, and expects to fill it, to a large extent, with American occupants. This would be impossible if the present policy were maintained.

Much has been written regarding deliberate damage done by the Germans to the manufacturing plants in the neighborhood of Lille. The machinery that was not touched, however, is in a useless condition, due to the action of the weather and the elements during the four years of war and idleness, so that all must be replaced. It is quite possible to lay too much stress on what the Boche did, and not enough on what must be done to reëstablish the industries. Many soldiers are being demobilized and many are without employment. This is so true that the hotels are able to employ waiters at $14 per month, chambermaids at $9 per month, and elevator boys at nothing per month. The majority of the hotel guests are foreigners, who do not appreciate these conditions.

A recent order for grinding machinery included 4-in. balls, but it was found impossible to purchase these in France, although one of the easiest and simplest of foundry products. It is difficult to hope for any great industrial change until after peace is signed; and one of the points which is giving great concern to the financiers is the question of exchange, and what will become of the franc when international trade is free of all restraint, except of import duties.

It seems likely that the American trader who has installed himself in France is six months to a year too early.

MARK R. LAMB.

Paris, Feb. 28, 1919.

About Spanish

The editorial in the Mar. 29 issue of the *Journal* on the Spanish language fails to include one aspect of the matter. You say: "American mining companies in Chile and Peru doubtless like to engage men with a knowledge of Spanish, but they would probably prefer those who have acquired it in the field." But how about the natives of Chile and Peru; are they not deserving of some consideration? The mining engineer who has learned Spanish in the field has usually acquired it from the *peons*, and, consequently, in his official or social intercourse with educated natives, he has no other means of communication than *peon* Spanish. To that extent he suffers in their estimation and in his own dignity. In the same way a foreign manager in this country who commanded no better English than is spoken by immigrant laborers would suffer in our estimation.

Learning the language in the field has also the drawback that the dialect of one country or district is of little value in another, whereas Castilian is understood and respected wherever Spanish or its derivatives are spoken. Like most things worth while, it is difficult to acquire, but offers a bonus on its utilitarian value as the gateway to one of the richest of literatures.

New York, Apr. 1, 1919. H. H. KNOX.

[The criticism is welcomed, and the point made by Mr. Knox is well taken. Nevertheless, we would like to dissociate ourselves from the idea that the engineer must necessarily acquire his Spanish from the laboring class—a conclusion which was neither implied nor anticipated. We said: "A new language can best be *studied* after one reaches the country where it is spoken," and such an opinion can hardly be construed as advocating the acquisition of *peon* Spanish unintelligible to the better-class native. Needless to say, we are thoroughly appreciative of and in whole-hearted agreement with Mr. Knox's closing remark.—EDITOR.]

Standardization of Salaries

The thoughtful editorial on the "Standardization of Salaries" that appeared in the *Journal* of Mar. 8 should be read by all engineers. The attempt on the part of the American Association of Engineers to evolve a schedule is commendable, and should find ready support. It is the lower-salaried men that have the greatest difficulty in securing compensation adequate to their needs and commensurate with their attainments. The very nature of their employment, the relatively small groups that exist in any one locality, prevent the determination of anything like a standard salary for particular kinds of engineering work. The numbers of young graduates that scatter out into engineering fields each year, and who are ready to try any job at almost any salary in order to get a start, undoubtedly complicate the situation. I am also of the opinion that the low starting salaries have some influence in keeping down the salaries that as a rule are offered for more responsible positions.

Employers are to be blamed for their shortsightedness in keeping men on low salaries, for, when such men leave, the expense required for their replacement and the interruptions to the regular course of the work, not to mention the actual money loss that may result from mistakes, involve an expenditure that in the aggregate is greatly in excess of the salary increases that might have retained the men. Although the turnover is not as great as in the case of labor, it is large enough to be well deserving of consideration.

Much is heard of welfare for the working man, and there is a great deal of talk of profit-sharing for him, but nothing is said about the man in intermediate position. He is like the "common people"—presumably able to take care of himself and not supposed to raise any objection. Still, it is difficult to prevent him from making comparisons, and the conviction that there should exist an organization to further his interests will arise and persist. I am not in favor of an organization similar to the labor union, but I believe that the national societies might find this a fertile field of endeavor. Why should they not look into the problems that confront the younger members of their organizations. Why should they not stand for adequate compensation in the starting and intermediate positions? They had to struggle through the mill themselves, and are in a better position to appreciate the difficulties, and to take effective steps, than employers. METALLURGIST.

New York, Mar. 15, 1919.

Steam Economics in Simple Terms

Mr. Worcester's article, "Steam Economics in Simple Terms," which appeared in the *Journal* of Mar. 29, reminds me strikingly of a similar experience of mine. On p. 562, in speaking of hand-operated cutoffs and valves, he tells of a remarkable experience in which he made a considerable saving for a company by teaching the engine room men to use the cutoff instead of regulating the engine by means of the throttle valve, and received a substantial remuneration for so doing. The remarkable parts of the story are, first, that he was allowed to monkey with the machine at all, and, second, that he was paid anything for his trouble. Probably his boss had more confidence in him than my boss had in my ability.

Immediately after being graduated from college I worked at a mine in Colorado where there was a steam-driven air compressor which had a hand-operated cutoff valve. For some reason I was chosen as the man to run this compressor during the night shift. The reason for this strange choice could not have been because I was a licensed steam engineer, for no one there knew I had ever held such a license. Whether it was because they thought the job required no particular knowledge, or for the reason that no one else cared for a 12-hour night job all alone in the power house, I never knew.

The former engineer, who had operated the plant for many years, showed me all the intricacies of the machine and the job for a couple of shifts, until I was considered sufficiently informed to assume the great responsibility alone. The cutoff valve was set at one-half, and should never be touched, according to instructions. However, as soon as I was alone, I opened the throttle valve wide, carried a full 100 lb. of steam, and regulated the compressor by means of the cutoff valve, which saved me some labor in the way of firing the boiler. Next morning the old engineer came in unexpectedly and caught me in the act of regulating this valve. Words can hardly describe his horror and indignation that I should touch that sacred part of the mechanism. I would have something smashed, and might easily blow up the plant, if I did not follow instructions. Words from me only added fuel to the fire, and I was threatened with discharge. Later I had an opportunity of taking this question up with the manager, but he felt that I should continue to run the engine as it had always been run. Still later I explained the case to the master mechanic as lucidly as I could and in as many ways as I could think of. He was willing to admit that perhaps I might be correct theoretically, but practically they had found it best to leave the cutoff at one-half and regulate the machine by means of the throttle. It had always been done that way, and something might happen if I started to do differently. They all agreed that I would be fired should I persist. Consequently I had to use the throttle valve until all visitors had retired, and be sure that the cutoff was left at one-half when I went off shift.

Evidently the wise heads had some consultations on this point, for the old engineer later said in way of apology, "I suppose you fellers do learn a lot of things back East. I don't know as it would do any particular harm to move that there wheel, only we never do."

Dover, N. J., Apr. 16, 1919. A. O. CHRISTENSEN.

Calibration of Base-Metal Thermocouples

In the Mar. 22 issue of the *Journal* I note a letter from Prof. W. F. Dietrich, of Stanford University, in regard to an article of mine on the "Calibration of Mar. 8. I agree with Professor Dietrich that a of Base-Metal Thermocouples," published in the *Journal* correction factor must be applied to the cold-junction temperature of the rare-metal couple, as indicated, and this was done in the case of the sample calculation given, but mention was inadvertently omitted. That is, the temperature of 16.8° C., as given, was the corrected temperature, the factor used being 0.55, which is the correction factor for the particular couple used, in the range 650° to 1000° Centigrade.

The factor in the case of the base-metal couples was purposely neglected, because I consider it an ultra refinement when the normal errors in practice are taken into consideration.

I am aware of the fact that couples calibrated at one temperature may not hold the same calibration factor for another, but I think that my statement that the correction to be applied to the base-metal couple (10° F.) is correct. I had previously stated that it was desired to control the temperature within the range of about 1000° to 1600° F. It was also mentioned that the couple was calibrated within this range.

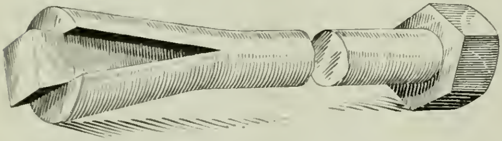
I agree with Professor Dietrich that I have carried my figures to more decimal places than necessary, and I would not do so in practice. It was done in the sample calculation merely to show the steps in detail.

One additional correction should be made at this time, also. The article read that I used one couple of Pt and one of Pt-Rh, whereas it should have read that there were two Pt + Pt-Rh couples used.

C. S. Crouse,
Professor of Metallurgy, University of Kentucky,
Lexington, Ky., Apr. 2, 1919.

Setting Anchor Bolts With Sulphur

The description of grouting an engine bed with sulphur that appeared in the *Journal* of Feb. 8 suggests another similar use of sulphur at mine power plants, i.e., that of setting an engine or hoist on an old foundation which has no appropriate anchor bolts. To do this, anchor bolts are prepared as usual, excepting that the bottom end is split but not opened out. Iron wedges are then made and driven into the split, just far enough to secure a firm hold. Holes are drilled in the foundation large enough to allow the bolt to go in easily. The bolt is inserted, and after the nut is placed in position to protect the threads, the bolt is driven down on the wedge, which forces the wings apart, as shown in the sketch. Molten sulphur is then poured in around the bolt, and in half an hour is set hard enough to hold the machinery in place.



METHOD OF PREPARING ANCHOR BOLTS

A man-hoist at the Esperanza mine at El Oro, Mexico, that handles triple-deck cages with 27 men per trip, has been anchored in place for over eight years by means of bolts set in this manner, with no sign of loosening yet. As noted in the article on grouting mentioned above, care must be taken in melting the sulphur not to overheat it.

Frederick MacCoy.
Jerome, Ariz., Feb. 15. 1919.

Improved Mexican Conditions

We noted with much interest the article appearing in the Mar. 22 issue of the *Journal*, by "American Engineer," and believe the closing paragraph summarizes the Mexican conditions better than any other article we have seen on the subject.

Operations on our properties in Mexico were suspended in 1914, but we have managed to protect the titles, and have recently succeeded in rebuilding the El Favor-Mololoa mill. Operations were started on Feb. 22. Only 15 of the 35 stamps are in operation, but the remainder of the mill will be completed at an early date. Shipments of high-grade ore were being made to the smelter while reconstruction was going on, and, altogether, 22 cars have been sent out.

The cost of marketing this ore is, of course, high under existing conditions, but at the present price of silver the transaction leaves us a satisfactory margin of profit. A number of our stockholders recently made a trip of inspection to the properties. The party was given special consideration and attention all through the country. It entered by the Port of Laredo, going through Mexico City, where a stop was made, and thence to Guadalajara, and made side trips out on the National lines and the Southern Pacific to our different properties. The return was over the same route. The party has traveled over Mexico for two weeks, both by train and mule, without accident or difficulty.

Makeever Brothers.
New York, Mar. 28, 1919.

Concerning Ricketts & Co., Inc.

Our attention has been called to an article on p. 542 of the Mar. 22 issue of the *Journal* headed "Dr. A. R. Ledoux." A sentence in this article reads as follows: "After the partnership with the late Dr. P. de P. Ricketts was dissolved, Dr. Ledoux continued to carry out professional work in the same office, the name of the firm being changed from Ledoux & Ricketts to A. R. Ledoux & Co." This is considered by our clients to indicate that, owing to the death of Dr. Ricketts, the firm of Ledoux & Ricketts dissolved, and that this dissolution happened only recently.

As a matter of accuracy, Dr. P. de P. Ricketts and Dr. A. R. Ledoux formed a limited partnership in the year 1881, which was to last for five years. At the expiration of this time, namely in 1886, the firm of Ledoux & Ricketts was dissolved by mutual consent, and the two firms of A. R. Ledoux & Co. and Ricketts & Banks were formed. The firm of Ricketts & Banks was later dissolved, and the firm of Ricketts & Co., Inc., was formed and we have been carrying on our professional work for a number of years, and still are carrying it on, with a greatly enlarged laboratory and staff. Our offices are at 280 Madison Ave. and our laboratories are at 7 Dutch Street.

Ricketts & Co., Inc.
New York, Apr. 3, 1919.

Ball Milling and Flotation

It would appear, from the letter published in the Mar. 8 issue of the *Journal*, that the writer, A. P. Watt, is unacquainted with the facts as to the operation of the Marcy mill at the experimental plant at Inspiration. To be correct, it was first used as an intermediate machine, but at the time of the carrying out of the flotation work under consideration it was producing a finished product.

I differ from Mr. Watt in his conclusion that the size of the sulphide particles in the overflow of the ball-mill product is determined by the classifier alone. Classifier capacity is of great importance in lessening the amount of overground material; but in overflow mills the sulphide particles show the same amount of overgrinding as the gangue particles, no matter what the classifier capacity is. This overgrinding does not affect the saving to any extent in flotation, but is a disadvantage in water concentration. In cyanidation, where the metals are, for the most part, contained in the sulphides, the overgrinding of the sulphide particles is, naturally, of considerable benefit.

C. T. Van Winkle.
Salt Lake City, Utah, Mar. 29, 1919.

Assayer and Chemist

New methods of analysis and experimental control are evolved from day to day; and the helpful influence of fresh ideas and old but pertinent facts clothed in new language or presented from a new point of view cannot be overestimated. A number of notes are appended dealing with a variety of subjects of interest to those engaged in laboratory work; but many other ideas fail to bring credit to their sponsors and do not achieve the broader purpose of successful experimentation for lack of publicity. Hidden lights are futile. The value of an effort can be estimated only after it has been made. The compilation of even a short note on a point of interest may open up avenues of thought and research, leading to further investigation and achievement. The intention to publish either facts or opinions should result in introspection and the cultivation of a greater degree of accuracy. No achievement is self-sufficing—it must inevitably fade in importance and be replaced by a desire toward a greater and more serious effort.

Analysis of Graphite Ores*

A sample, weighing 0.2000 to 1.0000 gm., depending on the relative amount of graphitic carbon present, is placed in a 100-c.c. evaporating dish with 25 c.c. of 1 to 1 HCl, heated over a hot plate for 15 min., filtered through a filter of ignited asbestos, and washed with hot water until free from chlorides. The filter and the residue are then transferred to a porcelain or platinum boat and dried on the hot plate. The boat containing the residue is transferred to the tube of a combustion furnace and burned in a stream of oxygen gas, the CO_2 formed being collected in a potash bulb with a 30% KOH solution. The combustion tube should contain some fused lead chromate to retain any sulphur that may be present.

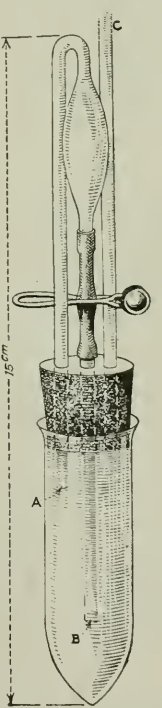
Rapid Carbon Dioxide Determination

By A. Graig†

Having occasion to test for small amounts of carbonate in factory control work, I found the apparatus to be described convenient, and the results obtained were fairly accurate for low percentages.

The generator shown in the sketch is made of a test tube shortened to a convenient length. The pipette bulb may be made by blowing out a piece of thick-walled tubing of small diameter to a capacity of about 2 c.c. The tube *A* extends below the stopper just far enough to connect a rubber tube. The tube *B* is made long enough to dip into a small beaker for filling. *B* and the pipette are connected by a rubber tube and pinch-cock, so that air from the generator replaces the acid falling from the pipette. *C* leads to the gas burette, for which I use two ordinary 50-c.c. burettes. *C* is continued in one piece, turned across and down, and stoppered into the top of one of the burettes, so that the generator hangs from it without other support, but is sufficiently flexible to allow of being shaken.

To fill the pipette, attach a rubber tube to *A* and suck the acid up through *B*. Concentrated HCl is best, as CO_2 is not appreciably soluble in the small amount used. Then, as a standard, weigh 0.2 gm. of ignited Na_2CO_3 into the dry test tube. A 50-c.c. graduate makes a convenient holder. Fill the open burette and raise it in the hand until the water rises to the "0" of the closed burette, leaving enough in the open burette for leveling. Close the stop-cock of one of the burettes, return the open burette to its stand, connect the generator, level, and read the burette, taking care not to allow the hands or breath to warm the inclosed air. Then open the pinch-cock of the generator, allowing the acid to fall drop by drop until the action ceases. Shake the generator by the pinch-cock to make sure that the acid has reached all the carbonate. Then level the burette and read it, taking the increase in volume



APPARATUS FOR DETERMINING CO_2

---

*Abstracted from pamphlet No. 3 of the War-Minerals Investigation Series, U. S. Bureau of Mines, by George D. Dub.

†American Reclaiming and Refining Co., Jersey City, N. J.

as CO_2. The volume of gas will be about 47 c.c., as under room conditions gases have almost exactly 90% of their standard weight. This is true, of course, only near sea level. The tests should then be made at once, without allowing the temperature of the room to change. Greater accuracy may be obtained, particularly when caustic alkalies are tested, if the generator is immersed in water at room temperature during the reaction and the reading of the burette, though time is saved if the heat developed is so small as to be negligible and this precaution is omitted. The result may be calculated by means of the following factors: 0.0830 ÷ c.c. of standard reading × c.c. of test reading = grams CO_2 in test.

Nomenclature of Sodium Compounds*

BY ROGER C. WELLS

The name soda was originally used for the basic part of sodium compounds to mean the oxide, Na_2O, the name being analogous to those of other oxides. However, it has long been used in trade for the carbonate and in household economy for the bicarbonate and the hydrated carbonate, known as sal soda, and is frequently applied indiscriminately to all compounds of sodium as "nitrate of soda." The better usage is to call such substances "sodium" compounds—for instance "sodium nitrate"—to prevent ambiguity.

The accompanying table gives the various trade names, the chemical formula of the important constituent, the usual percentage of the compound designated in the marketed product, and the ordinary chemical name.

TRADE NAMES AND FORMULAE OF SODIUM COMPOUNDS

Trade Name	Formula	Percentage	Chemical Name
Soda ash	Na_2CO_3	98-100 Na_2CO_3	Sodium carbonate.
Sodium carbonate monohydrat	$Na_2CO_3 . H_2O$	85-86 Na_2CO_3	Sodium carbonate monohydrate.
Sodium sesquicarbonate, trona	$Na_2CO_3 . NaHCO_3 2H_2O$	47 Na_2CO_3. 37 $NaHCO_3$	Hydrated sodium carbonate-sodium bicarbonate
Salsoda, washing soda, crystal carbonate	Na_2CO_3 $10H_2O$	37 1 Na_2CO_3	Hydrated sodium carbonate.
Bicarbonate of soda, baking soda, saleratus	$NaHCO_3$	99 3 $NaHCO_3$	Sodium bicarbonate or acid sodium carbonate
Caustic soda	$NaOH$	75-99 $NaOH$	Sodium hydroxide.
Soda lime	$NaOH+CaO$		Sodium hydroxide and calcium oxide.
Borax Tincal	$Na_2B_4O_7$ $10H_2O$	52.9 $Na_2B_4O_7$	Sodium tetraborate.
Sodium hyposulphite "Hypo."	$Na_2S_2O_3$ $5H_2O$	64$Na_2S_2O_3$	Sodium thiosulphate.
Yellow prussiate of soda	$Na_4Fe(CN)_6$	100 $Na_4Fe(CN)_6$	Sodium ferrocyanide.
Red prussiate of soda	$Na_3Fe(CN)_6$	100 $Na_3Fe(CN)_6$	Sodium ferricyanide.
Sodium nitroprusside	$Na_2Fe(CN)_5 NO. 2H_2O$	88 $Na_2Fe(CN)_5NO$	Sodium nitroprusside.
Salt cake	Na_2SO_4	98-100 Na_2SO_4	Sodium sulphate.
Niter cake	$NaHSO_4$	78 $NaHSO_4$	Sodium bisulphate or sodium acid sulphate.
Glauber's salt	Na_2SO_4 $10H_2O$	44.1 Na_2SO_4	Hydrated sodium sulphate.
Chile saltpeter Soda niter	$NaNO_3$	95-96 $NaNO_3$	Sodium nitrate.

Separating Mixed Oils†

BY PAUL W. PRATHER

As is well known to anyone who has to make a separation of mineral and saponifiable oils, one of the most troublesome conditions is the formation of an emulsion after shaking the soap solution with ether in a separatory funnel. The emulsion can be rapidly destroyed by the simple procedure of applying the hose of a good suction pump to the mouth of the funnel. In a few seconds the ether will boil and the emulsion disappears, leaving a sharp line of demarcation between the ethereal layer and the aqueous solution. If a piece of heavy-walled rubber tubing is used, of ⅜-in. outside diameter, so-called nitrometer tubing, a tight joint can be made by merely inserting the end in the funnel mouth.

Estimation of Cyanogen in Cyanide*

BY ROGER C. WELLS

Analysts are accustomed to determine only the cyanide radical in cyanides, as their value depends on the cyanogen content, but it has long been customary to report the cyanogen as potassium cyanide. As pure potassium cyanide contains 40% and sodium cyanide 53% of cyanogen, it follows that sodium cyanide may be reported as carrying more than 100% of potassium cyanide. This also allows very impure sodium cyanide to be sold as 97 or 98% potassium cyanide, but, needless to say, the potassium salt is not now largely used. Recently sodium cyanide has been selling on the basis of its actual sodium-cyanide content, the highest grade being 96 to 98% sodium cyanide (NaCN): or cyanogen 51 to 52%. The old "98% KCN" carried about 39% of cyanogen. Four pounds of sodium cyanide are therefore chemically equivalent as a solvent to about 5℔. of the old "KCN."

Parting Gold-Silver Prills

BY D. E. CHARLTON

The process to be described suggests a method which may be used in heating the porcelain crucibles containing the parting solution; and, where adopted, has resulted in a saving of heat and the elimination of unnecessary paraphernalia:

After "blicking" has occurred, the cupels are removed from the muffle, placed in the same relative position on an asbestos-covered board, and the buttons removed. The buttons are then brushed, weighed, and flattened if necessary, and dropped into the crucibles for parting. The latter are placed on the now partly cooled cupels, each button occupying its original cupel. Provided there are not too many buttons to be weighed, it will be found that sufficient heat is retained in each cupel to complete the parting, and the acid solution will not boil over unless the crucibles are placed in the cupels too soon after their removal from the muffle, or unless only a small amount of acid is used. The same method may be adopted for drying the prill, after the parting solution has been poured off and the gold washed, previous to brightening.

---

*Abstracted from "Mineral Resources of the U. S. 1917 II." p. 307

†Abstracted from *Chemist-Analyst*

*Excerpt from "Mineral Resources of the U. S., 1917—II." p. 326

Company Reports

New Cornelia Copper Co.

In the annual report of the New Cornelia Copper Co., L. D. Ricketts states that during 1918 the production of copper was as follows: Electrolytic cathodes, 31,264,642 lb.; returnable copper in cement copper shipped, 10,990,666 lb.; returnable copper in ore shipped, 4,694,831 lb.; makng a total of 46,950,139 lb.

Toward the end of the year a small amount of diamond drilling was authorized to the southwest of the developed orebody to determine the proper limit for stripping in the open-pit operations, and this development work has already opened up about a million tons of additional sulphide ore. A number of diamond-drill holes in the main orebody were bottomed in ore, and there is undoubtedly much ore under the developed ore which cannot be measured until further development work is done. The tonnage of completely developed ore remaining in the ground at the beginning of the year, together with tonnages that have been extracted, is shown in the following table:

ORE RESERVES OF NEW CORNELIA COPPER CO.

	Tons	Average Estimated Grade Per Cent. Cu.
Oxidized ores	11,960,145	1.568
Sulphide ores	40,302,457	1.587
Total	52,262,602	1.579
During the year the following tonnages of ores were mined:		
Oxidized ore to the leacher	1,775,000	1.465
First class ore to Douglas	84,161	3.39
Total	1,859,160	
Tonnage remaining	50,403,441	
During the year there were developed ores as follows:		
Sulphide ores	916,980	1.573
The tonnage of ore estimated as fully developed at the end of 1918, therefore, is	51,320,421	

When the Ajo Consolidated property was purchased and absorbed it became evident that a greater monthly production was justified than the total of 3,000,000 lb. originally planned, and it was found necessary to undertake certain construction which would permit increase of output and prevent overstrain. In producing 2,250,000 lb. or more of electrolytic copper it was found necessary tc run all three of the motor-generator sets continuously. A fourth unit was accordingly ordered and is now being installed. A fifth unit of three Symons disk crushers has been added to the fine-crushing plant. This will permit the operation of four at a time, permit the work of crushing to be completed within 16 hours, and greatly decrease the cost of repairs and upkeep of the plant.

Two additional reduction towers for the reduction of ferric iron by sulphurous-acid gas were added to the four originally installed. These towers are of larger size and equal in capacity the four towers originally built. These towers were necessary to decrease power consumption in the electrolytic tank house and because of the larger output of copper.

It was found that washing the leached ore with four wash waters was insufficient. An additional sunken concrete tank of 500,000 gal. capacity was accordingly built, providing storage for a fifth water wash. This tank has been put in operation and has resulted in an increased saving of nearly 1 lb. of copper per ton of ore.

At the main pumping plant at Well No. 1 a new station has been cut and a pump similar to the pump now in use, but of somewhat larger capacity, is to be installed. This pump provides an adequate spare and insures a steady water supply. A small duplicate air compressor, an additional steam shovel, a locomotive, and 16 new pit cars for transporting the ore to the crushing plant have been added to the mine equipment.

In the course of two years, sulphide ores will be uncovered in the open pit. In about three years the mine can produce as much as 5000 tons a day of this class of ore; and, after that, the output should rapidly increase until a capacity of 10,000 tons a day of sulphides can be produced. The question of the proper way to treat this ore is most important. In spite of the high cost of material, therefore, an appropriation was obtained from the board of directors (of $160,000) for the construction of a test mill. It is not the intention to run this mill at the start for more than one shift a day, but it is necessary to have a mill of this size, because it must be furnished with full-sized machines in order that the results obtained may be relied upon and duplicated in the final plant. Little difficulty is expected in obtaining knowledge as to a suitable process.

There is no doubt that ores similar to those now available are easily amenable to flotation. The chief problem to be solved is the determination of the proper method of grinding the ore; the actual fineness to which it should be ground and the proper machines with which to do it. The ore is hard, and this problem is an important one. The test mill will be started sometime during the spring of 1919.

The only construction work that may be recommended during the year 1919 is a new or modified plant for the cheap handling of the cement copper. Permanent construction of a plant of this kind has been delayed in order to develop a practicable process. This has apparently been done; and, with a proper system of tanks and the introduction of mechanical handling of cement copper, costs can undoubtedly be reduced and expenditures abundantly justified.

Calumet & Arizona Mining Co.

In the annual report of the Calumet & Arizona Mining Co., L. D. Ricketts stated that during the year there was produced at the company's smeltery 83,442,625 lb. of fine copper, of which 49,432,984 lb. was the product of the Calumet & Arizona Mining Co. and the remainder was produced from New Cornelia and other custom ores. The smeltery also produced 32,682.35 oz. of gold, and 1,109,411.50 oz. of silver.

In addition, 60,733 tons of sulphide ore returned 1,848,568 lb. of fine copper, 2,107.524 oz. of gold, and 56,069.37 oz. of silver.

The supply of labor throughout the year has been inadequate. The average number of men employed underground prior to June, 1917, was about 1450, with a surplus of miners; whereas during the year 1918 the average was about 1140, with no surplus. With this scarcity of labor there was a marked decrease in efficiency, which is estimated to have been fully 30% less than when the labor supply has been abundant.

The most important development work undertaken, aside from that in connection with the known orebodies, was in the long drifts on the 1400 and 1600 levels, to develop the territory adjacent to the recent developments in the Denn mine. These developments are important because they are at least 2000 ft. from any of the known orebodies, in entirely new territory. This ground is regarded as most promising for the development of important orebodies.

The Campbell shaft was closed down in 1917, on account of the scarcity of labor, and work in the sinking of this shaft to the 2000-ft. level ceased.

The reports of the engineers show that the company has somewhat increased the tonnage of ore in sight during the year. The war closed so near the end of the year that there has been no visible effect on costs or wages, but there is no doubt that the result will be a reduction in wages and a decided increase in the efficiency of the men.

The smeltery has worked continuously, with a decided falling off in tonnage of custom ore as well as of domestic ore. As the ore is mined from deeper levels there is less and less oxidized ore and more sulphide, and it is becoming evident that it will be more advantageous to smelt all the ore in reverberatory furnaces if it be possible to solve the problem of crushing the lump ore cheaply and expeditiously, because the company will be able to obtain lower ton costs and better recoveries. This subject is receiving serious consideration.

The new 3000-kw. turbine operated satisfactorily during the year. The transmission line has been strengthened, and heavier transmission wires have been installed. In spite of some delays and a close-down for a considerable time to replace transmission wires, a continuous average of over 1000 kw. of electric power produced from steam generated from the waste heat from the reverberatories has been sent to the mine. At the present time it is not practicable to consider the expansion of the power plant, on account of slow deliveries and high costs, but there is no doubt that at as early a date as practicable the company should add at least one more 3000-kw. turbine and furnish more power to the mines. In the course of the next year this will become an important question, because either the power plant at the smeltery will have to be increased, or the power plant at the mines, which is antiquated, must be replaced. The power plant should be centralized at Douglas as far as possible.

Shattuck Arizona Copper Co.

The Shattuck Arizona Copper Co. reports a gross income for the year ended Dec. 31, 1918, of $2,663,082.83. Subtracting costs amounting to $1,883,424.04, which include expense of development work, refining and marketing of metals and general administrative disbursements, the net income is $784,658.79. Reservations for depletion of mine and depreciation of plants and equipment are placed at $541,191.47, and, deducting this sum from the net income, there is left a net profit for the year of $243,467.32. Dividends paid amounted to $437,500. Adding the net profit to the balance on hand Dec. 31, 1917, and deducting dividends, a balance, as of Dec 31, 1918, of $809,095.83 remains.

During 1918, the report shows that 93,967 tons of copper ore and 29,277 tons of lead ore were mined; 93,995 tons of copper ore and 29,106 tons lead ore were shipped, and 94,092 tons of copper ore and 28,550 tons of lead ore were smelted and treated. Development work done during 1918 was about the same as in 1917, and totaled 15,125 ft., the work being distributed on nine levels. The milling plant for low-grade lead ores began operation on July 1, 1918.

Osceola Consolidated Mining Co.

Total copper produced during 1918 by the Osceola Consolidated Mining Co. amounted to 15,919,647 lb. at a cost of 17.67c. per lb. For 16,380,996 lb. of copper delivered, an average of 24.41c. per lb. was received. Total net income from 1918 operations was $1,203,953.42; taxes were $660,882.44 (estimated) and dividends paid amounted to $961,500. Rock treated amounted to 1,194,967 tons, at a cost, including mining, transportation, stamping and taxes, of $1.78 per ton. Refined copper per ton of rock treated was 13.3 lb. Underground work during 1918 consisted of the following: Osceola, No. 6 shaft, 1219 ft. of openings; North Kearsarge No. 3 shaft, 122 ft. of openings, and No. 4 shaft, 379 ft. of openings.

Mass Consolidated Mining Co.

The Mass Consolidated Mining Co. reports for the year ended Dec. 1, 1918, that its income was $796,638.33 and expenditures were $810,967.81. Additions to buildings and equipment cost $13,703.50; insurance and real estate sales amounted to $2434.16. Together with the balance on hand Jan. 1, 1918, total cash assets, as of Dec. 31, 1918, were $295,773.01. Scarcity of labor hampered operations and increased costs. Development work totaled 1945 ft. of drifting and 337 ft. of crosscutting. A total of 196,456 tons of rock was stamped, and produced 5,509,130 lb. of mineral. This amount gave a total refined copper production of 3,403,827 lb. at a cost of 23.82c. per pound.

Colorado Fuel and Iron Co.

The 27th annual report of the Colorado Fuel and Iron Co. states that gross receipts from sales during 1918 totaled $48,233,574.51; operating expenses were $40,769,206.12, and net earnings, $7,464,368.39. Other items are: Income from sources other than operation, $636,742.26; interest, taxes, sinking funds, and similar charges, $2,781,088.83; depletion, depreciation, and value reductions, $2,187,974.08; estimated amount of income and excess profits taxes, $400,000, and dividends, (8% on preferred and 3% on common stock), $1,186,875.40. After making the proper additions and deductions, $1,545,172.34 remains as a credit to profit and loss.

The sum of $607,862.99 was spent for additional tenant houses and club houses for employees; three increases in wage rates were made during the year, and an eight-hour day was established at the steel plant. The report shows that 809,491 tons of iron ore and 4,455,881 tons of coal were mined; 452,986 tons of limestone quarried; 432,406 tons of pig iron produced, and 800,638 tons of coke manufactured. Finished iron and steel production amounted to 478,916 tons.

The Industrial Conference

THE Editorial Conference of the New York Publishers' Association held an important symposium on industrial and economic conditions on Apr. 11 in New York. Much credit is due to the executive committee of the conference for the careful preparation of an interesting and important program.

The subjects and speakers were: "Recent Advances in Industrial Management," by John Calder; "Problems of Our Foreign Trade," by G. A. O'Reilly, of the Irving National Bank; "Necessity for Organization in the Settlement of Labor Disputes," by V. Everit Macy, president of the National Civic Federation; "Industrial Democracy," by Dr. Charles A. Eaton; "Post-War Financial Problems," by Francis H. Sisson, vice-president of the Guaranty Trust Co.; "Prices, Yesterday, Today, and Tomorrow," by O. P. Austin, chief statistician of the National City Bank, New York; "Industrial Coöperation," by Charles P. Steinmetz, consulting engineer of the General Electric Co.; "Stabilizing the Dollar in Purchasing Power," by Professor Irving Fisher, of Yale University.

Though all of the papers were of considerable interest, space is not available for extended comment, and extracts are given from two of the papers only.

From the address of Francis H. Sisson, the following significant paragraphs are taken:

"We gradually are comprehending, also, that whether or not there shall be a formal organization of a League of Nations, we are bound to other peoples by innumerable and far stronger ties than those which any international covenant could impose. There has, indeed, been no more convincing proof of this fact than that recently provided by the withdrawing of governmental support from sterling and franc exchange. The larger significance of what was seemingly only a financial operation is daily becoming more apparent. It marks in a dramatic fashion the shifting from a war to a peace basis, not alone in financing, but also in practically every economic phase of international relations.

"It is one of the most immediate vital post-war financial problems, and concerns the importer and manufacturer of domestically consumed products as well as the exporter and manufacturer of goods which are sent abroad—for it creates an invisible tariff against American goods in England and France, which sooner or later, but inevitably, will affect our domestic trade. We are awakening to a realization that the prosperity of the country today depends upon increased production and, consequently, that it behooves us to expand our foreign markets instead of letting them contract.

"If we are to increase our production, which, as I have pointed out, is necessary to the maintenance of our prosperity, we cannot take goods in full exchange for our products. Besides, we are nearer than any other people to economic independence, and do not need imports in anything like the quantities necessary to settle the trade balance in our favor

"Payment in gold is as impossible as it is undesirable. The value of the excess of our imports over our exports in January alone exceeded the total value of gold produced in all countries except the United States during 1918. In addition, we now hold more than one-third of the world's reserve of gold coin and bullion, having added about $1,500,000,000 to our store of the precious metal in the last four years. We could not with safety drain other nations of their remaining low stock of gold if we would, for, as we are already their creditors to the extent of about $12,000,000,000, it is imperative for us to help them maintain their currency on as sound a foundation as is practicable under existing circumstances.

"The granting of credits to purchasers of our goods will very materially aid in solving the immediate problem of financing foreign trade, but at best it can be only a temporary expedient. Credit, as you are well aware, is merely the giving of a present value in exchange for a promise to pay. It serves to postpone payment of indebtedness to a more propitious time for the buyer or borrower, but it does not settle the account."

The address of O. P. Austin, on "Prices, Yesterday, Today, and Tomorrow," was particularly interesting and is summarized in the following:

"The chief causes of the world advance in prices appear to be the inflation of world currency, coupled with the 'scarcity demand' and the consequent advance in labor costs. The prospect of material reductions in the near future would depend upon the possibility of the removal or modification of the chief causes of the advance.

"Stated chronologically, the chief causes of the advance seem to have been first, the 'scarcity demand' for war materials, food, clothing, manufactures, and manufacturing materials and the labor required for their prompt production; but this was quickly followed by an enormous world inflation, in which paper money with a face value of $36,000,000,000 was emitted by the printing presses of the countries at war, and the legal tender circulating medium of the world was thus advanced from $15,000,000,000 in 1913 to over $45,000,000,000 in 1918, most of the gold formerly in circulation passing into the vaults of the governments and their great banks as a partial basis for this greatly enlarged paper currency.

"The enormous inflation thus brought about, coupled with the continued 'scarcity demand' for food, manufactures, manufacturing material, and labor required for their production, was accompanied by great advances in prices, first in the materials for the war, the advances gradually extending to other articles which their respective producers must exchange for those in which the advance had already occurred, and this made the advance in prices worldwide, and applied to all classes of articles, irrespective of their immediate relation to the requirements of the war.

"The chief question involved in a consideration of the future of prices is whether there is a prospect of an early removal of the causes of the advance. The 'scarcity demand' still continues in everything except war supplies, and even in that line is not entirely ended, as there are about 15,000,000 men still under arms. The demand for food is as insistent as ever, owing to the disordered state of the population of Central Europe and the impoverished condition of the neglected soils of all that Continent, and the factories and empty shelves of all the world are clamoring for new supplies, which ran low, during the long extended war period.

"As to a material reduction of the inflated currency, the prospects for the near future do not seem encouraging, in view of the fact that the 1919-20 'budgets' of the principal countries of the world, now being made up, call for fully four times as much money as those of the year preceding the war, suggesting that the governmental demands in the first peace year after the war will be about $50,000,000,000, as against about $12,000,000,000 in 1913, and that the governments which must quadruple their demands upon their taxpayers and prepare for a reduction of their debts will hesitate about reducing the amount of money in circulation.

"Though there may be a slight downward trend in the general price level, and distinct reductions in certain articles, the difficulty in removing the chief causes of the advance suggests that the general reduction in prices in the near future may not be as rapid as had been anticipated."

South Dakota's 1917 Gold Production*

The output of gold from mines of South Dakota during 1917 was 356,244.88 oz., valued at $7,364,233. The decrease in the output for the year was 4,663.88 oz. in quantity, and $96,411 in value. The output of placer gold was 44.70 oz. There were 30 producing mines, of which 23 were deep and 7 were placer, a decrease of 6 deep and 9 placer mines as compared with 1916.

The total quantity of ore mined and treated in 1917 was 1,868,310 short tons, averaging in recovered gold 0.1907 oz., or $3.94 per ton, as compared with 1,870,783 short tons, averaging $3.99 per ton, in 1916. The mills of the state treated 1,867,583 tons of ore, which yielded as bullion $7,350,460 in gold and 181,051 oz. of silver, valued at $149,186, an average recovery per ton of $3.94 in gold and 0.10 oz. silver, as compared with $3.98 in gold and 0.11 oz. in silver in 1916. The crude ore shipped to smelteries amounted to 727 tons, having an average content per ton of 0.855 oz. of gold, valued at $17.67, and of 7.85 oz in silver.

GOLD PRODUCED AT MILLS IN SOUTH DAKOTA IN 1917

Process	Ore Treated, Short Tons	Gold in Bullion, Fine Ounces
Amalgamation	1,677,523	228,018 51
Cyanidation	(a) 1,809,417	127,560 01
Total		355,578 52

(a) Includes 1,619 457 tons of tailings from part of ore amalgamated

In 1917 the mines in South Dakota consumed 13,199 lb. of quicksilver and 384,938 lb. of sodium cyanide, equivalent to 1 lb. of quicksilver, for every 17.28 oz. of gold, or every 127 tons of ore treated, 0.21 lb. of sodium cyanide for every ton of ore or tailings treated, and 1 lb. of cyanide for each 0.33 oz. of gold recovered.

The Homestake mines and mills were operated without interruption. The shaft on the Oro Hondo mine, adjoining the Homestake property, was sunk from 2000 ft. to 2200 ft., and considerable drilling and diamond drilling were done. The Golden Reward mill was operated steadily on siliceous ores obtained from its own mines. The Mogul mill was operated steadily, chiefly on custom ore. The Trojan mill was operated continuously on company and custom ore. The Bismarck mine and mill were operated for a short period. The Wasp No. 2 Co. did not operate its mine or mill during 1917, and the mill has been dismantled. The New Reliance mine and mill were idle. The Deadwood-Standard mill was operated on ore from the Elk Mountain mines during part of the year.

A small output of placer gold was made in Lawrence and Pennington counties. Small shipments of gold ore were made from the Keystone district.

The Victory Loan Cannot Fail

We have built a great arch across the world. Into it have gone the traditions and the hopes of the American people. Men and munitions and billions in gold are parts of it; the blood-cemented friendship of the civilized nations of the world is in it, and the world's future rests upon it.

Only the keystone of the arch remains to be put in place, finishing the task and binding the whole together.

That keystone in the Victory Loan.

What if we fail to raise it in triumph?

First, and most impossible, such a failure would mean the repudiation of the men who have died for us, our own men. It would mean ingratitude and an unequaled hypocrisy.

Second, such a failure would mean the disruption of our industries, and, as we and our Allies are interdependent, their industries as well.

With one accord, the business of America turned from its accustomed channels to the winning of the war. Billions of dollars were spent by the Government, and many bills remain unpaid, for work done and for goods delivered. Until these bills are paid the creditors will be crippled. The Victory Loan will pay them.

It is argued that if the Loan fails, the money can be raised by taxes. But taxes cannot be collected from a business that, for lack of money, is inactive. Taxes will not solve the problem.

The Allies owe us more than ten billions of dollars. Why not call these loans? Common decency forbids hitting a man when he is down; and the Allies are down, financially. The war has swept their treasuries bare, and two of them are sorely hurt. Consider France, with her five richest departments devastated; Belgium, overrun and ruined; England, strained to the breaking point. They need every penny we have loaned them for the rehabilitation of their own industries. If we demanded payment from them now, we should not only prevent the resumption of that production that will pay their debts, but we should make it impossible for them to buy from us, and so further hobble our own trade at a time when we need it most. We cannot ask the Allies for repayment now.

If the Victory Loan fails, the arch falls, for no arch can endure without its keystone. No heavier than the rest—no larger—it is the heart of the great structure we have raised.

If the Victory Loan fails, our country might plunge into an economic chaos, and, because our country is the richest and strongest of all, the rest of the world, harried and war-worn as we are not, might be carried with us.

Daily Production of Cartridges at one of the large plants of the Remington Arms-Union Metallic Cartridge Co., at Bridgeport, Conn., at the peak of the productive period consumed 40 tons of lead, 17 tons of powder, 59 tons of copper, 22 tons of zinc and 2 tons of nickel, according to the "New York Tribune."

---

*Abstracted from a Mines Report by Charles W. Henderson, to form a section of "Mineral Resources of the U. S., 1917—Part I," U. S. Geological Survey.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Exports of Mining Machinery

The exports of mining machinery from the United States during January, 1919, were as follows:

Countries	Oil-Well Machinery	All Other Mining Machinery
France		$7,510
Italy		8,793
Norway	$158	67,250
Spain	...	36,641
England	500	36,874
British Honduras	....	75
Canada	6,442	142,639
Costa Rica		3,497
Guatemala	...	2,591
Honduras	58	2,788
Nicaragua		85
Panama		133
Salvador	...	980
Mexico	11,064	112,224
Newfoundland and Labrador	...	775
Trinidad and Tobago	28,741	...
Cuba	17,135	24,013
Dominican Republic	15,605	987
Argentina	5,231	2,278
Bolivia	...	16,773
Brazil	1,933	4,896
Chile	...	64,852
Colombia	277	4,349
Dutch Guiana	....	2,182
Peru	3,746	44,502
Uruguay	54	.....
Venezuela	293	...
China		13,602
Chosen		2,685
British India	568	9,719
Straits Settlements	....	3,760
Dutch East Indies	13,299	5,511
Japan	......	28,585
Australia	1,374	58,181
Philippine Islands	....	20,367
Belgian Congo	....	40,587
British South Africa	....	157,788
Portuguese Africa	....	28,402
Totals	$106,478	$956,874

Award to Edward R. Stettinius

General Pershing's citation in awarding the Distinguished Service Medal to Edward R. Stettinius reads as follows:

> For exceptionally meritorious and distinguished services. As member and chairman of the Advisory Liquidation Board of the A. E. F., he had a guiding influence in the determination of important Army policies. He gave useful coöperation and suggestions in connection with the establishment of the finance section of the General Staff, formed to coördinate the business and financial interests of the Army. With conspicuous ability he assisted in outlining the plans for inter-Allied and international settlements of great magnitude. His assistance to the A. E. F. in varied and important matters was invaluable.

Resumption of Trade With Austria

Acting concurrently with the authorities of the other associated governments, the War Trade Board announces that persons in the United States are permitted, on and after Apr. 2, 1919, subject to the rules and regulations of the War Trade Board, to trade and communicate freely with persons in German-Austria.

In accordance with this authorization, applications will now be considered for licenses to export or import all commodities to consignees or from consignors, except that, for military reasons, the importation into German Austria of a number of commodities will be restricted, and export licenses for the same will be granted only in exceptional cases.

American exporters are advised that merchandise is permitted to be exported to German Austria only upon the understanding that it is intended to supply the internal domestic needs of that country; and that, without the consent of the Inter-Allied Trade Committee at Vienna, the reëxportation of such merchandise from German Austria to countries with which commercial relations are not authorized is forbidden. Further, such reëxportation constitutes a violation of the Trading With the Enemy Act.

For the exportation of commodities to German Austria, applications should be filed on Form X-A. No supplemental information sheet will be required, unless the commodity is a manufacture of gold, in which case Supplemental Information Sheet X-29 should be attached. For importations into the United States from German Austria, individual import licenses will be required, in accordance with the regulations applicable to imports from neutral European countries.

The War Trade Board has received no official advices concerning the regulations governing importations into German Austria, and prospective exporters should therefore communicate with their customers abroad before making definite commitments, so that the importers may comply with any import regulations that may be in effect.

Postal communications should be addressed via France or Italy or Switzerland, and sent either on French or Italian licensed liners carrying mail. Cablegrams and cable remittances should be made via French cable lines. Merchandise should be shipped on vessels proceeding directly to Adriatic ports, preferably Trieste.

British Import Restrictions

The War Trade Board announced, for the information of exporters in the United States, that it has been informed of the following changes in the import regulations of Great Britain:

The following commodities, which heretofore have been importable only under special license, are now among a number which may be imported freely under general license: Abrasives, abrasive cloths, acetic acid, all kinds; antimony ore, barytes, diatomite, electrodes, emery stones, magnesite, nickel.

In making the above announcement the War Trade Board wishes to call attention to the fact that it is not in a position to speak authoritatively on foreign import restrictions, but is merely transmitting the information for the convenience of those on the War Trade Board's mailing list. Inquiries with regard to foreign import regulations should be addressed to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Permission to establish rates on bullion and copper matte dependent upon value has been granted by the Interstate Commerce Commission to apply from Mexican border points to St. Louis and to East St. Louis. Similar permission was granted to cover shipments of ore from Silver City and other stations in New Mexico to Peoria, Illinois.

The Pratt Claim Under the War-Minerals Relief Act

Washington Correspondence

In support of their claim for $900,000 under the War-Minerals Relief Act, N. P. Pratt and his brother, George L. Pratt, the owners of the Chestatee Pyrites and Chemical Co., of Georgia, appeared on Apr. 15 and 16 before the War-Minerals Relief Commission in Washington. Edgar Watkins, an Atlanta attorney, also appeared in their behalf. The hearing was before the full commission. The testimony showed that operations were begun on the property late in 1916 without any request having come from the Government. Preparations were made to work the pyrites deposit on a comparatively small scale, but, following a visit from Fuller Calloway, representing the Secretary of the Interior, and after George L. Pratt had conferred personally with Secretary Lane, operations on a much larger scale were begun.

The claim had been carefully prepared, and the amounts expended prior to the visit of Mr. Calloway were separated from the expenditures thereafter. It was the intention of the owners to transport their product by motor truck to the railroad, 13 miles away. This method, however, limited shipments from the mine to 50 tons daily. Under the enlarged plan a railroad spur at a cost of nearly $200,000 was built to the mine.

The equipment included a concentrating mill of a rated capacity of 600 tons daily, and a dam to make possible the use of water for power. The company was just beginning operation under its enlarged program when the armistice was signed, with the result that the product, which had brought as high as 35c. per unit, fell off rapidly in price, with all prospects indicating that it cannot operate when Spanish pyrites begins to come into the market.

The commission insisted on great detail. The question, however, seems to be entirely one of amount. Apparently it is conceded by the commission that the claim comes, unquestionably, under the act. One of the reasons for taking it up first was that the claim has been excellently prepared. It is expected that there will be few claims which can show so clear a case in the matter of compliance with a governmental request. George L. Pratt testified that Mr. Calloway, in the presence of Secretary Lane, told him he would be a slacker if he did not undertake the full development of his property. That Mr. Calloway, who is one of the most prominent business men in Georgia, had full faith in the successful outcome of the venture was indicated by the fact that he offered to invest $200,000 of his own money in the enterprise. In addition to the direct requests from the Secretary of the Interior and his representative, other evidence was introduced to show that the Government was unusually interested in securing the product of the mines. The Secretary of Agriculture overstepped all technicalities and undertook extensive road-building operations to facilitate deliveries by motor truck. At the request of the War Industries Board, C. E. Juhlin, a mining engineer in Government service, was sent to the property, where he mapped out plans for ore development which were followed precisely.

A stenographic record is being made of all proceedings at hearings. Counsel for the claimants was allowed to take an active part in the first hearing, and it is safe to conclude that the commission will make no objection to the employment of attorneys if claimants deem it wise. The commission, however, is anxious to have it known that claimants without attorneys will have every opportunity to get before the commission all the facts surrounding their cases.

Mine Reconstruction in France

Although the securing of coal from the Sarre Valley will permit some activity in the iron industry in Alsace-Lorraine, Westphalian coal must be obtained if the industry is to be brought to full efficiency, in the opinion of Frank H. Probert, the dean of the College of Mining of the University of California, who has just returned from a visit to Europe. Professor Probert, who is consulting engineer of the Bureau of Mines, visited the mining areas in the devastated regions as a member of the Bureau of Mines committee which is studying the problems presented in the rehabilitation of mines there.

The physical damage done to the iron mines in Alsace and Lorraine, says Professor Probert, was not great. The principal injury has been caused by extracting the ore without thought of the permanency of the work, or advance development. Much time will be required to replace the steel plants, most of which were subjected to scientifically conducted destruction. Ample proof of the wilful nature of this destruction is in the possession of the Allied military authorities.

Those plants which can be operated must depend on German coal. Professor Probert is hopeful that an arrangement can be made which will permit of the importation of Westphalian coal. The absolute destruction of the coal mines in the Pas de Calais section makes it necessary to use either Westphalian coal or coal from the Sarre Valley. The Sarre mines, however, produce a poor quality of coking coal. It will not be possible to operate blast furnaces efficiently unless provision is made for the introduction of better coal.

Professor Probert estimates that it will be five years before it will be possible to dewater and reopen the mines in the Pas de Calais section, and from 10 to 15 years before they can be brought back to pre-war production. The flooding of the eastern end of the district offers the greatest problem in reclaiming these mines. It will be necessary to remove approximately 25,000,000 cu.m. of water. Although it is not known how much quicksand has come into the mines, Professor Probert believes that it will be possible to reclaim most of the old shafts and laterals. After making his inspection, Professor Probert reported his findings to the American Peace Commission.

Brazilian Manganese Industry

Exports of manganese ore from Brazil during 1917 were greater than during any previous year, according to a supplement to *Commerce Reports*, and amounted to 532,855 metric tons, all of which was shipped to the United States. The accompanying table shows manganese exports from Brazil during the years 1902 to 1917, in metric tons.

Year	Tons	Year	Tons
1902	157,295	1910	252,958
1903	161,926	1911	173,941
1904	208,260	1912	154,870
1905	224,377	1913	122,300
1906	121,131	1914	183,630
1907	236,778	1915	288,671
1908	166,122	1916	503,130
1909	240,774	1917	532,855

The Pan-American Conference In Washington

The governing board of the Pan-American Union on Apr. 9 decided to hold an important conference in Washington during the latter part of May or the first part of June. Invitations will be extended to the commercial and financial experts of all Federal departments, to the consular, commercial, and financial representatives of the Latin-American governments in the United States, to the United States Chamber of Commerce, to the National Foreign Trade Council, and to such organizations, firms, and individuals as are interested in the development of Pan-American trade.

It is expected that between 1000 and 2000 delegates will attend and that the opening and general sessions will be addressed by the President, the secretaries of State, of the Treasury and of Commerce, the Latin-American ambassadors, ministers, and consuls, senators and representatives, and heads of the Shipping Board, War Trade Board, War Finance Corporation, Federal Trade Commission, Federal Reserve Board, Tariff Commission, Council of National Defence, and other high officials.

Director General Barrett, in discussing the proposed conference, expressed a conviction that it will do more than any other recent influence to clear the way, after the confusion of the war, for a great and impending development of Pan-American commerce.

Price Stabilization

Overshadowing all other matters in official interest at Washington in the last week has been the controversy between the Railroad Administration and the Industrial Board of the Department of Commerce over the matter of price stabilization. The discussions have been followed closely by all industries, as the concentration of buying power in the unified administration of all railroads has brought many industries face to face with a most serious situation.

Although the whole controversy has centered around steel rails, it was really the coal operators who brought the question to a head. They declined to enter into any agreement with the Industrial Board until absolute assurance could be given that the Railroad Administration would be a party to the agreement. A number of statements have been issued in the matter, but the one by George N. Peek, the chairman of the Industrial Board, is regarded as being of unusual interest. It clearly outlines the issues in which so many industries are vitally interested. Mr. Peek's statement, slightly abridged, is as follows:

"The Industrial Board was formed to carry out a well-defined industrial policy to which the Government, represented by the President, the Cabinet and the Director General, was fully committed. There is no ambiguity either in the record or in the minds of the people of the United States as to just what that policy is. It is to avoid industrial stagnation pending a return from war to peace prices, to start the wheels of industry, to give employment to labor, to reduce the cost of living, to insure prosperity. Neither is there any ambiguity as to the methods to be employed in accomplishing this end. A scientific study of costs of production is to be made. Upon these studies of costs, prices of basic commodities are to be determined which shall be as low as cost of production will permit, which shall squeeze out all speculative or opportunist profit, and upon which industry can begin operations without fear of a considerable drop in the market. This policy and method are viewed by our people as the first constructive, comprehensive, and direct attempt that has been made by the Government to reduce the cost of living and secure fairness in trade. The announcement of the steel prices was immediately reflected by increased buying, and the new governmental policy and method thus were far on the way toward justification and success.

"To the complete success of this plan, however, there was one absolute essential: that the governmental departments should express the confidence of the Government in the execution of this most important policy. Especially is this true in respect of steel rails, in the buying of which the Government, through its control of the railroads, consumes a large percentage of the output.

"At this late date in the execution of the plan this important essential to its success has been denied by the Director General of Railroads, and by that denial the labor of the Industrial Board is set at naught and the Government is exhibited as setting up an industrial policy with one hand and destroying it with the other.

"Considering the first of the Director General's reasons for refusing to accept the steel prices—that the Industrial Board has no right to impose a price on the Railroad Administration—the technical prerogative of the Railroad Administration must be and always ha been cheerfully conceded by the Industrial Board. But presuming the Government to have been committed to this important industrial policy, the board feels that the Railroad Administration is under a powerful, if not a compelling, obligation, either to have the governmental policy abandoned by the same source that announced it, and to assume full responsibility for the inevitable effect of such a step, or to support the policy, or to demonstrate that the Industrial Board has failed in its function and that the prices announced by the board are not fair.

"This brings one to the second of the Director General's reasons for his grave action—that '*in his opinion*' the prices are '*too high*.' The significance of this expression cannot be overlooked.

"A representative of the Railroad Administration is a member and a part of the board. Contrary to Mr. Hines' impression, this representative did not maintain that the prices of steel generally were 'too high.' He finally dissented only on the price of rails. That is not, however, the circumstance of greatest significance. Throughout the discussion, from its earliest word to this latest pronouncement, the figures representing costs of production were constantly available to the Railroad Administration's representative, and the basis upon which conclusions have been reached has been repeatedly presented to the advisors of the Director General and to Mr. Hines himself. Never have those figures been contested, never have additional or contradictory data been presented, never has the argument of the Railroad Administration been addressed to those figures nor to the conclusions drawn from them by the board. Repeatedly all these gentlemen have been urged to bring forward any facts which would assist the board in reaching a conclusion on prices lower than those approved, and never has this urging proved fruitful. The answer of the Railroad Administration has ever been, as it is today, that the price at which the Railroad Administration will buy is within its own discretion and that '*in its opinion*' the prices approved by the board are '*too high*.'

"In fairness to the Railroad Administration, it must be admitted that, using the full effect of its power of monopolistic buying, it might secure a price on rails somewhat lower than that announced by the Industrial Board. The figures stand to prove, however, beyond all question, that such a price would be lower than production costs of any but one or two of the most highly organized, powerful, and lowest-cost producers. For example, the pre-war price of rails was $30. The increase over pre-war costs of production, for the United States Steel Corporation, in direct labor alone, excluding labor in transportation, is reported by that corporation to be $19.48 per ton. The price approved by the Industrial Board on rails was $47, or $2.48 less than the increase of cost of labor alone would account for.

"The inevitable result of the use of the enormous buying power of the Railroad Administration to reduce any price would be to create a situation which would have to be met by increasing of prices to the public, by throwing all railroad business into a monopoly of powerful producers, or reducing wages.

"In the opinion of the majority of disinterested men, all these results are highly undesirable, and are, of themselves, gravely inimical to industry and to the public welfare. These results alone are, however, of an importance relatively incomparable to the vastly greater harm inherent in the frustration of the industrial policy of the Government, and the forced return to the period of commercial and industrial stagnation which has continued since the signing of the armistice and which threatens to continue and grow worse in the absence of a strong governmental policy alleviating it.

"Doubtless the Director General is within his rights in insisting upon his technical prerogative to determine prices for himself, to exercise an arbitrary discretion in making that determination, and to use all the powerful means within his control to obtain the lowest possible prices on iron, steel, and coal for railroad consumption. The board insists, however, that, in the exercise of that right, the Director General must assume full responsibility for all the results of the course he has chosen.

"It is not the opinion of the board that governmental organization is such that important policies can be so lightly frustrated. The Railroad Administration's refusal to accept the steel prices puts a temporary check on the work of the board, but, before abandoning the vital industrial policy which it represents, the board will see that the whole controversy is submitted to the President for final decision."

March Pig-Iron Production

The pig-iron output for March amounted to 3,090,243 gross tons, or 99,685 tons a day, as compared with 2,940,168 tons, or 105,006 tons daily, in February, according to *Iron Age*. This average rate of production is 5% less than that in February, 6.5% less than in January, and 12.5% less than the 113,942 tons daily in last September, the record month. March output is less than February for the first time since 1913. There was a net loss of 40 furnaces during the month, 44 being blown out and only 4 going in.

Chromite in the United States

The total gross weight of all grades of chrome ore produced and shipped in the United States in 1918, according to the U. S. Geological Survey, was about 79,000 long tons, equivalent to 63,000 long tons of ore of 50% grade, such as is usually imported. In 1917 there was produced and sold in the United States about 43,700 long tons of chrome ore of all grades, of which California contributed 36,700 tons, Oregon 6700 tons, and Washington, Maryland, and North Carolina the remainder. Of the 1918 total, 56,200 tons came from California, 22,500 tons from Oregon, and the remainder from Maryland, North Carolina, Pennsylvania, Washington, and Wyoming. No shipments of chrome ore from Montana were reported. This is a much larger output than was estimated from the output in 1917, but not so large as would have been possible had the demands and prices early in the summer of 1918 continued through the year. If these had been maintained, the increase in output would have continued, the maximum production would probably not have been reached until near the end of October, and the total production of crude ore in 1918 would probably have been nearly 100,000 long tons, an amount believed to be approximately equal to the consumption of chromite by the United States during the year. The large domestic output showed that the United States has a great reserve of chromite, and under proper incentive could probably produce, at least for a few years, all that it needs, even for use in war.

Although there were about 700 owners of domestic chrome deposits in 1918, only about 270 actually shipped and marketed their output. Many others reported a large quantity unsold and on hand on Dec. 31, 1918, amounting to about 46,000 short tons of crude ore, equivalent to 30,000 long tons of 50% ore. Statistics showing stocks in the hands of importers, dealers, and consumers at the end of the year are not available.

The importation of chromite in 1918, as reported by the Bureau of Foreign and Domestic Commerce, was more than 100,000 tons, nearly 28,000 tons more than in 1917. The larger part of this ore came from Rhodesia, New Caledonia, and Brazil. The average cost at the shipping port of the imported ore, much of which was of high grade, was $28.17 a ton, and to this cost must be added the ocean freight.

From Canada the United States imported 20,949 tons of chrome ore, much of it of low grade, at an average value of $31.56 a ton. The price offered last summer for 38% domestic ore, f.o.b. cars main-line shipping point on Pacific Coast, was $47.50 a ton. These figures apparently support the claims of the large consumers that high-grade imported ore costs them less than low-grade domestic ore, and they are therefore calling for imports. On Jan. 15, 1919, a War Trade Board ruling went into effect removing all restrictions on the importation of chrome ore except from enemy countries. This ruling practically restores pre-war conditions as to chromite and apparently leaves to the domestic producer only a limited local market in which he may successfully compete with imported ores. It is evident that the imports have in large part destroyed the market for domestic ore.

"Broken Eggs Cannot Be Mended."—(Lincoln). Neither can "cashed-in" War Savings Stamps grow to their maturity value.

Editorials

Mrs. Phoebe A. Hearst

THE news of the death of Mrs. Phoebe A. Hearst will be received with regret by many interested in the mining industry, but more particularly by the employees of the Homestake Mining Co. Mrs. Hearst established, in Lead, S. D., a club for the use of the Homestake employees and their families. Of the many efforts along similar lines in other places, this club has probably achieved greatest success, and may well serve as an example of how such clubs should be organized and managed. A free library and kindergarten classes were also established in Lead.

To the University of California Mrs. Hearst presented the Hearst Memorial Mining Building for the use of the mining college of that university. It is a magnificent structure, and a fitting memorial.

Mrs. Hearst was not only a woman of great breadth of view, but one whose sympathy with and love for humanity found expression in innumerable acts of kindness, few of which were known to anyone except the recipients.

Ingeniería Internacional

THE initial issue of *Ingeniería Internacional* has appeared. As stated in the *Journal* of Jan. 4, the publication was established to provide a medium for the international exchange of ideas on engineering. It will record and visualize in a general way, for the benefit of engineers, contractors, and manufacturers, developments in American engineering; will promote international trade coöperation, and develop closer engineering relations between the United States and Latin-American and Spanish-speaking peoples.

The production of such a periodical necessarily entails much initial preparation and labor, but the *Ingeniería Internacional* staffs have succeeded well in their task, and the first, the April, issue presents a well-balanced number, replete with illustrations and with text covering a wide variety of subjects. The issue contains interviews with men prominently identified with engineering and industrial affairs, and original articles on commercial and technical subjects, in addition to miscellaneous abstracts and excerpts from other McGraw-Hill publications.

The extensive field which is covered by the new paper, the sources of information which are available to the publishers, and the inherent condition which has heretofore prevented coöperation and coördination of engineering ideas and methods, present an opportunity that demands the best in technical journalism.

There is a growing need for the development of good will between the United States and our Spanish-speaking neighbors; and an export-trade medium deserves encouragement and support. The initial issue of *Ingeniería Internacional* is of such creditable caliber that its helpful and broadening influence, in promoting the objects that called it into being, is assured.

Mining Industry's Post-War Problems

PREPARATORY to the signing of the armistice, in fact for many months before the happy event took place, the Allies were studying, through committees and commissions, the problems that were sure to arise at the close of the war. Our own Government somewhat tardily took up the same subject, and its officials, though handicapped by having post-war conditions confront them before the problems had been fully studied, are doing their best to handle the various situations intelligently.

The problems of the mines, though of national importance, are largely problems of individual properties, to be studied and solved by managers as they present themselves. Discussions that have already taken place and communications that have been published present the idea that principles should be formulated, and that we should then make our practice square with these principles. Theoretically, this may be the way to handle the situation, but all of the principles have not been laid down, and in the meantime troubles in the mining camps are pressing for solution, and it is the duty of the respective managements to deal quickly and intelligently with the situation that confronts them. A study of what one's neighbors are doing under similar circumstances and how best to apply existing remedies to one's own conditions holds more promise of early solution than does the study of principles.

The miner's problem in a nutshell is, "How shall I keep things going in the face of high costs of labor and supplies and low price of metal produced?" Though this may not be his only problem, it is the most important at the moment. If the pumps and the hoists could be stopped, if the stamps could be hung up and the furnace blown out, and all the men with their families sent away on a week's picnic, all would be well. But plant and equipment rust and deteriorate more rapidly when idle than when in use, and they must be kept in good condition. And, of all the machines, the human machines of the plant are the most delicate and need the most particular care. We say human machines advisedly, because each man on the works, from manager to mucker, represents a cog or wheel in the big machine. The human machine must be provided with fuel every day if it is to be kept in fit condition and ready to produce.

It is right here that the small or personally owned property possesses a great advantage over the large corporation. Where personal contact exists, friendly relations also exist, and difficulties tend to disappear more rapidly. When the boss can say to Bill Stimson, the hoist engineer: "Bill, dope up the cable good, and smear the engine with white lead and lard. Don't know when we'll start again. Then come out to the ditch with a pick and shovel. There is a week's work on the hillside"—when such a speech can be made and accepted seriously, difficulties are not so great as in the case of the larger organization. We can imagine Bill taking his pick and shovel and going to work without any resentment toward the boss and glad of the chance to be doing something, but we could not imagine supine acquiescence in the event of the Anaconda management directing all of its hoisting engineers to report for duty on the railroad grade on Monday morning at half their normal wages.

It may be old-fashioned, but it is wise, to cultivate the personal contact and individual responsibility whenever possible. The large organization has its advantages, but also its disadvantages. It is necessary, and, like the large, delicate engine, runs economically while all is going well, but needs the greatest care or one loose pin will throw the entire plant into a state of idleness and disorder. Though there are certain advantages possessed by the small concerns, this is not a good reason to advocate the division of the big organizations into smaller parts.

And this brings us to another interesting situation. War conditions and post-war conditions have caused cessation of operations at many small mines and prospects. This is serious, because many of the great mines of the future must grow from the small mines and prospects of the present. Individual initiative and enterprise have made America what it is today, and the cultivation of these traits has, in 150 years, made us what we are. The suppression of them for centuries has made Russia what she is. If reconstruction is necessary in the mineral industry, it is not from the top to the bottom, but from the foundation upward. The top is in a fair way to take care of itself.

Renewed and substantial encouragement for the small operator may not sound like an important post-war problem, but it is the foundation upon which must stand one of the columns of our national structure of the future. Its neglect will mean one weak member that may weaken or wreck the whole edifice.

Industrial Coöperation

THE most notable speaker at the recent Industrial Conference was Charles P. Steinmetz. In a simple direct way Dr. Steinmetz discussed industrial coöperation. Combining a wide engineering experience and intimate contact with industry with the keenest of analytical minds, his conclusions cannot but be illuminating and worthy of extended consideration. He pointed out the weakness of all paternalistic schemes for the improvement of labor conditions, and indicated the offensiveness to the wage earner of much of the misdirected welfare work. In speaking of the relationship of capital and labor, the necessity of labor sharing not only in the profits but in the management of industry, as well, was presented as the direction in which industry must look for a solution of present difficulties. The working out of the problem along the lines suggested is, as Dr. Steinmetz remarked, a matter of slow growth and gradual development rather than of sudden change. There is much of value in Dr. Steinmetz's suggestion of the plan of "wage dividends," together with all that it implies in representation in management and control.

The Courage To Experiment

THROUGHOUT the whole fabric of human life and endeavor is woven the thread of chance. Great social and economic investments are merely experiments, depending always to some extent on chance for their success or failure. But, though chance may wield so potent an influence, the primary need for initiative must not be overlooked. For initiative leads to experimentation, and experimentation to achievement. And achievement seldom comes by chance.

Experiments are often termed failures in that they indicate the impracticability of a certain line of action. They are, however, almost invariably successful in eliminating from consideration the less essential proposals. It is feasible to forecast happenings and reactions in certain instances with accuracy, but in many cases it is impossible. The problem resolves itself into one of preliminary experimentation, carried out on a large or small scale, as circumstances dictate. Small-scale experiments are, relatively considered, cheaply performed; they can often be conducted to give results that may be duplicated to a nicety on a large scale, but they are not always applicable. Large-scale experiments involve heavy expense, and it often requires courage to institute them.

The war has broadened the outlook; and unheard-of sums have been spent in the encouragement of local production. Some experiments resulted in failure, but the success of the remainder has justified the expense tenfold—it has proved that the resources were there, and that it was just a question of developing a latent asset with sufficient capital and courage.

America's success during recent years has been due largely to an exceptional ability to finance experiments on an unprecedented scale, aided, also, by the spirit which recognized the value of taking a chance and risking high stakes when the prizes are of unmeasurable worth and of illimitable import and national significance.

Big problems involve big expenditures. Caution with regard to a conclusion as to the necessity for incurring such liabilities, where vital industrial or individual progress is at stake, is justified only where complete failure is a possibility. In many cases, however, some measure of success in any logical scheme can be forecast. Delay under such conditions is unpardonable if it is realized that the improvement can be achieved only by means of a proportionate outlay.

Nowadays, nations that are unwilling to incur expenditures which may be termed vast are likely to find themselves left behind in the race for a national supremacy based on the contentment, comfort, and sociological position of their people as a whole. The Great War has taught the world that the reason for delay in furthering vital schemes for national improvement and well-being are mostly hollow and inadequate. An inexcusable conservatism, coupled with an inherent dread of the consequences of spending large sums of money, was often the cause. Lack of justification for the outlay was sometimes pleaded as an excuse for delay. Since August, 1914, however, new standards have been set; and, both with regard to expenditure and achievement in a good cause, no limits have been considered. In a few cases waste resulted, but the goal was "neck or nothing"; and the winning post was reached with the realization that there was ample justification for adopting unusual and drastic measures which involved colossal expenditures, when apathy and procrastination would have resulted in the degradation of all the ideals worth fighting for.

When the goal is clear and unmistakable, there should be no delay in setting about to reach it. Costs are only relative. It is the result that counts.

Save, and Then Save

WHETHER we are in sympathy with the Victory Loan or not, whether we subscribe or leave that duty to our neighbors, whether we prefer to lend money to the Government or have the Government take from us, in the form of taxes, what it needs—whatever our point of view—one thing is certain: the bills are our bills, and we must ultimately pay them. Each and every one of us must contribute voluntarily or involuntarily, knowingly or unknowingly, and we have got to save to pay these bills.

It may be tiresome to be preached to, especially if one does not feel in the saving mood. But it is not tiresome to him who feels the necessity of thrift; rather, he has his eyes open for the possible chance of developing thriftiness along new lines. Here is where we all need help. We need some suggestions that will enable us to get more out of life or put more into it; some suggestions that will make it possible for us to get 10% more service out of a belt or a hoisting rope, or it may be a pair of shoes, or out of a gallon of oil or a pound of dynamite. The man who can give us hints along these lines is the one we want to hear or the author we want to read.

Perhaps the *Journal* is optimistic in expecting that a number of its readers are going to send in suggestions that will produce little savings here and there around the mine and mill, but it hopes for and expects them. Nothing will be too small to be disregarded, and the total may amount to a respectable figure.

Perhaps one of the first sources of thrift that the local manager should have in mind is that of careful buying; the endeavor to get the full worth of money expended; the insistence upon quality with respect to all purchases. Today there is scarcely an article to be purchased for the mine that is priced at anything like what can be regarded as normal. Tomorrow the quotation may be a trifle lower and next week a shade less, and on this recession one may be inclined to place orders, but if he does so it will behoove him to bear in mind that the manufacturer is anxious to sell and equally anxious to avoid loss.

Does the reduction in price represent any reduction in quality of goods? It is well to bear this question in mind and insist upon the manufacturer doing his part in the thrift campaign. The consumer has been pretty thoroughly lectured in regard to spending wisely, but we doubt if the manufacturer has been given corresponding advice and attention about producing wisely. The waste involved in the production and use of cheap inferior goods is large, and the manufacturer's practice in this direction cannot be condoned through his statement that he makes what the people want.

We can reach the producer and set him on the right road through our insistence that when we buy we must have the best. This is one item in practical economy and practical thrift through which we may pay a portion of the bill that stands against our account.

Concentration of Iron Ores

SHIPMENTS in the Lake Superior iron-mining districts, which to date have produced somewhat over 900,000,000 tons of ore, reached the high point in 1916, when they amounted to 66,658,466 tons, although each of the years following recorded a slight decrease in the shipments from the season preceding. In a general way, it may be said that this drop has not been due to lack of ore reserves, because production has depended mainly upon the demand of the furnaces, and their requirements have regulated the operation and output of the mines.

Recent estimates show that the ore of commercial grade will be exhausted within comparatively few years and that the remaining iron-ore resources in the district will average less than 45% in iron. The gradual removal of the higher-grade deposits has led to an increase in the mining of lower-grade ores, and the latter will, in time, necessarily replace the former ores.

Iron-ore smelting requires the use of high-quality grades of ore, and, though the larger proportion has been supplied direct from high-grade ore deposits, a certain percentage has been procured from lower-grade bodies, the ore from which, after being mined, has been treated by washing methods.

The growing interest in iron-ore concentration, which has been particularly noticeable on the western part of the Mesabi Range, has been the result of the realization that there is much available ore in that section that may be made suitable for furnace use. And this condition will doubtless continue. The ores of the western Mesabi lend themselves particularly well to treatment by simple methods, for the ore structure is such that ordinary means of concentration may be used, and the separation process as applied to mill construction is largely a matter of mechanical arrangement. The Trout Lake concentrator of the Oliver Iron Mining Co., at Coleraine, Minn., which was the first plant to be placed in operation on the Mesabi Range, was completed in 1910, and now consists of six units and has a capacity of 3,000,000 tons of crude ore per season. In the district 11 plants are now operating and others are under consideration or are being built. In his article, "Iron-Ore Concentration on the Mesabi Range," which appears in this issue, F. A. Kennedy has outlined the general practice as followed in iron-ore washing in that district, together with suggested improvements which will be appreciated because of the increased interest which concentration methods will continue to possess.

The United States Steel Corporation

THE winning of the war may be attributed to many agencies, but not the least of these was the important part played by the United States Steel Corporation, whose varied operations of the last year mark a period of notable accomplishment. The seventeenth annual report, abstracts of which are published in this issue, contains a record of remarkable achievement by the subsidiary companies.

Totals of production and shipments of the various companies during 1918 were less than those of 1917, but the shortage was offset by increased output in special lines, and the remarkable successes which attended operations that were a departure from former practice. Among the increases in output may be mentioned the production of plates, extensively used in shipbuilding, which totaled 2,171,362 tons, or an increase of 47.3% over the 1917 output. Notable among the strictly war-work developments were the study of chemicals for gas masks and the making of rolled sheets for helmets, by the American Sheet and Tin Plate Co., and the manufacture of gas and mortar shells from welded pipe by the National Tube Company.

During 1918, as in past years, the officers of the corporation continued the extension of welfare work for the benefit of employees. This commendable practice has been one of the secrets of the successes which have marked the operations of the corporation, and its example may well be followed by all employers of labor, for it has repeatedly been proved that coöperation between labor and capital begets a healthy growth for industry.

Loyalty of employees is not fostered by a spirit of paternalism, and the policy which gives workmen of the United States Steel Corporation the opportunity to subscribe for stock upon easy-payment terms may be emulated to advantage by other employing concerns.

BY THE WAY

China exhausted most of its own supplies of jade stone many centuries ago and now depends upon Burma for the stone, says *Commerce Reports*. The chief centers for jade carving are Canton, Peking, and Soochow.

As a suggestion in passing, it might be mentioned that composite names have been frequently adopted in various mining districts as designations for mines, plants, and places, and their use strikingly suggests the romantic side of the mining industry. One of the latest of these to reach us is from the Cobalt district, namely, Coniagas, the syllables being formed respectively by the symbols Co, Ni, Ag, and As. Another is the designation of the Cuyuna Range, in Minnesota, the name being composed of the syllables "Cuy" and "Una." The former is a contraction of the given name of Cuyler Adams, who was active in the early exploration of that territory, and the last syllable is the name of his dog, "Una."

The following bona fide copy of a letter received by a mining engineer was sent to us recently and illustrates the necessity for a close study of phonetic spelling and the fertile imagination that is required by him who professes an interest in mine prospects:

"Der sur I have groap 8 gold clames wit a good shon for a big min it is Popry Dick Ha a wet of200 betwn wals un wal is Sist othr is granit can be trased 3 mil ur mor. if you ur yor find wans sumtin Big were you will Hav Lots of ore 7 of the clames shos good Iwill giv 1 yer too see wat Can find ifthe Bunch ant Big a nuf we coud git 4 more all the Properts a roun me is good you PlesLet me No if you Can handl this Propirty You Hav 6 feet of ore too start on a shaft Sout West End 6 feet or Nort Est End from cras root it is Lo grade but you will Los of it Had ases $5 too $32.50 in gold cares a Little copper & sum Silver 2 of clames Shos well in Silver you can git all valus wit tin 7 mils from railrod& Smilter

Wit a rod all doun $( ) is the Pris 3 yers
too Pay
& oblig yors
X.

Cap'n Dick thoughtfully puffed his tightly packed pipe of Peerless. "M'son", said he, "tha worl' do change. 'Ere is all creation h'upset over fitin' tha 'Uns, tha peace problem 'angin' fire, h'industry in a 'uge turmoil, an' w'ere with 'igh costs an' all are we gawin'? Dam-me, sometimes I wonner jus' w'ot's to be tha h'end. But with all this 'ere, I can't say as 'ow you an' me 'as cause to worry. Leave 'er w'ere sha's to, m'son, an' these 'ere diplomats an' politicians an' h'arbitrators will work un h'aout. But w'ot do 't me tremendus is this 'ere h'interference with pers'nel liberty. Dam-me, do seem as 'ow these days man can't raise 'is 'and to blaw 'is nose but w'ot some chap mus' tell 'im 'ow to do un. Take this 'ere pro'ibition. 'Ere be I an' there be thee, back long we. Thee says to me, 'I'll stan' thee to a pint,' and daown we gaws af'er shif' to tha pub. We may 'ave one, we may 'ave ten, but 'ome we gaws to tha missus, an' shows h'up bright an' h'early nex' moornin' to tha mine. Min' you, m'son, I don't say there be not they 'oo don't make a 'og o' theirsel's, but tha 'ardship comes w'en tha h'innocent suffer with tha guilty. I tell 'e, m'son, this 'ere chap 'oo wrote tha 'Miner's Solace' in tha *h'Engineerin' an' Minin' Journal* naws wot 'e's talkin' abaout. These 'ere 'ipocrites 'oo wants to 'ave all smokin' stopped mus' be crazy. 'Oo ever 'eard of a man takin' five withh'out a smoke? An' 'ow in 'ell do they think a chap can figger 'ow bes' to blas' a stope? Smokin', m'son, is a 'abit in minin' but, dam-me, there never was a better. 'Ere, you, let's 'ave a bit moor Peerless."

State Senator O. L. Sparks, of Galena, Kan., has the reputation in the Joplin district of having made and spent more money than any other mine operator in the lead and zinc fields. Says the Kansas City Star: "Sparks made and lost most of his big money in the 'Badger Diggins.' The last time he went 'flat broke,' about six years ago, was when he was trying to get more money out of the old S. H. & S. A flood came, and he spent a large sum pumping out the water. Then, just as he got all the water pumped out, his mill burned, and almost before the ashes got cool another flood came, and he had more water than at the beginning.

"When he took stock of himself Senator Sparks found he had nothing and was $20,000 in debt. That was only six years ago, and today he owns the finest house in Galena, a 16-room home with billiard parlors and dancing pavilions; a lot of Galena property, more than 1300 acres of land, five mines and other valuables.

"'How did you make your last come-back?' he was asked.

"'Well, sir, one day I happened to be in Joplin and met a fellow who said he had lost $5000 in a mining venture and that if his wife found it out he would catch hell. He said another mine operator had told him I was a lucky dog, and that if he wanted to get his money back I could get it if any man could.

"'I told him I myself was broke, but I had been broke so often that it didn't make much difference to me. I told him I knew of a piece of land I believed we could make a stake on and that if he would put up some money against my experience we would tackle it.

"'He gave me $500, and I got a drill and went at it. I hit ore in the first hole we drilled, and pretty soon he sold out when he had made back all he had lost and could go home to his wife without catching hell. I kept the mine and made $37,000 in a year and a half. Then I bought in "The Pup," and in a couple of years had a tolerably fair stake. With some other parties I bought "The Pup" land for $47,000 and I haven't hit bottom since.'"

NEW PUBLICATIONS

Yacimientos Carboniferos de las Provincias de Pallasca, Huaylas y Yungay. By Juan M. Yáñez León. Pp. 85; illus. Bull. 90, Cuerpo de Ingenieros de Minas del Peru, Lima, Peru.

The pamphlet was evidently issued for the purpose of disseminating information with regard to the economic coal deposits of Peru. The geological and structural features are considered in detail, and descriptions are given of the deposits and their development toward an economic basis.

Handbook of Mechanical and Electrical Cost Data. By Halbert P. Gillette and Richard T. Dana. Pp. 1734. McGraw-Hill Book Co., Inc., New York. Price, $6.

This book was written to fill a need that was felt by mechanical and electrical engineers, and consists of notes and data that have been collected and formulated by the authors in the practice of their professions. The indispensability of the information thus collected prompted its arrangement and publication in book form. The main purpose of the book is to place in the hand of the engineer, in the most convenient form for reference, the largest practicable amount of information bearing upon economic and intensive construction, production, and transportation in the mechanical and electrical fields. So far as possible the material has been classified along the lines of the work that one man is likely to be called upon to undertake; and a comprehensive index supplements the volume and enhances its value. In writing the book, the authors have borne in mind the requirements of the designer, the appraiser, the chief of construction, the superintendent of operation, and the engineering student. Among the various subjects treated are: General economic principles; depreciation, repairs and renewals; buildings; chimneys; moving and installing; fuel and coal handling; steam power; internal combustion engines and gas producers; hydro-electric plants; first cost and operating expenses of complete electric light and power plants; overhead electrical transmission and distribution; underground electrical transmission and distribution; lighting and wiring; belts, shafts and motor drives; compressed air; gas plants; pumps and pumping; conveyors, hoists, cranes and elevators; heating, cooking, ventilating, refrigerating, and ice-making; electric railways; and miscellaneous costs. The book is complete and the data are reliable. It should find a place among the most frequently consulted books in the engineer's library.

Industrial Goodwill. By John R. Commons. 6 x 8¼. McGraw-Hill Book Co., Inc., New York.

An excellent little book, and appropriately named. Every employer of labor and every employee should read it. A careful study of its contents should create a better understanding of what is meant by goodwill and what is necessary for the development of industry along rational lines. A few quotations may appropriately be given. In speaking of labor, the author says:

> This I call the machinery theory of labor. Labor is not a commodity—its value determined by demand and supply—but each laborer is a machine—its value determined by the quality of its product. The theory is not new. Its application is a new discovery in science and engineering. The commodity theory is the merchant's theory of buying and selling. The machinery theory is the engineer's theory of economy and output. Man is, after all, the most marvelous and productive of forces of nature. He is a mechanism of unknown possibilities. Treated as a commodity, he is finished and ready for sale. Treated as a machine, he is an operating mechanism to be economized.

Again, under the subject of goodwill:

> Scientific management picks out the individual and offers him the inducement of making more money. It separates him out from the group with which he has consciously or unconsciously, perhaps, identified himself. It cuts across the solidarity of labor as a class, unmindful that the laborers are competitors with each other, that they are buying jobs which they feel are limited in supply, and that their feeling of solidarity on this account reprehends the one who injures his fellows by lessening their chances for jobs, or who reduces the level for compensation for all by his self-seeking competition.
>
> But the goodwill of labor is a collective goodwill that does not play one laborer against another, or the unemployed against the employed, or take advantage of the needs of a class, but acknowledges labor's solidarity of interest as well as the individual laborer's self-interest.
>
> Scientific management, since it begins and ends with individuals separated from their fellows, has the defects of autocracy. It means government by experts. An expert comes into the factory and makes a study of the operations of the selected individual. That individual and his fellow-workers are much concerned about his time studies, his stop-watch, his cold calculations, which decide for them the amount of work that shall be portioned out for the task. But they cannot be consulted. They are objects to be investigated, not investigators.
>
> But goodwill is reciprocity. It is not government at all, but mutual concession. It yields as much to the prejudices and passions, to the conservatism and even suspicions of patrons as it does to scientific knowledge of what is good for them. Goodwill is not necessarily a virtuous will, or a loving will; it is a beneficial reciprocity of wills, and whether there is really a benefit or really a reciprocity is a matter of opinion and mutual good feeling as much as a matter of science. . . . .
>
> For it is goodwill that converts the "class struggle" of socialism into class harmony. It converts retaliation into reciprocity. Where it does not exist, there the public, more and more, is turning to another theory, not merely the goodwill theory of labor but the public utility theory of labor.

Other extracts might fittingly be reproduced to illustrate the trend of the book, which is distinctly of a constructive nature; but sufficient has been given to show the fairness of the author and his deep insight into the many industrial problems. The concluding paragraph of the work has a peculiar significance at present and is therefore worthy of quotation:

> No nation hereafter, not even America, can live to itself alone. America has come out of the war the one great industrial power of the world. Other nations are bankrupt. America is their creditor. America has the capital, the resources, the shipping, the man-power. America may use its power as Germany tried to do. It may subsidize its capitalists and trusts and make a science of dumping. It may make other nations eventually its enemies. Or it may submit its excessive power to be regulated in partnership and equality with other free nations. The struggles of the future are industrial. The world may be governed by supply and demand, and America will win by superior control over supply. Or the world may be governed in partnership, and America will take an equal chance of winning in the race of international goodwill.

Compressed Air Plant. (Third Edition.) By Robert Peele. 6 x 9¼, pp. 485, illus. John Wiley and Sons, New York.

As stated by the author in the preface, there have been recent changes of importance in the details of design of both compressors and rock drills, and the issue therefore contains many replacements of the cuts appearing in the two earlier editions, besides the necessary changes in text. Part I of the volume treats with the production of compressed air, and includes the development, structure and operation of various types of machines. Part II comprises information and details concerning the transmission and use of compressed air. This section includes a complete description of various types of reciprocating and hammer drills, together with statements of their performance, records and costs. Other applications of compressed air, such as used in coal-cutting machines, pumps, and haulage, are considered. Demonstrations and descriptions of certain of the older compressors and drills are retained, and the arrangement of the issue is such that the entire subject is treated in a full and able manner.

Production and Value of Mineral Products in Michigan for 1917 and Prior Years. Publication 27, Geological Series 22, Michigan Geological and Biological Series, R. C. Allen, director. 9¼ x 6½, pp. 225.

The data include statistical tables of production and value, historical sketches, and lists of producers of metallic and non-metallic minerals in Michigan.

Personals

F. D. Chase has removed to Dedham, Mass.

P. E. Butcher is vice-president and general manager of the Dominion Co. at Danville, Ill.

William Holzhauer is with the Aluminum Castings Co., being employed in the metallurgical department.

E. A. Sporley, of the Bureau of Mines, has completed a tour of inspection of the Mesabi Range mines.

David D. Irwin has accepted a position with the Phelps Dodge Corporation in the office of the president.

H. L. Batten is in Rossland, B. C., engaged with the Consolidated Mining and Smelting Co. of Canada.

R. W. French, formerly situated at Ingot, Calif., is now with the Department of La Union, San Sebastian, Salvador, C. A.

M. B. R. Gordon is vice-president and managing director of the Molybdenum Products Co., Ltd., Wilberforce, Ontario.

Ralph E. Barker has accepted a position at the Tacoma Smeltery, Tacoma, Wash. He was formerly with the Garfield Smelting and Refining Co.

Alexander Faulds, of Vancouver, B. C., left recently for China on a professional business trip and will be absent for several months.

L. Stepanoff, mining engineer, has established an office at Grand St. 151, Blagovestchensk on Amur, Amur Province, Russia.

S. D. Callaway and **J. E. Davis** have formed a partnership under the name of the Chotaw Engineering Co., Patrick Bldg., Poteau, Okla.

Paul R. Forbes has resigned his position with Shewan-Tomes & Co., of New York, and is now situated at 712 Prospect Ave., El Paso, Texas.

Oliver U. Bradley is U. S. Oil and Gas Inspector for the Department of the Interior at Muskogee, Okla., with offices in the Federal Building

B. R. Mackay will be in charge of a party sent out by the Geological Survey of Canada this year on an exploration trip into British Columbia.

Howland Bancroft, of Denver, announces that he will be associated with **B. L. Thane** after June 1, with headquarters in the Crocker Bldg., San Francisco.

L. K. Armstrong, secretary-treasurer of Columbia Section of the A. I. M. M. E., has been elected president of the Spokane Engineering and Technical Association.

Claude E. Amidon, who has been employed in the Chemical Warfare Section at the Astoria Heat, Light, and Power Co., has removed to 40 Block F., Pueblo, Colo.

Charles W. De Witt, until recently mine superintendent of the Chiksan Mining Co., is en route to Omsk, having accepted a position with the U. S. Government for duty in Siberia

Col. James R. McLean, of the British Army, has arrived in New York en route to Mexico, to confer with Carranza in regard to 15,000,000 acres of British oil land confiscated in 1915.

C. O. Stillman, of Toronto, recently vice-president of the Imperial Oil Co., has been elected president in place of the late Hon W J Hanna. A. M. McQueen succeeds to the vice-presidency.

Paul W. Gaebelein, mining and metallurgical engineer, who served during the war as a first lieutenant, Ordnance Reserve Corps, has opened offices at 17 West Ninth St., Colorado Springs, Colorado.

William Bischoff, assistant general superintendent of the Dominion Iron and Steel Co., Sydney, N S, has resigned to accept the position of assistant general superintendent of the Lukens Steel Co. of Philadelphia.

F. L. Gilman, formerly works manager of the National Conduit and Cable Co., is now the European general superintendent for the Western Electric Co being in charge of the manufacturing plants in England and on the Continent

F. E. Lucas has been appointed to the newly created position of economy engineer with the Dominion Steel Corporation of Sydney, N S, with the view of eliminating wasteful practices and the introduction of economical processes.

Federico Garcia Caceras has severed his relations with Negociacion Minera E E Fernandini, Cerro de Pasco, Peru, and will become metallurgical engineer for Compania Gallofa-Consolidada de Colque-Chaca, Bolivia, S. A.

A. W. Carroll, assistant superintendent of the Raritan Copper Works, and **S. Skowronski**, in charge of the Research Department, left recently on a business trip, during which they visited the Baily electric furnace plant at Alliance, Ohio; the Edgar Thomson steel works, and Kopper's byproduct coke plant, at Pittsburgh, Penn.

Amor F. Keene anounces that he has accepted the position of consulting engineer and member of the American advisory committee of the Gold Fields American Development Co., Ltd.—the representative in America of the Consolidated Gold Fields of South Africa, Ltd., of London—with headquarters at the offices of the Gold Fields American Development Co., Ltd., 233 Broadway, New York.

A. C. Clark is manager of the Raritan Copper Works; **F. L. Antisell**, superintendent; **A. W. Carroll**, assistant superintendent and **N. W. Pierce**, office manager, according to a revision of the positions of executive officers of the works made at a recent meeting of the board of directors. Mr. Pierce has also resumed his former position as chairman of the General Safety Committee.

Societies

Colorado Scientific Society held its 335th regular meeting on Apr. 5, at the Denver Athletic Club. Albert C. Crehore delivered an address on "Atomic Phenomena."

American Society of Civil Engineers held a meeting on Apr. 16, when W. G. B. Thompson spoke on the "Development of New Jersey's Highway System and Its Relation to Hudson River Vehicular Tunnels and Ferries."

American Institute of Mining and Metallurgical Engineers has appointed a committee to coöperate with the Canadian Mining Institute consisting of E. P. Matheson, A. R. Ledoux, and L. K. Armstrong. D. H. McDougall, W. Miller, and R. H. Stewart will represent the Canadian Mining Institute.

Engineers' Society of Western Pennsylvania held a joint meeting with the Pittsburgh sections of the American Chemical Society and the American Electrochemical Society on Mar. 25. The subject discussed was "Gas, Smoke, and Flame in This War and the Next," by William H. Walker, Colonel, Chemical Warfare Service, U. S. A.

Association of Members of American National Engineering Societies in Cuba has been recently founded to foster the interests of various national engineering societies represented in Cuba. Its membership is composed of all the prominent engineers in Cuba. The year book has just been published. Carlile Ulbricht, secretary, Empedrado No. 17, Havana.

Industrial News

Mine and Smelter Supply Co. advises that B. W Hills has been appointed manager of sales of the machinery and supplies department at the Denver office.

Chicago Pneumatic Tool Co. announces the appointment of F V. Sargent, district manager of sales in the Boston territory, succeeding F. S. Eggleston, with headquarters at 182 High St., Boston.

A. P. Green Fire Brick Co., of Mexico, Mo., has opened an eastern district sales office in New York City at 30 Church St Howard C Thayer, formerly field mechanical engineer for the J G. White Engineering Corporation at U S. Nitrate Plant No 2, is in charge.

Cutler-Hammer Manufacturing Co. announces that E. C Cherrington and T R Cooley, who for several years have been in the sales service department at Milwaukee, have been transferred to the Pittsburgh office of the central district, Mr Cherrington becoming office manager and Mr Cooley engineering correspondent

Paul O. Abbe, Inc., is the title of the new organization created to succeed the business of Paul O Abbe The new corporation has purchased a site on which new buildings are being erected to afford increased manufacturing facilities Mr Henry Selman, one of the original inventors and developers of the grinding mill, is associated with the new corporation

American Manufacturers' Export Association has appointed the following committee on education for foreign-trade service: W W. Nichols, Allis-Chalmers Manufacturing Co.; G. H. Carter, W. R. Grace & Co.; H. E. Cole, Standard Oil Co.; H. H. Merrick, Chicago Association of Commerce; H. S. Smith, Gulf States Steel Co.; E. P. Thomas, U. S. Steel Products Company.

J. F. Davis, Harris Trust Bldg., Chicago, has taken over from the du Pont Powder Co.'s plants a considerable number of boilers which have been in use from three to six months, and is in the market to make contracts to install these boilers ready for operation. Every boiler is guaranteed. Prices will be furnished upon request. A number of well-known manufacturers are represented, and various types of construction are included. New Keeler boilers can also be furnished.

Huff Electrostatic Separator Co., which has been situated for the last 14 years at 60 India St., Boston, has recently acquired and fitted up a large plant at Arlington, Mass., a suburb of Boston, to which it has moved its offices, ore-testing and chemical laboratories and works. It maintains a well-equipped laboratory for the purpose of making either preliminary or complete tests showing the results that can be obtained commercially in the separation or concentration of minerals, abrasive materials, and reclaiming valuable contents of many waste materials by the Huff electrostatic process. H. B. Johnson, an expert on graphite refining, is general manager of the company.

The Oliver Continuous Filter Co. reports an export business for 1918 which is practically twenty times greater than the company's export business five years ago. Recent foreign sales include six 12-ft. diameter by 16-ft. Oliver filters, with complete vacuum equipment, to the American Smelter Securities Co. for its Veta Grande mill at Parral, Chihuahua, Mexico. Another Oliver installation in Mexico during 1918 was that of a 14 x 18-ft. filter at the mill of the Alvarado Mining and Milling Co. at Parral. During the present month the Oliver company is shipping duplicates of the Veta Grande filter to the Benguet Consolidated Mines, in Benguet, Philippine Islands, and another to a cyanide plant in the Dutch East Indies, which is being installed by the Netherlands government.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Drill Bit. Granville A. Humason, Shreveport, La., assignor, by mesne assignments, to C E. Reed, Houston, Tex. (U. S. No. 1,294,106; Feb 11, 1919).

Dump Cars, Locking Mechanism for Alexander M Gow, Duluth, Minn. (U. S. No. 1,294,088; Feb. 11, 1919)

Dump Car. William D. Skidmore, New York, N. Y, Emmeline M Skidmore, administrix of the estate of said William D Skidmore, deceased, assignor of one-half to Francis de Lancey Robinson. (U S. No. 1-293,954; Feb. 11, 1919.)

Inclined Screen. Lewis G Rowand, Brooklyn, N Y., assignor to the New Jersey Zinc Co., New York, N Y (U S No 1,-294,309; Feb. 11, 1919)

Lift Pump. Frank English, Fresno, Calif (U S. No 1,294,069; Feb 11, 1919)

Mining Sulphur, Apparatus for John W Peters, Roslyn, N Y (U S No. 1,293,902, Feb. 11, 1919)

Oil-Well-Cleaning Appliance. William J Hogue, Kansas City, Mo (U S. No 1,-293,777, Feb 11 1919)

Rock Drill. William A Smith, Denver, Colo, assignor to the Denver Rock Drill Manufacturing Co., Denver Colo (U S No 1,293,960; Feb 11, 1919)

Rotary Boring Drill. Howard R Hughes, Houston, Tex, assignor to Hughes Tool Co, Houston, Tex (U S. No. 1,292,608, Jan 28, 1919.)

Rotary Drilling Tool. Charles P Mayner, Montebello, Calif (U S No. 1,292,-842, Jan. 28, 1919)

Tungsten. Process of Separating Tungsten Compounds from Substances Carl Andersen and Eric Hjalmar Westling, San Francisco, Calif (U S No 1,292,559, Jan 28, 1919.)

Zinc Oxide. Preparing Pigment Leland E Wemple, St. Louis, Mo, assignor to American Zinc, Lead and Smelting Co, Boston, Mass (U S No 1,292,976, Jan 28 1919)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Apr. 11

February Production of Petroleum in California totaled 7,841,848 bbl., or an average daily production of 280,066 bbl., an increase over January of approximately 2700 bbl. in daily average. Shipments from the fields in February totaled 7,470,373 bbl., adding 371,465 bbl. to the crude-oil stocks, which at Feb. 28 totaled 32,671,059 bbl. The number of wells producing in the 11 active fields in the month was 8659. New rigs installed, 36; number of wells started drilling, 318; number of completed wells, 42; abandoned, 2. Field prices at Mar. 15 remained as of May 1, 1918.

Montebello Oil Field, which has attracted attention for last two years for its production of both oil and water, had produced up to Feb. 1, 1919, a total of 8,700,051 bbl. of oil. The production comes from two strata or zones of oil sand. The first or upper zone has yielded 1,876,121 bbl. of oil and 121,332 bbl. of water from 19 wells which produce exclusively from the upper zone. A number of wells producing from both the upper and lower zones are not included in the 19 wells. Two of these 19 produced 99,859 bbl. of water, or 82% of the total water yield. The total production of oil from the second oil zone up to Feb. 1, 1919, was 6,823,930 bbl. Three wells produced 410,201 bbl. of water of a total of 648,361 bbl. The largest water producer of the three is now taking steps to remedy the condition. It is notable that the large water producers in the two zones of the Montebello field have been neither drilled nor operated according to the requirements of the oil and gas department of the State Mining Bureau. But there is at present an inclination to observe the rules regarding shutting off the water.

High Price of Fuel Oil paid by California producers was made the subject of special attention in the annual report of the State Railroad Commission for the year 1917-1918. The report states that the price more than doubled in 1918 and gives a list of important points situated on railroads and the fuel-oil price per bbl. at these points. These prices range from $1.60 at Los Angeles to $2.80 at Needles and from $1.62 at San Francisco to $2.40 at Yreka. These figures represent the minimum and maximum prices in the southern and the northern sections of the state and are determined by the long and short haul freight rates. Though the commission's report compares these prices to former prices at 65c. to 80c. per bbl., it may be as well in this connection to call attention to the rise in price at the well in the several fields that became effective in May, 1918, ranging from $1.23 to $1.57 per bbl. for oil ranging in gravity from 14 to 37 deg. Bé. The cost of fuel oil to the consumer was increased in 1918, when the prices of materials essential to oil-well drilling increased and the materials could not be obtained even at exorbitant costs. If the price of oil at the well had not been increased to meet the high cost and threatened destruction of wells, there would have followed an industrial disaster that even ultimate greater costs to the consumer could not have forestalled. There would have been such a decrease in the petroleum production of the state that more industries would have been closed down for lack of fuel than were slightly hurt by the high costs. More than 2,000,000 bbl. of oil was consumed by the hydro-electric power and light companies because of the light rain and snow in the winter of 1917-1918. The gold-placer dredges were obliged to run on short time to conserve electric power to the essential uses required by the Government in the carrying out of war needs. The field stocks of oil were being steadily reduced by lack of drilling new wells and the increased demand for oil fuel. It does not seem reasonable that anyone could expect anything else than an increase in the cost of oil fuel. Possibly the cost to the consumer is just at this time, the close of the first quarter of 1919, higher than it should be. But the lowering of the cost to the consumer means a reduction in the price paid at the well to the producer, and it is doubtful if such a reduction as would benefit the consumer would insure a continued increase in production in the field.

BUTTE, MONT.—Apr. 12

Engineers' Union of Butte will consider a proposition refusing to allow any miner who is not a member of an organization affiliated with the A. F. of L. to be lowered into the mines, and a vote may be taken at the meeting on Apr. 13. This action is considered to be an effort to combat the local I. W. W. organization and Bolsheviki, who are seeking to undermine organized labor. This will be the first direct act of organized labor against these forces in the Butte district.

DENVER, COLO.—Apr. 15

Bureau of Mining and Commerce is the name of a new civic organization formed by mining men of Idaho Springs recently, for the purpose of promoting the mining and commercial interests of the City of Idaho Springs and the County of Clear Creek. The following officers have been elected to serve during the ensuing year: Charles Hancock, president; W. E. Pasmore, first vice-president; William Woodward, second vice-president; L. A. Hafer, secretary; and John Meyer, Jr., treasurer.

Mineral Experiment Station at Silverton, San Juan County, Colo., is the object of a resolution recently introduced in the State Senate by John H. Slattery, of Silverton. The resolution proposes that the Bureau of Mines, and the officials in charge of the experiment station at Golden, Colo., be requested to establish without undue delay, and to maintain at Silverton, for such period as may be deemed necessary, a field experiment station, for the study and investigation of and experimentation with problems connected with mining, milling, and reduction of ores, and the recovery of minerals and metals from the mines of the San Juan mining district. The State Bureau of Mines of Colorado is requested to coöperate with and assist the U. S. Bureau of Mines in the establishment of and the work to be done at such field station.

WALLACE, IDAHO—Apr. 14

Hecla Mining Co. held the annual meeting of the stockholders in Spokane, and the old officers and directors were reëlected. Two quarterly dividends of 15c. per share were authorized, payable June 28 and Sept. 28. After the meeting, James F. McCarthy, president, announced that the mine would continue in operation on the present basis of about 80% of normal production until the depression in the metal market is relieved. He also stated that the income and excess-profits tax for 1917 and 1918 is still unsettled and that A. W. Stranger, of Portland, will represent the company in the hearing before the Commissioner of Internal Revenue.

The Production of Gold in Shoshone County in 1918 was $302,360, according to the annual report of Robert N. Bell, State Mine Inspector, which gives this county the first place among the counties of Idaho. Prior to last year the production of gold had declined to a point of comparative unimportance, and this sudden advance is credited by Mr. Bell to the dredging operations of Yukon Gold Co. on Prichard Creek. Part of the gold produced in this county is credited to "byproduct gold derived from the final treatment of Coeur d'Alene lead ores." With the exception of one property which shipped considerable ore last year which carried $10 or more to the ton, the gold recovered from the lead ores of this district is almost negligible. There is a little gold in the ore, but it has been many years since it was sufficient to be reported on the smelter returns, and it is not now sufficient to pay the smelters to recover it from the slag. Thus it is evident that practically all of the gold produced last year in this county should be credited to the Yukon dredge. The manganese steel buckets are closely connected, have a capacity of 7 cu.ft. and dump at the rate of 20 per minute. D. H. Ferry is manager of the dredging operations.

SALT LAKE CITY, UTAH—Apr. 14

Potash-Producing Companies in Utah are interested in the National Potash Association, and delegates were sent to take part in the meeting of potash producers opened in Denver on Apr. 2, and held with a view to establishing such an association. Among others there were represented the Mineral Products Co., producing potash from alunite rock at Marysvale; the Ogden Portland Cement Co., producing from flue dust; and the Salt Lake Potash Co. Utah capital will be represented by the Liberty Potash Co., owning extensive deposits of leucite rock near Green River, Wyoming, from which it is planned to produce potash, according to a new process.

Important Legislation affecting the mining industry in Utah has been enacted by the State Legislature in the course of the session just ended. A "blue-sky" law has been passed; the workmen's compensation act passed two years ago has been amended; the taxation of metalliferous mines has been finally placed at "three times the net proceeds," with the Governor's signature—although himself strongly indorsing the insertion of the words "at not to exceed" three times the net proceeds—affixed Mar. 21. As has been previously mentioned in these columns, it was expected, after conference between the Governor, a committee representing the operators, and others, that, on payment of an occupation tax for the year just ended by mining companies contesting the constitutionality of this tax, the law as affecting taxation would be passed to stand at "not to exceed" three times the net proceeds. The Senate passed the bill as expected, but the House, under suspicion of certain members seeking political capital, failed to ratify it. In a communication to the Governor, the operators' committee, headed by Walter Fitch, of Eureka, formally released the Governor, after the House had failed to ratify the bill as passed by the Senate, from his obligation under agreement with it, without, however, endorsing the bill as passed. The new bill carries a section repealing the "occupation tax." The "blue-sky" law, becoming operative in May, 1919, presents certain features taken from the Michigan, Arizona, and California laws, including the "Pardee law," of California, almost entirely. The law requires all companies, dealers, and agents to file statements and obtain licenses from the state, the maximum filing fee for corporations being $25 annually. The fee for dealers or brokers is $10, and the statutory fees are required for copies of statements or other documents on file. Securities must be marked so as to show issuance under license of the state, the marking to recite this to be permissive and not to indicate indorsement by the state or recommendation of purchase. Publication in the state of the advertisement of unlicensed companies is prohibited, a provision being inserted to cover cases where foreign concerns without Utah agents place advertisements locally. Violation of the act is punishable by a fine of $1000 to $5000, and imprisonment in the state penitentiary for not more than five years. In regard to the Workmen's Compensation Law, a proposal seeking the establishment of monopolistic state insurance was defeated. The waiting period was reduced from 10 days to three days. Benefits were increased from 55 to 60% of the average weekly wage, and from $12 to $16 weekly maximum. Mine lessees are made employees of the mine for the purposes of the act, but the mine owner is permitted to deduct the amount of insurance from royalties paid under the lease. The provisions permitting mutual medical attention systems were retained in the law, although a strong effort was made to eliminate them. A bill was passed requiring a semi-monthly pay day and one prohibiting the collection of fees for obtaining employment. A basic 8-hour bill—the state already has a law fixing eight hours as a day's work underground—was defeated, as well as a "one day rest in seven" bill.

The date for the hearing of the suit between the Utah Consolidated and the Utah Apex Mining companies, of Bingham, in regard to the question of apex rights, has been set for June 2 by Judge Tillman D. Johnson of the U. S. District Court. The suit promises to be an interesting one both from a geological and legal point of view.

DULUTH, MINN.—Apr. 14

Navigation and the Iron-Ore Shipping Season opened here simultaneously upon the arrival of the steamer Pargny, of the Pittsburg Steamship Co., and the first train-load of ore from the Mesabi Range. The recent bad weather did not delay shaft mines from shipping, and it is expected that open-pit loading will start soon. Shipment of ore from mines on the Vermilion Range was begun this week to the docks at Two Harbors, preparatory to loading the first boats, which will arrive Monday.

Ore-Royalty Tax Bill was passed by a vote of 92 to 25 in the Minnesota House of Representatives after the tonnage tax had been defeated. Practically all operating mines in Minnesota are worked on a royalty basis, and the ownership of the various properties is scattered among a large number of people—largely non-resident. Hence royalty incomes are considered in many quarters as unearned increment, and the sympathy which so largely aided the operator in his fight against the tonnage tax has been withheld from the fee owner. It is contended that the bill is a super-income tax, and hence illegal, and it is probable that, if the legislation should pass the Senate and the Governor, the courts will refuse to permit its operation, even though the state should thus lose the $525,000 annually which it is estimated would accrue.

HOUGHTON, MICH.—Apr. 10

Stocks of Copper in the United States today total approximately 1,600,000,000 lb. There are in Europe stocks of copper, owned by the governments of France and England and by large users of copper in those countries, totalling 650,000,000 lb. Together the total amount of unmarketed copper now for sale reaches more than two billion pounds.

Even with the restricted output of copper mines in the United States as operating since Jan. 1, the production was more than 300,000,000 lb. for the quarter. The total sales for that same quarter were 110,000,000 lb. So the total stocks of copper were added to, during the first quarter of 1919, by 190,000,000 lb., notwithstanding the fact that curtailment had been put into general practice wherever possible.

JOPLIN, MO.—Apr. 12

School of Mines in Oklahoma Section of the zinc and lead district has been assured. The Oklahoma Legislature agreed to appropriate $125,000 for a school to be situated at or near Miami, Okla., and Governor Robertson visited that town and announced that he favored getting the institution under way at the earliest possible date.

Community Prospect Drilling Campaigns are being planned in several of the older parts of the district where activity has recently fallen to a low ebb. Carl Junction, Mo., where there formerly were a number of good zinc producers, is the first place where a community company has actually placed a drill at work. It is planned to put the second drill in operation within a few weeks. Most of the leading business men and citizens of the town are interested in the effort to locate fresh ore deposits that will attract mining operators.

American Zinc Institute effected the creation of a local chapter at Picher, Okla. The latest meeting of the Tri-State Safety and Sanitation Association voted to merge the organization into that of the Institute. No change in officers or dues will be made, and the weekly luncheon meetings at Picher will be continued. The change was made without opposition and apparently met the full approval of all the mining men of the district. Stephen S. Tuthill, of New York, secretary of the American Zinc Institute, was a guest at the meeting, and, following the favorable vote to make the merger, declared that if there had ever been any question as to the success of the Institute it was now eliminated.

BIRMINGHAM, ALA.—Apr. 10

Woodward Iron Co.'s Shaft No. 4, being sunk by the E. J. Longyear Co., was incorrectly reported in regard to the monthly average rate of sinking in the Apr. 5 issue of the "Journal." The statement was made that sinking was being done at the average rate of 100 ft. per month, whereas information furnished by the E. J. Longyear Co. is to the effect that the shaft was started on Aug. 11, 1918, and up to Feb. 1 an average of 117 ft. per month had been maintained, and the average to Mar. 1 was 143 ft., the lower figure was owing to sinking through a particularly hard chert. After passing through this chert on Apr. 5, it is stated that expectations are to make 180 ft. for the month which was accomplished in January. The shaft is 13 x 21 ft., vertical, and is to be 1300 ft. deep. Fabricated steel sets are being put in, and it will be lined with concrete.

Tennessee Coal, Iron and Railroad Co. is considering building a giant aërial tramway or railway line from Red Mountain Top, near Ishkooda, to Fairfield and Ensley, to handle ore, which will result in considerable reduction of transportation expense. The estimated cost of this tramway is about $5,000,000, and the right of way is said to have been secured and complete details worked out for its construction. The Tennessee company has built, during the last year and a half, 1435 houses, a schoolhouse, an emergency hospital, and a large hospital costing $1,000,000, to be completed in a few weeks. This building record is in line with the industrial development policy of the corporation. There is still a scarcity of houses in the immediate vicinity of operations, and plans are said to be under consideration for more buildings. Other additions and projects of the company are given as follows: Manufacturing properties, work completed during the year—Ensley works: office building for roll shop and rail mill; additional openhearth furnace and converter; improvements to cooling system at blast furnace No. 2; turbo blower for converter department; 400-ton hot-metal mixer; equipment for separation of iron from slag; ladle-repair shop; pipe fitters and riggers' shop; chemical filtration system for feed water; bessemer furnaces, rebuilding Little Bell furnace; bessemer rolling mills, new office building; addition to drive on 8-in. guide mills. Work in progress: Ensley works-equipment at openhearth plant to facilitate triplexing process; additions to electric power-plant equipment, including 7500 kw. turbo generator; electric power-transmission lines; 10 high-duty drill presses for finishing mill. Fairfield works: a 45-in. blooming mill completed; also a 110-in. sheared plate mill and combination structural and bar mill; office and shop buildings, with complete equipment; facilities for finishing structural steel for ships. A bolt, nut, and rivet shop and two reheating furnaces are being installed.

Inquiries for Pig Iron in volume are coming in, but Birmingham producers assert that little business is being booked. A few car-lot sales were recorded during the week, and one of the cast-iron pipe plants took on a little tonnage; but the general business is still lagging, despite the reduction in iron prices recently. A large tonnage of iron is being sought for export, and Alabama interests could secure much of the business but for excessive freight across waters. Local operators hope to book part of the trade, and prominent iron interests state that if this business is obtainable the situation here will be relieved. Should there be a demand, approximately 180,000 tons is ready for immediate delivery, even though there has been some curtailment of production.

Manufacture of iron in Alabama for the month of March will be the lowest yet recorded, it is expected, furnace operations being kept up only where it is absolutely necessary. Little iron is being shipped now, consumers still holding off on receiving iron ordered last year and the first month of this year.

Owing to the Government policy of operating railroads as cheaply as possible, only where absolutely necessary are freight trains being run on Sunday, and as a result it is said that not a freight train was operated on Sunday, Mar. 30, on the Birmingham Mineral Division of the Louisville & Nashville R.R. The Birmingham Southern Ry., the railroad division of the Tennessee Coal, Iron and Railroad Company, had plenty of work to do, though the full force was not at work. The hot-pot trains between Alice furnace, in the city proper, and the steel plant at Ensley were running on schedule Sunday.

SPOKANE, WASH.—Apr. 10

United Copper Mining Company, which is operating in the Chewelah District, in an annual statement shows that, notwithstanding the high prices for labor and supplies in 1918, and the fact that operations were curtailed by a great shortage of electric power, there was an operating profit for the year of $18,674. Indebtedness on Jan. 1 amounted to $39,879, which has been practically wiped out since the date of the report by shipments of high-grade silver ore opened in the mine recently. It is believed that dividends will be resumed not later than June 15. President Wolfle states that from this date there should be a net profit of about $10,000 monthly.

VICTORIA, B. C.—Apr. 10

University of British Columbia has been voted $500,000 by the provincial government for use this year, contingent upon $250,000 being supplied by the dominion government.

Objection to Marketing Foreign Metals was taken at a recent meeting of the Trail, B. C., Reconstruction Board, and representations were made to the dominion government as indicated by the terms of the appended resolution:

"Whereas the whole interior of the Province of British Columbia is largely dependent upon the mining and smelting industry, and these industries are most seriously affected at the present time, owing to the demand for copper and lead being almost negligible; and

"Whereas such markets as may exist are flooded with metals dumped into Canada from other countries; and

"Whereas tremendous stocks of these metals exist in Canada at the present-time, and, if relief is not quickly forthcoming, the entire industry will collapse and throw approximately 15,000 men out of employment; therefore be it

"Resolved by the Trail, B. C., Reconstruction Board on this 24th day of March, 1919, that the importation of these metals into Canada be allowed by special permit of the dominion government until the stocks of metals now on hand are disposed of and the money tied up in these stocks is released to carry on the industry again."

The Development of Magnetite Deposits of British Columbia is again the object of a third effort, this time to be made by William Sloan, Minister of Mines, who proposes asking the British Columbia Legislature, now in session, for authority to take from any of the iron ore properties of the province a quantity of ore not to exceed 10,000 tons in all for experimental uses. The owners, it is proposed, shall be allowed 25c. per ton, tax free, on ore taken. There are at present two small furnaces near Vancouver, B. C., owned by companies which are prepared to take advantage of the terms of such legislation. These are the Tudhope Electro Metals, Ltd., with office and factory at False Creek, and the Vancouver Magnetite Iron and Steel Smelting Co., Ltd., with a plant at Ronaldsay, Howe Sound, 27 miles from Vancouver. The Tudhope company, which has been treating scrap iron, has concluded, after conferring with Mr. Sloan, that to demonstrate satisfactorily the practicability of smelting British Columbia iron ores on a commercial basis, it might be necessary to operate a plant for an experimental period of six months, especially if various deposits were to be drawn upon for these experiments. As an inducement to undertake this, they asked of the provincial government 5000 tons of ore at the rate of about 1000 monthly. Mr. Sloan holds the opinion that there is available an ample supply of ore of the character necessary for producing the class of pig iron demanded by the British Columbia and foreign trade. It is likely, however, that the ore to be secured most readily is that to be found on claims more or less undeveloped, situated on or close to tidewater. The Tudhope company is ready to make necessary changes in its electric furnace for treating magnetite ores. The present equipment consists of a 25-ton 1500-kw. electric furnace recently completed at a cost of $50,000. The plant of the Vancouver Magnetite Iron and Steel Smelting Co. consists of a blast furnace having an estimated daily capacity of 25 tons of pig iron, which has been engaged in producing pig iron scrap. The management of the company is anxious to try smelting magnetite ores of British Columbia, and, with a supply for demonstration assured, is likewise prepared to make the necessary changes in its plant.

TORONTO, ONTARIO—Apr. 14

Dominion Government Has Appointed a Readjustment Commission, which will investigate the differences existing between labor and capital. The Canadian Mining Institute, representing, as it does, the second largest industry in the dominion, will ask for the appointment of one commissioner to represent this industry.

Deposit of Coal has been discovered as a result of intensive geological study of some of the formations along the Newfoundland railway. Engineers familiar with that country believe it to be the continuation of the Cape Breton coal measures. The coal, according to reports, is of good thickness and excellent quality.

Rock-Salt Deposit recently discovered at Malaga, in the Cape Breton district, Nova Scotia, is receiving attention from Ontario parties, and in all probability a serious attempt will soon be made to work it. The salt occurs in a flat-lying bed with an apparent thickness of 250 ft., and is found 85 ft. below the surface. A shaft has been sunk and has penetrated 50 ft. of salt of good quality. The fishing industry of the Maritime Provinces and Newfoundland absorbs about 100,000 tons annually, and practically all of this is imported from Great Britain and from Spain. This is the only known deposit of salt in Canada east of Lake Erie, and a good market for the product seems assured.

The Mining News

ALASKA

KENNECOTT (Kennecott)—Completion of a big tunnel between Mother Lode mine and Kennecott property disclosed high-grade deposit of ore similar to that in Mother Lode.

ARIZONA

Mohave County

HACKBERRY (Hackberry)—New mill, under construction nine months, has had trial runs, reported successful, with oil-flotation and table concentrates running, respectively, 360 and 240 oz. silver, in addition to 24% lead and some gold. Extraction said to be 85% of assay values. Plant has 200 tons' daily capacity. Fine crushing is by ball mills. Electric power for mill and mine is generated in three-unit oil plant. Start was witnessed by principal owners, Gus Holmes, of Salt Lake, and James Murray, of Butte. Ore, down to 900 level, blocked out for two years of mill consumption. Mine has been worked intermittently since discovery in 1874. William Neagle, manager.

NATIVE COPPER specimens brought into Kingman from large deposit lately found near Mud Springs, west of Chloride. John McCuish, Will Brakeman, and Jack Flynn have located 21 claims.

GOLD TRAILS (Kingman)—Two tons of ore shipped. Shaft will be sunk to 500 ft.

RICO EXPLORATION (Kingman) — Policy of deep exploration determined upon at late annual stockholders' meeting. New working shaft to be sunk.

McCRACKEN SILVER-LEAD (Signal) —Extended holdings by purchase of Otsega property on same lode. New mill to be in operation within few months.

Pima County

NEW CORNELIA (Ajo.)—Much of the mass of a 150-ft. hill has been blown up by a blast of 48,000 lb. of powder, that broke 200,000 tons of carbonate ore for handling by steam shovel. New strike in Ajo Consolidated ground developed unexpectedly rich ore, on 250 level, which had been missed in drilling explorations. Gross tonnage of developed ores above 1% now is estimated at 56,000,000, largely sulphide, to be handled in flotation plant projected. Sulphides shipped to Douglas, only carbonates and oxides being locally treated by leaching. Has cut off one shift; employing about 680 men.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Carbon dioxide is being used to fight fire which started in 4000 level. Work has been difficult and dangerous, some of the men have been gassed, but indications are that the fire soon will be smothered. Work resumed in upper levels.

KENNEDY (Jackson)—Work interrupted by gas from fire in Argonaut resumed Apr. 2. The two mines are connected by crosscut, which has been bulkheaded.

CENTRAL EUREKA (Sutter Creek)—To deepen shaft by contract 20 ft. to 3700-ft. point. Good ore on 3500 and 3600 levels, which are connected by winze.

Calaveras County

NELSON (Copperopolis) — Installing Cornish pump to clear large amount of water and permit development. Good ore disclosed.

Eldorado County

CHURCH-UNION (Nashville)—Preliminary survey and examination by Albert Burch, of San Francisco, representing Bewick, Moreing & Co.

Inyo County

PINE CREEK TUNGSTEN (Bishop)—To resume extraction and treatment of ore when weather permits.

WILSHIRE (Bishop)—Remodeling milling plant. To resume operation soon.

Kern County

WINNIE (Randsburg)—Optioned by Los Angeles men for $20,000. Development to begin immediately. Charles Koehn is owner.

Nevada County

BENTON G. (Nevada City)—Repairing and retimbering completed; main tunnel being advanced toward channel.

IDAHO-MARYLAND (Grass Valley)—Deed conveying Gold Point Consolidated to this company filed with county recorder, bearing $2900 revenue stamps. This is part of the recent consolidation by Erroll MacBoyle and the Bulkeley Wells interests.

Plumas County

ARCADIAN (Greenville)—To start active development in May. Mine worked intermittently in past. Optioned by Charles A. Joy.

NEW YORK (Greenville)—Crosscut tunnel advancing toward main ledge under lease to D. W. Shanks and associates, of San Francisco.

Riverside County

PALISADE (Blythe)—To ship carload of silver-lead ore. New road one mile long from mine, completed at cost of $3000, essential to motor-truck haul to railroad. Ore runs from $50 to $127 a ton. Hansen, Villman, and Yost are principal owners.

Siskiyou ,County

FIFTY CHROME MINERS assembled at Yreka, formed an association and arranged to send delegates to the next meeting of the Pacific Coast Chrome Association at San Francisco. The Siskiyou County association was formed by electing H. J. Barton, chairman; J. P. McNamara, secretary, and R. H. Lake, treasurer. Delegates selected are Gus Reichman, George Milne, and W. A. Murray.

COLORADO

Boulder County

SMUGGLER (Balarat) — At directors' meeting decided to build a cyanide plant. E. E. Warren appointed mine superintendent, Melvin Brugger retained as consulting engineer, and G. R. Prunty appointed purchasing agent. Recent development work opened high-grade gold ore.

BLUEHILL (Jamestown)—Operating old Standish Law mine. Opened 12-in. vein of silver-lead ore. C. H. Hunt, manager.

MELVINA (Salina) — Trial shipment made to Boulder Ore Sampling Co. James F. Bartlett, manager.

VICTORIA (Summerville) — Opened a lead-silver orebody carrying gold. Winze being sunk from 400 level east heading.

BIG FOUR (Leadville)—Local operators secured lease and started development. Electric hoist and other equipment installed.

BOHN (Leadville) — Development resumed by Peter Horrigan and associates; opened a blanket vein carrying silver.

DERRY RANCH GOLD DREDGING (Leadville)—Plan to resume dredging operations during April. Crew has been employed in repairing dredge; 10 men now removing ice from dredging pond. Ice formed to depth of 4 ft., being broken up by dynamite, and cakes hoisted to shore by wire-rope cableway. R. F. Lafferty, general manager.

Teller County

MODOC (Cripple Creek)—Opened commercial ore on 1000 and 1200 levels of Last Dollar shaft and during March shipped 350 tons.

LONGFELLOW (Victor)—Being developed and operated by the Excelsior Mining, Leasing and Electric Co. under lease from Stratton Cripple Creek Mining and Development Co. Orebody opened between fifth and sixth levels of Llewellyn shaft. Winze being sunk on vein 10 ft. wide. During March, five carloads shipped from this winze.

IDAHO

Shoshone County

OLD HICKORY (Mullan)—Work suspended in tunnel where lead-silver ore was disclosed for 400 ft., ranging in width from a few inches to 3 ft. Appears to be top of oreshoot. Preparing to drive crosscut 2500 or 3000 ft. to cut ore 500 ft. deeper. Compressor will be ordered, as now using Star plant.

HECLA (Wallace)—Company paid quarterly dividend of 15c. per share on Mar. 28, amounting to $150,000. Total amount paid by company to date, $7,405,000. Annual meeting will be held in Spokane on Apr. 8.

INTERSTATE-CALLAHAN (Wallace)—Annual meeting of company will be held at Phoenix, Ariz., on Apr. 14. Four directors will be elected. Action will also be taken on proposal to move main office of company from New York to Wallace.

KANSAS

Joplin District

VINEGAR HILL (Baxter, Kan.) — Placed electric shovel in its Barr mine, the first to be tried in the district. J. G. Trewartha is general superintendent.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Copper production for March as follows: Ahmeek, 1,930,333 lb.; Allouez, 455,664; C and H, 4,592,295; Centennial, 149,423; Isle Royale, 1,093,660; La Salle, 13,800; Osceola, 1,038,204; Superior, 83,314; White Pine, 295,360 pounds.

MINNESOTA

Cuyuna Range

WAGES have been reduced at practically all mines to the basis which prevailed through 1918 up to August and September of that year.

ARKO (Ironton)—Shipping manganiferous ore to Zenith Furnace Co., Duluth.

MINNESOTA MANGANESE (Ironton)—Has taken option from the Shawmut Co., of Duluth, on SE¼ of the NW¼ and the SW¼ of the NE¼ of Section 9-46-29. Will have property drilled under contract by Osterberg & Johnson.

ONEIDA MINES (Ironton)—Readjustment of affairs in progress, to allow its Clark and Sultana mines, recently shut down, to be reopened.

ONAHMAN IRON (Trommald)—Ferro and Algoma mines closed down Mar. 29.

Mesabi Range

MILLER (Aurora)—Small cave-in Mar. 31, resulted in one death.

LAURA (Hibbing)—First Mesabi-Range property to start loading for Lake shipment. Beginning Apr. 1 about 15 cars daily over Great Northern.

WEBB (Hibbing)—Work on new crushing and screening plant temporarily suspended.

BENNETT (Keewatin)—Preparing for complete electrical equipment. Power from Great Northern Power Co., which is now installing transformers for stepping current down to 250 v. Concrete foundations for electric pumps in south side of underground workings being laid.

Vermilion Range

SECTION THIRTY MINE (Ely)—Resumed shipments to Zenith Furnace Co., West Duluth; about two hundred tons daily.

MISSOURI

Joplin District

FREEHOLD O. & G. (Joplin)—Started second mill at Waco; will start construction of No. 3 plant immediately. No. 1 property situated just across state line in Kansas; other two in Missouri. No. 2 plant at start indicates unusually rich recovery from dirt obtained at 172 ft. W. S. Marquiss, Webb City, Mo., is manager.

MONTANA

Jefferson County

HOPE AND KATIE (Basin)—Fifty-ton carload to Washoe works at Anaconda. Value, $15,000 gold.

EVENING STAR (Boulder)—Two carloads silver-lead ore from 70-ft. shaft.

ROBERT EMMETT (Boulder)—Two shifts driving tunnel to lead below old shaft. Silver-lead ore.

AMALGAMATED SILVER (Clancy)—Crew of 27 men working on Free Coinage, and contractors driving 200-ft. drift on Muskeegan. Both mines in ore.

FREE COINAGE (Clancy)—Second carload in March to smeltery from Free Coinage vein. Net returns from smelter on ore shipped before was 129 oz. silver.

LEGAL TENDER (Clancy)—Small shipment to smeltery. High-grade silver ore. Shaft 500 ft. deep.

MONEY MINE (Clancy)—Drifting at 150-ft. level Six to 8 in. high-grade silver ore.

MONTANA

Lewis and Clark County

HELENA MINE (Helena)—Eighteen inches steel galena in south 400 level.

NEW YORK MONTANA TESTING AND ENGINEERING (Helena)—Have contract with Carnegie Steel Co. for manganese ore and concentrates calling for 500 tons per month, expiring Aug. 1, 1919. Filling contract with concentrates from ore shipped by Clark-Montana Realty Co., at Butte. Crude ore averages 32% Mn and 40% SiO_2, and by jigs and Wilfley tables concentrated to 49 to 51% Mn and 10-12% SiO_2. Ratio of concentration is about 2.4 to 1. Engineering staff of this company will have charge of equipping and operating Monarch Mining and Power Co.'s property situated 14 miles south of Elliston. There are being installed a 125-hp. steam plant, a 12-drill compressor, and sawmill. A two-mile tramway and a 200-ton concentrator will be erected this summer. Ore is silver-lead, carrying some gold and copper. Chas. E. Fryberger, manager.

STEMWINDER (Helena)—Carload silver ore to smeltery netted $1300.

WHITLATCH (Unionville) — Repairing 500-ft. shaft to mine gold ore.

Silver Bow County

DAVIS DALY (Butte)—Board of directors arrived in Butte on Apr. 9 for an inspection of mines. Expect board to decide to begin operations at Mount Moriah shaft, a former silver producer adjoining Anaconda property on Butte Hill.

NEVADA

Nye County

TONOPAH DISTRICT ore production for week ended Mar. 29 was 7074 tons, of estimated gross milling value of $120,258. Producers were: Tonopah Belmont, 2337 tons; Tonopah Mining, 1050; Tonopah Extension, 1873; West End, 946; Montana, 128; Tonopah Divide, 245; Jim Butler, 173; MacNamara, 210; Cash Boy, 9; and the Halifax 103 tons.

GOLDFIELD DEVELOPMENT CO. (Goldfield)—A. I. D'Arcy, general manager, discussed Combination mine being operated by company in recent report to effect that, if cheap mining was done upon tonnage and grade of ore present, profitable operation would result. Expect to drive haulageways on level below 380 level throughout ore channel from January shaft to Florence line, and by system of raises and chutes ore will be brought to surface. Cannot use Combination shaft, because it is partially in vein, and surface ground would cave in drawing off ore. Will use 600-ft. shaft 300 ft. from vein sunk in early days, requiring only retimbering. Cost of drifts, raises, chutes, stations, and repairs to adopt this method estimated less than $60,000. Property equipped now with hoists, compressors and underground electric haulage locomotives. Expect to handle 500 to 1000 tons daily. Will use cyanide process at mill, which requires $15,000 for repairs and changes.

NEW JERSEY

Morris County

WHARTON STEEL CO., Wharton, near Dover, N. J., has acquired the Black Rock Mining Co.'s property and rights situated near Dover and Morristown. About 400 employees went on strike Apr. 2, demanding 50c. per hour and an eight-hour day.

NEW MEXICO

Grant County

BOSTON-HECLA (Lordsburg) — Have started sinking main shaft, which will be collared as three compartment and then reduced to two compartment. Timber headframe will be erected at once. Jim Jackson, superintendent of 85 Mine, has contract for first 40 ft. at $22.50 per ft. including everything but raw timber; will be hand work. Remainder of contract, 260 ft., not yet closed; accepting bids. R. E. Van Druff, president.

85 MINE (Lordsburg)—Being examined by A. S. & R. representative under direction of Julius Kruttschnitt, southwestern manager. Working 200 men in mine and shipping 300 tons ore daily. Mill shut down and force discharged.

GREAT EAGLE SPAR MINE (Lordsburg)—Shut down; has 3500 tons high-grade calcium-fluoride ore in bins and 300 tons on railroad loading platform; will resume with better market. Fred Kroll, superintendent.

JO HITCHINS (Lordsburg)—Working lease on surface ores on Superior claim of 85 Mine.

LAST CHANCE (Lordsburg)—Building adobe-concrete storage and watchman's house on ore platform of A. & N. M. Ry.; 22 tons concentrates shipped during month, valued at about $25,000; 15 ft. of ore on 220 ft. level. B. Prescott, superintendent.

OCTO (Lordsburg)—Temporary shutdown of shaft sinking while bulkheading water seams on 140 level; changing tanks and piping, and, when completed, shaft sinking will be resumed. E. Ernest, superintendent.

OKLAHOMA

Joplin District

LONG-HUNT (Hockerville)—Purchased N. J. B. mill, at Duenweg, Mo., and will move it to lease southeast of Hockerville. W. P. Longmire, Sapulpa, is president; T. R. Dean, Miami, secretary, treasurer, and manager.

ALAMO L. & Z. (Miami)—Has taken over Lucky Bob, situated northwest of Quapaw, Okla., and begun operations; has been down for six months.

RED ROSE (Quapaw)—Operating mill with dirt trammed from First National, half mile distant.

TEXAS

Brazoria County

CROWN (West Columbia) — Building fourth storage tank to furnish capacity of 1,000,000 gal. To handle output, will put in either pipe line or build barges to operate on Brazos River. Recently brought in 5000-bbl. well on No. 1 Marmion tract.

HUMBLE OIL (West Columbia)—Two steel tanks of 55,000-bbl. capacity each being built. Contracts for others may be let. Recently 6000-bbl. well brought in on No. 2 Girard tract.

Eastland County

FIRE AT RANGER on night of Apr. 6 destroyed several square blocks of business district. Loss in buildings estimated about $100,000, most of buildings being roughly constructed, as Ranger was boom town; but loss of contents estimated from $500,000 to $750,000. Rebuilding will probably begin at once. Oil field not damaged.

Liberty County

AMERICAN PETROLEUM, as subsidiary of the Republican Production Co., will build pipe line from Hull field to Victor, where it will connect with company's pipe line running from Humble to refinery of Petroleum Refining Co. on Huston ship channel.

Matagorda County

TEXAS GULF SULPHUR (Gulf) — Amendment to charter filed increasing capitalization from $3,000,000 to $5,000,000. Now producing over 1000 tons sulphur per day. Third well being steamed. First shipments being made.

Wichita County

TEXAS PETROLEUM REFINERS' ASSOCIATION (Wichita Falls)—Formed Apr. 5 by refiners of this section. Object is readjustment of freight rates to Northern and Eastern consuming territories. Ardmore rates are present basis; differential over Tulsa rates wanted.

UTAH

Juab County

CHIEF CONSOLIDATED (Eureka)—Quarterly dividend this time 6¼c. a share, usual amount 12½c., payable May 1. Amounts to $55,265, bringing total by company to $1,400,795. Paid $379,900 during 1918. March shipments, 103 cars or about 5000 tons. February, 100 cars, and January, 96.

IRON KING (Eureka)—Shipments of fluxing iron ore to be started on completion of Goshen Valley R.R. to this property and Tintic Standard.

PLUTUS (Eureka)—Understood soluble limestone expected at 60 ft. below 1000 level not encountered at this distance, and sinking of winze to be continued.

Salt Lake County

MICHIGAN-UTAH (Alta) — Aerial tramway to Tanners Flat in process of repair. Damaged by snowslide. Expected to be ready for operation in about a week.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Narrow-gage road operating between Wasatch and Tanners Flat. It is expected that tracks to Alta will be clear in three or four weeks. Will be capable of handling about 300 tons of ore daily, with new Shay engine added, bringing number to three engines.

OHIO COPPER (Bingham)—Local creditors in conference with secretary of company in regard to indebtedness. Company also owes about $125,000 in East, due on improvements to mill and added flotation department, which cost was about $550,000. Mill fire of last year also a setback. Assets and controlling interest in Mascotte tunnel and railway estimated by secretary to exceed $2,000,000 in value. Issue of mortgage to cover debts and furnish operating fund under consideration. Operations suspended recently, owing to drop in metal prices.

UTAH-SALDURO (Salduro) — Company has filed papers showing capitalization of $2,000,000 to take over and operate potash und salt works of Solvay Process company at Salduro, producing potash and salt from brines underlying Great Salt Lake desert or salt beds, near Wendover, on the Western Pacific Railroad.

WASHINGTON

Ferry County

LONE PINE-SURPRISE CONSOLIDATED (Republic) — Will resume shipments of ore from Last Chance mine. Plan to ship 50 tons a day to Tacoma smeltery. Shaft down 690 ft. below collar. Excavation being made for 100-ton ore pocket, just below 650 level, where vein is entered. Employing 16 men.

Stevens County

OLOLIM COPPER (Spokane)—Producing ore from property in Spokane Indian reservation. Ore coming from drift on vein at 100-ft. depth; reported shaft will be sunk 210 feet.

CANADA

British Columbia

LOUIS CREEK MINING (Louis Creek)—Has installed machinery for recovery of gold.

KITSELAS MOUNTAIN MINING (Usk)—Situated on the Grand Trunk Pacific Ry. negotiating for sale to North Dakota syndicate, which recently made examination.

Manitoba

FORBES CLAIMS (The Pas)—These eight claims near Mile 194, Hudson Bay Ry., purchased by North Canada Exploration Co. some time ago. Shaft was put down 75 ft., encountering reported high-grade ore. Machinery of Sultana mine at Kenora, Ontario, also owned by company, being shipped to property.

Ontario

LA ROSE (Cobalt)—Has given up its option on Homestake mine in Kamloops district, British Columbia.

TEMISKAMING (Cobalt)—Still negotiating for purchase of Dolly Varden and Wolf properties, Portland Canal district, British Columbia. Difficulty still experienced in getting railway situation cleared up.

WHITE RESERVE (Elk Lake)—Contracted for drifting and crosscutting at 140-ft. level. Number of veins opened up on surface.

WRIGHT HARGREAVES (Kirkland Lake)—Has decided to increase mill capacity from 150 to 200 tons a day. Construction work will start soon.

DOME (Porcupine)—Expects to start milling on Apr. 15. Work now under way on Dome Extension, which is under option.

HOLLINGER (Porcupine) — Treating 2500 tons a day and producing about $7,000,000 a year.

MEXICO

Baja California

CAMPAGNIE DU BOLEO (Santa Rosalia)—February production of copper was 1,803,645 pounds.

BRAZIL

DIAMOND MINES at Moribeca and Boa Vista in the region of Diamantina, according to report of Vice-Consul Richard P. Momsen at Rio de Janeiro, will be developed by a company recently formed under the name of Companhia Brazileira Diamantifera. Practically all of the capital of the organization is represented by properties belonging to the Syndicato Diamantino.

SPAIN

POTASH BEDS of Catalonia, according to report of Consul General C. B. Hurst, at Barcelona, may be worked under concessions being granted to foreign and Spanish companies. Concessions have been awarded to Solvay & Co.: Minas de Suria, Santander, Spain; Sociedad Anonima Fodina, Lauria 21, Barcelona, and the Sociedad Anonima La Sevillana, Trafalgar 11, Barcelona, Spain.

The Market Report

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
10	4 6500	101⅛	48 13/16	14	4 6600	101⅛	48 13/16
11	4 6450	101⅛	48 15/16	15	4 6550	101⅛	48⅞
12	4.6500	101⅛	48⅞	16	4.65.5	101⅛	48 13/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
10	15 0 @15 31	†72½	4 95 @5 00	4.65 @4 70	6 15 @6.20
11	15 0 @15. 5	†72½	4 95 @5 00	4.65 @4 70	6.12½ @6 17½
12	15. 0 @15. 5	†72½	4.95 @5.00	4.65 @4 70	6.12½ @6.17½
14	15. 0 @15. 5	†72½	4.90 @5.00	4 65 @4 70	6 05 @6 10
15	15.10 @15.15	†72½	4.90 @5.00	4 65 @4 70	6.02½ @6.07½
16	15.10 @15.15	†72½	4.90 @5.00	4.65 @4.70	6.00

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Apr.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
10	77¼	77¼	81½	227	275	25	24	36½
11	76½	76½	81	225½	223¾	24½	24	36½
12						....	....	....
14	76½	76½	81	222½	219	24½	24	36½
15	77¼	77¼	81	223	219½	24½	24	35¼
16	76¾	76¾	81	224	221¼	24½	24	35¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Apr. 16, 1919

All of the principal metal markets exhibited a declining tendency this week. Business was very dull. Both lead and zinc fell to about the low points of the year.

Transatlantic freight is quoted at 1c. per lb., but shipping arrangements are not easy to negotiate.

The stocks of metals held by the British government on Apr. 1, with the corresponding figures for Mar. 1 stated in brackets, were as follows, in short tons: Copper, 54,546 (57,537); lead, 108,030 (112,070); zinc, 42,612 (40,660); aluminum, 24,886 (14,564); nickel, 2675 (2612); antimony, 4884 (4844). The reductions in copper and lead were the first reductions in any month since the armistice, and probably indicate the feeding out of those metals into consumption and the gradual cessation in arrivals.

According to the London Metal Exchange, the stocks of copper in public warehouses, exclusive of those in the hands of the government, were 5387 long tons on Mar. 1, compared with 2596 tons on Feb. 1.

German papers report that the stocks of copper and brass in that country prove to be larger than was supposed, and the producers of spelter who were expecting to dispose of their metal as a substitute are disappointed. Spelter production has been maintained at a high rate, and stocks have accumulated uncomfortably; wherefore German producers are contemplating selling for export in neutral countries.

Copper, Tin, Lead and Zinc

Copper—The quotation of 15½c., delivered, regular terms, is maintained as something to talk about, but copper sold right along for less money, 15⅜c. having been accepted during the early part of the week, while during the latter part business was done on the basis of 15¼c., delivered, regular terms. Aside from one special transaction, the volume of business was all but insignificant, the market being distressing in its dullness.

There were reports of a good deal of copper being offered by brokers, who obtained their supplies from speculative hands and from consumers, some of whom overbought last month and desired to resell.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17@17¼c. per lb. f.o.b. mill, carload lots.

Tin—There are no new features to report. The U. S. Steel Products Co. is understood still to have a good deal of tin to sell.

Lead—The reduction in the price last week failed to stimulate any large buying, and nothing but ordinary business has been done at the reduced price. Indeed, some interests that have desired to sell lead have cut the price further without being able to market much. The Government is selling its lead, and although the total that it desires to sell is not very large, nevertheless, a little goes a long way in a market that is so thin as this one is at present. The St. Louis market was scarcely more than nominal throughout the week.

The War Department on Apr. 12 issued the following statement:

"Disposition of the surplus stocks of lead owned by the War Department is being made at current market prices in the community in which the surplus is held. This surplus is scattered throughout the country and in no one place is there a large quantity. Reports from the several bureaus show a total amount of 7000 tons of lead to be in possession of the War Department. This surplus lead is not being placed on the market in quantity at any one time, but is being sold in small quantities in various places."

Zinc—The sharp decline in this metal was apparently started by some speculative selling, but some of the smaller smelters immediately tried to force sales, with the result of sharp declines from day to day. On Apr. 15 a carload was reported sold at 5.97½c., and on Apr. 16 a round lot was done at 6c. The aggregate business for the week was not very large.

Labor troubles in Oklahoma appear to have been composed temporarily, and the several plants are now in operation except Sand Springs, which was closed in anticipation of a strike. Among the other plants there is a general curtailment of production.

High-grade spelter is quoted at 6⅜c.

Japan has recently been offering spelter in England.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—Nothing but small business was done. Offerings reflected a softer tone. We quote spot at 6½@6⅜c. April-May shipments were offered as low as 6¼c. However, the supplies now on the way from the Orient are believed to be small.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—This metal was firmer, and we quote $72½@75. There is said to be not much in stock in New York, but some shipments are on the way.

Silver and Platinum

Silver—The London quotations have fluctuated between 48 13/16 and 48 15/16d., dependent on sterling exchange, but New York price has remained fixed at $1.01⅛ under Government control. On and after May 1st next, depositors in the U. S. Assay office will have the option of receiving proceeds of silver deposits in fine silver bars or selling same to the Government at a price to be fixed by the Director of the Mint. Recently the Government has declined to return proceeds of deposits in fine silver and has purchased same at $1.00 per ounce 1000 fine. Exports last week from New York to London amounted to 506,145 ounces.

Mexican dollars at New York: Apr. 10, 77½; Apr. 11, 77½; Apr. 12, 77½; Apr. 14, 77½; Apr. 15, 77½; Apr. 16, 77½.

Platinum—Stronger. We quote $100.

Palladium—We quote $115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 12—Blende, per ton, high, $42.85; basis 60% zinc, premium, $40; Prime Western, $40@38; sludge, $36; flotation, $33; calamine, basis 40% zinc, $26@25. Average selling prices: Blende, $39.68; calamine, $27.22; all zinc ores, $39.22.

Lead, high, $63.85; basis 80% lead, $62@60; average selling price, all grades of lead, $61.62 per ton.

Shipments the week: Blende, 10,866; calamine, 418; lead, 1801 tons. Value, all ores the week, $553,540.

Further labor difficulties are expected at the smelteries on the 15th, when workmen at other smelteries than those closed down are expected to go out on a wage strike. Reports are current that a strike of coal miners is probable on Apr. 16.

Platteville, Wis., Apr. 12—Blende, basis 60% zinc, $42.50 base for premium grade and $40 base for high-lead blende. Lead ore, basis 80% lead, $56 to $58 per ton.

Shipments reported for the week are 2014 tons blende, 230 tons galena, and 255 tons sulphur ore. For the year to date the totals are 28,312 tons blende, 1412 tons galena, and 702 tons sulphur ore. For the week 2544 tons blende was shipped to separating plants.

Other Ores

Manganese Ore—High-grade furnace ore was mentioned as low as 40c. per unit.

Molybdenum Ore—No business reported.

Tungsten Ore—Charles Hardy reports as follows: "Not only sentiment but actual business in tungsten has undergone considerable improvement during the past week, and we know of business in tungsten ore, ferrotungsten, and tungsten powder at a scale which compares very favorably with the business done since the signing of the armistice. During the week ended Apr. 8, the highest price paid for ordinary tungsten ore that we could report was $6 per unit. During the past week business has actually been done in Chinese ore for spot delivery at $7 per unit. High-grade scheelite is offered at $10 per unit, at which price also a smaller quantity of the highest grade wolframite can be obtained. Tungsten metal was sold at $1.50 per lb. during the week.

Other Minerals

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Unchanged.

Iron Trade Review

PITTSBURGH—Apr. 15

There is virtually an open market in pig iron, but prices are not quotable below the nominal level, because there has been no business to bring out cut prices. In steel products, predictions of an open market are less plentiful. Less criticism is heard in the pig-iron and steel trades than in the daily newspapers of Director General Hines' refusal to accept the Industrial Board steel prices as a basis for the making of railroad purchases. What the steel trade chiefly regrets is the practical disappearance of the promised opportunity to control prices by agreement, through the industry holding meetings and having the Industrial Board approve the prices decided upon. However, the recent operation accomplished one thing, enabling the steel trade to make another reduction in prices, the first having been made in December, without throwing the market open to competition. Business will now probably drift until developments arise. The common opinion among steel producers is that little additional business would be brought out by making further price reductions, though a certain amount of business must be placed from day to day, no matter what prices have to be paid.

So far as concerns actual purchases of steel, the so-called Peek-Hines controversy is of relatively small import, for at best the amount of buying the Railroad Administration would be in position to do is limited. At present about 500,000 tons of rails are due the railroads, with shipments going forward at about 40,000 tons a week, so that no large rail tonnage would be required in the near future, and, as to cars and locomotives, many already in existence are idle. A comprehensive program of railroad buying awaits not simply the development of prices satisfactory to the railroads, but also the enactment of legislation by Congress defining the status the railroads are to occupy when the properties are returned to their owners, everyone being convinced that they will be returned some time.

The steel industry is now operating at about 70% of capacity, chiefly on small orders that are drifting in day by day, for immediate shipment, and specifications on contracts. Steel-ingot production in March was at the rate of about 37,900,000 tons per year, or about 77% of capacity, estimating capacity at 49,000,000 tons. If the mills are operating at 70% of capacity, they are producing steel at about 10% more than the average rate in the best years—1912 and 1913—prior to the war. Nevertheless the steel business is everywhere regarded as being extremely dull.

Pig-Iron—No business has been done in the past week worth mentioning. A leading merchant furnace interest states that an inquiry for 1000 tons would be sufficient to bring out a cut price. Meanwhile the market is quotable nominal at the old figures, as reduced first $3 and then $4.25 from the Government prices, as follows: Bessemer, $27.95; basic, $25.75; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh. Merchant furnaces are going out of blast every week, and the furnaces are practically a unit in preferring to see prices take their natural course, forcing furnaces out of blast and thereby operating to reduce production costs, until a balance is struck at which profitable business can be done.

Steel—An inquiry for 100 tons of forging billets is referred to as the first indication of demand for a long time for such material and as representing more activity than has lately been encountered in any description of unfinished steel. Specifications on billet and sheet-bar contracts are rather light, and are only to cover orders for finished steel already booked. Regular prices, practically nominal, are: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferroalloys

Ferromanganese—Reports have it that resale 80% ferromanganese can be had at $115, delivered, against $130 formerly quotable. Furnaces continue to hold to $150. Resale spiegeleisen is about $42, shipping point. There is practically no demand for either manganese alloy.

Coke

Coke—Coke production in the Connellsville region continues to decrease, and even some of the byproduct ovens are running rather slack. Odd lots of Connellsville furnace coke on track and requiring to be moved to save demurrage charges have been offered at down to $3.60. The regular settling price for April deliveries on contracts seems to be $4.25. Foundry coke commands $4.50 to $6, according to brand, per net ton at ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	......
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125	......	50.920	49.500	
Oct.	87.332	101.125	......	44.324	49.500	......
Nov.	85.891	101.125	......	43.584	48.969	......
Dec.	85.960	101.125	......	43.052	48.492	......
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic		London Standard		London Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	24.500	14.856	110.000	76.821	125.000	82.071
April	23.500	.....	110.000	.....	125.000	.....
May	23.500	.....	110.000	.....	125.000	.....
June	23.500	.....	110.000	.....	125.000	.....
July	25.904	.....	119.913	.....	134.913	.....
Aug.	26.000	.....	122.000	.....	137.000	.....
Sept.	26.000	.....	122.000	.....	137.000	.....
Oct.	26.000	.....	122.000	.....	137.000	.....
Nov.	26.000	.....	122.000	.....	137.000	.....
Dec.	(a)	.....	118.447	.....	133.167	.....
Year	24.628	.....	115.530	.....	130.507	.....

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	......	329.905	......
May	(a)	......	364.217	......
June	(a)	......	331.925	......
July	(a)	......	360.347	......
August	(a)	......	380.900	......
September	(a)	......	343.905	......
October	(a)	......	335.543	......
November	(a)	......	323.550	......
December	(a)	......	267.736	......
Av. year	(a)	......	330.138	......

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	.....	6.701	.....	29.00	......
May	6.818	.....	6.704	.....	29.00	......
June	7.611	.....	7.511	.....	29.00	......
July	8.033	.....	7.750	.....	29.00	......
August	8.050	.....	7.750	.....	29.00	......
September	8.050	.....	7.750	.....	29.00	......
October	8.050	.....	7.750	.....	29.00	......
November	8.050	.....	7.750	.....	31.20	......
December	6.564	.....	6.324	.....	40.00	......
Year	7.413	.....	7.222	.....	30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890		6.715	.....	54.000	
May	7.314		7.114	.....	54.000	
June	8.021		7.791	.....	54.000	
July	8.688		8.338	.....	54.000	
August	8.985		8.635	.....	54.000	
September	9.412		9.092	.....	54.000	
October	8.801		8.451	.....	54.000	
November	8.49[illegible]		8.141	.....	54.100	
December	8.163		7.813	.....	56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15		32.95	.....	33.95	
May	36.20		33.00	.....	34.00	
June	36.30		33.16	.....	34.16	.....
July	36.60		33.40		34.40	.....
August	36.60	.....	33.40		34.40	.....
September	36.60		33.40		34.40	.....
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40	.....	35.40	
Year	$36.67	.....	$33.71		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 15
Alaska Gold M.	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	71
Am.Sm.&Ref., pf.	105
Am.Sm.Sec., pf., A	92
Am. Zinc	14
Am. Zinc, pf.	43
Anaconda	62
Batopilas Min.	1
Bethlehem Steel	76
Butte & Superior	22
Butte Cop. & Zinc	7
Cerro de Pasco	42
Chile Cop.	23
Chino	37
Colo. Fuel & Iron	42
Crucible Steel	68
Crucible Steel, pf.	93
Dome Mines	14
Federal M. & S.	10
Federal M. & S., pf.	38
Great Nor., ore ctf.	41
Greene Cananea	41
Gulf States Steel	51
Homestake	98
Inspiration Con.	49
International Nickel	26
Kennecott	32
Lackawanna Steel	70
Mexican Petrol	188
Miami Copper	23
Nat'l Lead, com	71
National Lead, pf	108
Nev. Consol.	16
Ontario Min.	7
Ray Con.	21
Republic I.&S., com.	83
Republic I.&S., pf.	102
Sloss-Sheffield	53
Tennessee C. & C.	14
U. S. Steel, com.	99
U. S. Steel, pf.	116
Utah Copper	75
Va. Iron C. & C.	54
Worthington Pump	71

BOSTON CURB*	Apr. 15
Alaska Mines Corp.	‡ 12
Boston Ely	1
Boston & Mont.	63
Butte & Lon'n Dev.	11
Calaveras	1
Chief Con.	3
Contact	05
Corbin	‡ 25
Cortez	12
Crown Reserve	.35
Crystal Cop.	32
Eagle & Blue Bell	2
First Nat. Cop.	1
Houghton Copper	.20
Intermountain	‡ 05
Iron Blossom	.40
Iron Cap	11
Majestic	09
Mexican Metals	.18
Mines of America	‡ 05
Mojave Tungsten	.05
Nat. Zinc & Lead	13
Nevada-Douglas	.12
New Baltic	1
Onego	20
Pacific Mines	‡ 25
Rex Cons	13
Yukon Gold	.17

SAN FRAN.*	Apr. 15
Alta	02
Andes	25
Best & Belcher	14
Caledonia	10
Challenge Con	‡ 03
Confidence	‡ 03
Con. Virginia	1 30
Gould & Curry	07
Hale & Norcross	17
Jacket-Cr. Pt.	06
Mexican	49
Occidental	‡ 40
Ophir	1 15
Overman	04
Savage	25
Sierra Nevada	27
Union Con	55
Utah Con	03
Belmont	3 00
Jim Butler	38
MacNamara	70
Midway	58
Mont.-Tonopah	20
North Star	08
Rescue Eula	11
West End Con	1 [illegible]
Atlanta	15
Booth	30
Comb. Frac.	‡ 01
Florence	[illegible]
Jumbo Extension	13
Kewanas	05
Nevada Hills	03
Nevada Packard	20
Round Mountain	38
Silver Pick	09
White Caps	20

COLO SPRINGS*	Apr. 15
Cresson Con	5 [illegible]
Doctor Jack Pot	04
Elkton Con	05
El Paso	15
Gold Sovereign	‡ 02
Golden Cycle	1 85
Granite	15
Isabella	05
Mary McKinney	06
Portland	03
United Gold M.	19
Vindicator	38

BOSTON EXCH †	Apr. 15
Adventure	‡ 75
Ahmeek	73
Algomah	‡ 30
Allouez	36
Ariz. Com.	11
Arnold	‡ 20
Bingham Mines	‡8
Bonanza	‡ 10
Butte-Balaklava	‡ 30
Calumet & Ariz.	60
Calumet & Hecla	4[illegible]5
Centennial	12
Copper Range	43
Daly West	2
Davis-Daly	5
East Butte	8
Franklin	3
Granby	‡70
Hancock	6
Hedley	‡12
Helvetia	‡ 25
Indiana	‡ 50
Isle Royale	26
Keweenaw	‡1
Lake	4
La Salle	2
Mason Valley	‡2
Mass	4
Mayflower	4
Michigan	3
Mohawk	57
New Arcadian	1
New Cornelia	17
New Idria	‡9
North Butte	11
North Lake	45
Ojibway	‡1
Old Dominion	33
Osceola	49
Quincy	56
St. Mary's M. L.	‡40
Santa Fe	‡ 25
Seneca	14
Shannon	2
Shattuck-Ariz	‡14
So. Lake	75
So. Utah	‡ 12
Superior	5
Superior & Bost.	2
Trinity	2
Tuolumne	‡ 75
U. S. Smelting	49
U. S. Smelting, pf	47
Utah Apex	2
Utah Con	8
Utah Metal	‡2
Victoria	2
Winona	‡.80
Wolverine	17

N. Y. CURB†	Apr. 15
Big Ledge	[illegible]
Butte & N. Y.	‡[illegible]
Butte Detroit	04
Caledonia	.36
Calumet & Jerome	[illegible]
Can. Cop Corpn.	1
Carlisle	‡2
Cashboy	11
Con. Ariz. Sm.	1
Con. Coppermines	‡5
Goldfield Con.	18
Goldfield Merger	05
Greenmonster	‡[illegible]
Hecla Min.	5
Howe Sound	‡3
Jerome Verde	‡[illegible]
Louisiana	[illegible]
Magma	‡31
Marsh	06
McKinley-Dar-Sa.	46
Milford	‡ 75
Mother Lode	42
Nixon Nevada	28
Ohio Cop	50
Rawley	‡2
Ray Hercules	2
Richmond	‡ 5
Rochester Mines	21
St. Joseph Lead	11
Standard S. L.	[illegible]
Stewart	23
Success	04
Tonopah	‡3
Tonopah Divide	10
Tonopah Ex.	2
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	4
United Verde Ext.	‡32
United Zinc	‡[illegible]
Utica Mines	‡ 08

TORONTO*	Apr. 15
Adanac	17
Bailey	04
Beaver Con	43
Chambers Ferland	‡ 10
Coniagas	2 00
Hargraves	02
Kerr Lake	5 00
La Rose	25
Lake Shore	93
Min. Corp. of Can.	2 00
Nipissing	‡8 75
Peterson Lake	07
Temiskaming	32
Wettlaufer-Lor.	04
Davidson	69
Dome Exten.	27
Dome Lake	24
Hollinger	6 12
McIntyre	1 37
Newray	12
Porcu. Crown	26
Teck-Hughes	26
Vipond	20
West Dome	13

* Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

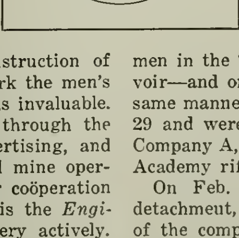
April 26, 1919

Volume 107 *Number* 17

The 27th Regiment of Engineers United States Army

By Lieut. R. H. Burrage

THE 27th Regiment of Engineers, U. S. Army, was organized under the provisions of an order from the War Department dated Aug. 15, 1917. This order called for the organization, "for the period of the emergency, the enlisted strength being raised and maintained by voluntary enlistment or draft," of certain special and technical engineer troops, among which was specified a *mining service*, consisting of regimental headquarters and six companies (mining). Although not definitely specified as such, the regiment was organized and trained as a combatant regiment, for duty in the front lines, its specialty to be military mining, both offensive and defensive. Actually, because of a change in the character and conditions of warfare, the most effective work done was in another field—the construction of bridges in the forward areas, in which work the men's experience in heavy-timber construction was invaluable.



Recruiting for the regiment was done through the office of the Chief of Engineers, by advertising, and by appeals that were mailed to mines and mine operators throughout the country, asking their coöperation and assistance in getting recruits. In this the *Engineering and Mining Journal* coöperated very actively. Some assistance in filling the regiment was given by the draft, through the induction of desirable draftees, especially in the cases of the last three companies.

The first step in the actual physical organization of the regiment was made on Oct. 23, 1917, by the transfer of about 75 men of Company F of the 23d Engineers, which had many men experienced in various phases of the mining industry, to the 27th Engineers, at Camp Meade, Md. This formed the nucleus of Company A, whose full quota of 250 men was finally reached on Dec. 20, 1917. The training undergone in America before departure overseas consisted of infantry drill, physical drill, ceremonies, mine-rescue work, first-aid work, field fortifications and activities of a similar nature. Capt. Norval J. E. Welsh, the company commander, acted also as commanding officer of the regiment until the assignment of Lieut.-Col. O. B. Perry on Jan. 29, 1918. On Feb. 1, Company B was organized by the transfer of all the men in the "Recruit Detachment"—the regiment reservoir—and on Feb. 18 Company C was organized in the same manner. These two companies were filled by May 29 and were given substantially the same training as Company A, with the addition of two weeks on the Naval Academy rifle range at Annapolis.

On Feb. 16, Company A, with a small sanitary detachment, left for Camp Merritt, and on Feb. 27 most of the company sailed on the S. S. "Agamemnon," 60 men who were held in camp under quarantine following on the S. S. "La Touraine" on Mar. 14.

Entraining at Camp Meade on June 28, 1918, Companies B and C, with Lieutenant-Colonel Perry, half of

Headquarters, and half of the Sanitary Detachment, under Major Wood, arrived the following day at Hoboken, boarded the U. S. S. "Siboney," and sailed on June 30.

After this departure the remainder of the regiment moved to Camp Leach, D. C., where it was quickly filled to full strength. Company D was formed on July 5, Company E on July 16, and Company F on July 24. These companies were formed under the command of Major (later Lieutenant-Colonel) M. E. Gilmore, and were given the same preparatory training that the first battalion received. On Aug. 21 these three companies, together with the second half of Headquarters and the Sanitary Detachment, entrained for Camp Merritt, and on Sept. 1 sailed on the S. S. "Nevasa," with Capt. John W. Balch as commanding officer, Lieutenant-Colonel Gilmore having been assigned to other duties.

Overseas Service

Company A debarked at Brest on Mar. 11, 1918, and after four days' rest at the Pontanezen barracks entrained for Jorquenay, a village near Langres, in the Department of Haute-Marne, where the men were joined on Apr. 9 by the rest of the company. At Langres the company was attached to the Army Engineers' School, and spent five months constructing model field fortifications, erecting camouflage, building roads, and acting as instructors in mining and pioneering. Although comfortably situated, the men chafed at the delay in reaching the front, for during this entire period only one detail, sent under Lieutenant Edmondson to repair dugouts on the Toul sector with the 26th Division, had any "excitement," this being in the form of a severe bombardment by high-explosive and gas shells, which did not, however, result in any casualties.

On Aug. 7 Company A left Jorquenay for Baccarat, Meurthe-et-Moselle, and worked under the direction of the 26th Engineers on water supply for the front areas. This service involved the construction and repair of reservoirs and pipe lines, and the installation of pumping systems. One detachment of 180 men, under Lieutenant Edmondson, was ordered to Griscourt and served on the advance throughout the St. Mihiel offensive, which began on Sept. 12 and terminated on the 17th. This water-supply work was of great importance in the offensive, and the company earned for itself the commendation of the Chief Engineer, First Army, for its part in this achievement. From Griscourt and Baccarat the company was ordered to Les-Islettes-en-Argonne, and its further activities will be described under the Argonne-Meuse offensive.

Debarking at Brest on July 13, 1918, Companies B and C, with the first half of Headquarters, spent four days at Pontanezen barracks and then entrained for Saacy-sur-Marne, which they reached July 19. In their quest for action they were destined to be more speedily rewarded than Company A had been, for they had reached France in the midst of the great Chateau-Thierry offensive, where America was bending every effort to break the backbone of the German drive toward Paris. Companies B and C were at once assigned to the Corps Reserve, First Army Corps, and on July 20, seven days after reaching France, marched into the Belleau woods, near the villages of Epaux and Buire, where they acted, until Aug. 1, as reserve infantry. Here they received their first shelling, from which, with good fortune, they escaped unscathed, and here they learned to don their gas masks for every automobile horn (a very popular time-killer with green troops). On Aug. 1 the two companies returned to their headquarters at Saacy, rested there a week, and on Aug. 8 separated, Company B reporting to the 14th Engineers at Trugny, where the company constructed a narrow-gage railroad bridge over the Ourcq River. They returned to Saacy, and on Aug. 19 left, with the Regimental Headquarters, for Neufchateau, in the Vosges.

After a week's rest at Neufchateau, Company B left Headquarters, operated a large engineer dump near Toul for about two weeks, and from then until Sept. 18 worked with the 26th Engineers on water-supply service in the forward areas of the St. Mihiel district. On this work, one detachment, at Thiaucourt, was heavily shelled, and one man gassed. Lieutenant Sedright distinguished himself by a search, under heavy shellfire, for men who had lost their way.

Company C also left Saacy on Aug. 8, and, after a few days' railroad work near Fere-en-Tardenois, made camp in the village of Dole, about four kilometers from the Vesle River, where a pleasant, although stirring, month was spent as Third Army Corps troops, working on road repair, quarrying, and construction of dugouts and observation posts along the Vesle front. The men were frequently subjected to severe shelling, and it was here, on Aug. 21, that the 27th had its first casualties, one man being wounded severely, and three men slightly. On Sept. 8 the company moved south by marching and by train, arriving at Dombasie, near Verdun, on Sept. 21.

Work During the Argonne Offensive

At the start of the Argonne offensive, on Sept. 26, there being no special bridge troops available, Companies A, B, and C of the 27th Engineers were selected as bridge troops for the First Army, because of their experience in similar work and their knowledge of timbering and heavy construction. Company C was available at Dombasle, and Companies A and B were brought in from the St. Mihiel district and stationed at Les-Islettes and Clermont-en-Argonne. Regimental Headquarters had been established at Clermont on Sept. 22, and was maintained there until after the signing of the armistice on Nov. 11. Clermont was at the time under shellfire, and one man of Company B was slightly wounded here on Sept. 22.

On Sept. 26 the three companies entered on a most intensive program, and from that time on their activities were so varied and their moves so numerous that it is possible here only briefly to list their achievements:

Company A—Sept. 26, frame-trestle crater bridge near Boureuilles; considerable shelling; two men wounded by German mine. Sept. 27, road construction with 23d Engineers near Varennes. Sept. 28, repair of plate girder bridge across Aire River; heavy shelling. Sept. 29, road repair near Charpentry; one platoon, under Lieutenant White, was called upon to stand to as infantry, to repel a German counter attack, one man being killed and four wounded. Oct. 1-3, place. Oct. 8-9, repair of bridge at Cheppy. Oct. 10-16, culvert construction, pile railroad bridge over Braniere Creek, pile highway bridge over Aire River. During the entire period spent near Varennes the company was under fire, and on Oct. 3 one man was killed in camp by a practically direct hit. On Oct. 16 Captain Welsh was relieved of his command and First Lieutenant Miller was placed in charge of the company. Oct. 17-23, large two-way highway bridge over Aire River at Chatel-

Chehery, under enemy observation and fire. Oct. 21-25, frame-trestle bridge over millrace at La Forge. Nov. 3-5, bridge repair at St. Juvin. Nov. 5-9, built and repaired three railroad bridges near Grandpre. Nov. 11-14, large highway bridge across Meuse River at Vilosnes. Nov. 16-27, road repair at road bridge near Etain, completely finished in 18 hours.

Company B—Sept. 26-27, two-way frame-trestle bridge over Aire River. Sept. 27-Oct. 3, bridge and road repair near Boureuilles; operation of water-supply train in vicinity of Aubreville. Oct. 4-13, stone bridge repaired near Boureuilles; two-way highway constructed over Aire at Apremont; this bridge was built under direct enemy observation and under heavy shelling and machine-gun fire. Two men were killed outright, two died from wounds received, one was seriously and eight were slightly wounded, but, despite the extreme danger, every man on the job worked with splendid spirit, two of the men who were killed being at the time on voluntary overtime. Oct. 16-20, constructed permanent masonry bridge at Boureuilles. Oct. 20-30, construction of pile-trestle bridges over Aire River and Buanthe Creek for 243-ton naval gun. Nov. 1-6, repaired bridges at Baulny, Fleville, Grandpre, and Cornay. Constructed bridge and repaired roads and culverts at Apremont. Nov. 7-10, repaired large bridge at St. Juvin and small bridges at Briquenay and Beffuet-la-Morte-Homme. Nov. 13-15, repaired pile bridge at Sivry-sur-Meuse. Nov. 16-25, constructed large railroad bridge at Wiseppe; repaired culverts on railroad bridges between Wiseppe and Stenay. Dec. 5, constructed five railroad bridges between Wiseppe and Stenay.

Company C—Although a part of the bridge section, Company C was assigned to work with the 22d Engineers on Sept. 26, grading and putting a narrow-gage railroad line to connect the French line at Esnes (Department of Meuse) with the German lines at Montfaucon, over ground that had been for four years a "No Man's Land." By Oct. 15 four kilometers were put in good condition and turned over to the 21st Engineers for maintenance, together with several sidings, a section house, and a ballast quarry. During this period the company furnished many loading details, and in several emergencies hand-trammed the heavy freight cars of ammunition and rations for several miles when the locomotives failed. Oct. 15-25, re-ballasted French railroad from Dombasle to Esnes. Oct. 25-Nov. 8, operated large ballast quarry near Bethelainville. Oct. 7-Nov. 11, mined bridges and guarded road mines and explosives at Les-Islettes, Futezu, and Crois-de-Pierres. Oct. 17-Nov. 9, constructed large railroad bridge for 243-ton naval gun over creek at Forges. Constructed and repaired roads and cleaned up destroyed bridges near Forges. Bridge reconnaissances were made along the front from Consenvoye to Dun-sur-Meuse, and one detail—Lieutenant Burrage, Sergeant Rutherford and Sergeant Marius Jean (French)—working inside the German lines at Vilosnes-sur-Meuse, encountered a German patrol, one man being wounded by a hand grenade, while three Germans were killed and one German was wounded. Nov. 10-22, repaired pile-highway bridge at Consenvoye; constructed large two-way bridge over the Meuse at Vilosnes, and a two-way bridge over the Meuse Canal. Nov. 24-27, repaired highway bridges at Dun-sur-Meuse. Nov. 28-Dec. 3, guarded bridge mines at Foidos and Lavoye; details pulling mines from bridges in vicinity of Verdun.

Companies D, E, and F—Debarking at Glasgow, Scotland, on Sept. 13, the entire second battalion entrained for Romsey, England, and after two days in rest camp embarked at Southhampton on the S. S. "Harvard," arriving at Le Havre on Sept. 17. The men at once entrained for the interior, and on the 19th reached the village of Charmoy, Department of Haute-Marne. Here they were billeted until Oct. 22, the time being spent as a final training period. While at Charmoy, the battalion suffered from a severe epidemic of influenza, resulting in the death of five men. Assigned to the First Army as Army engineer troops, the battalion left Charmoy, and on Oct. 24 reported to Regimental Headquarters at Clermont. Here they were assigned to bridge work in the advance area, and, as with the companies of the first battalion, each company went its separate way.

Company D—Oct. 26-Nov. 7, staked out and partly constructed a barrack camp for 5000 men near Apremont; repaired roads and railroads. Nov. 8-30, company in camp near St. Juvin; constructed two highway bridges north of Fleville, one between St. Juvin and Marcq, one south of Chevieres, one north of Chevieres, one south of Marcq, and two north of St. Juvin. Repaired highway bridge south of Grandpre, three railroad bridges between St. Juvin and Grandpre, highway bridges near Fleville, Buzancy, Grandpre, St. Juvin and Marcq, and three-mile road near Grandpre.

Company E—Oct. 26, after brief stops in Les-Islettes and Varennes, the company made camp in Montblainville, and until Nov. 7 worked on road repair and quarrying. Nov. 8, the company moved to Grandpre, where it maintained its camp until Dec. 8. Here it constructed a gas-engine piledriver, built three highway bridges over the Aire River, and repaired two other bridges.

Company F—Oct. 27, established camp near Varennes; repaired and widened three kilometers of the Varennes-Montblainville road; pulled German mines at Neuville. Nov. 8-16, in camp at Brieulles-sur-Meuse; repaired small bridge at Vilosnes; constructed railroad bridges in yard at Dun-sur-Meuse, and at Brieulles, and large highway bridge near Brieulles. Considerable road and building repair in same vicinity; many American and German dead buried. Nov. 16-Dec. 9, camp moved to Vilosnes-sur-Meuse; constructed highway bridge on viaduct and also one over the Meuse Canal.

When the regiment, on Sept. 26, took up its duties as bridge engineers for the First Army, Lieutenant-Colonel Perry was placed in the office of the chief engineer in charge of the bridge section, and he at once reorganized this department. It was due largely to his administration, backed by the splendid work of the companies under the field direction of Majors Norcross, Franklin, and MacGlashan (of the chief's office) that the regiment made its reputation as an efficient engineering unit.

The armistice was signed on Nov. 11, 1918, but the regiment kept up its bridge work until Dec. 5, when it received orders to report to the Commanding General of the S. O. S., for return to the United States. The regiment acquiesced without a dissenting voice, but visions of a Christmas at home were premature. By Dec. 10 the six companies were brought together at Le Chatelier (St. Menshould District), for the first time in the history of the regiment, and there they officially effected the battalion organization which had been in unofficial operation for some time. After four weeks of misery in the rain and mud of that village, they headed for the popular "40 Hommes or 8 Chevaux," or "American Bar," for the port of embarkation, but were halted again, at Verton, on Jan. 5, 1919. This delay was even longer, but, in its own inimitable way, the regiment filled the interim by promoting international amity with the civilian population. At last the good word came, and, leaving behind them a trail of broken hearts, the 27th moved to the embarkation camp at St. Nazaire on Feb. 26. Here they submitted, perforce, to the long series of baths, delousings, and intimate inspections, and relinquished their souvenirs. Luck was with them at last, for they were immediately assigned to a transport. On Mar. 6 they boarded the S. S. "Dakotan," lately (and still) a freighter, and on Mar. 7 sailed for home, debarking at New York Mar. 20. This date practically marks the end of the regiment, for it was at once split up into detachments which left for the various sections of the country for demobilization.

THE COMFORT FUND

No history of the 27th Engineers would be complete without mention of the "Association of the 27th Engineers." The idea of a "Comfort Fund" for the regiment originated in the mind of W. R. Ingalls, of the *Engineering and Mining Journal*, who made the suggestion to Colonel Perry by letter, the Association itself being started some weeks later at a meeting of the Mining and Metallurgical Society of America, on Nov. 22d. At this meeting Mr. Ingalls outlined the plan, and started the ball rolling with a donation of $1000 in behalf of the *Engineering and Mining Journal*. Through the continued efforts of Mr. Ingalls, backed by the columns of the *Journal*, the fund reached its goal of $20,000, going over the top with this amount shortly before the return of the regiment from France. The benefits derived from the expenditure of this fund, so generously contributed by the men of the mining industry, were of inestimable value to the officers and men of the regiment, helping the regiment, as it did, over some of the rocky paths it followed in France, and providing solace and comfort for the men by way of tobacco and luxuries for the mess, to relieve the monotony of army grub. This fund also made possible the Thanksgiving and Christmas dinners, after the close of the campaign in 1918, which were events that will long be remembered by the men. Mr. Ingalls by his hard work and persistent effort earned the deep gratitude of all officers and men of the 27th Engineers.

Venezuelan Petroleum Fields

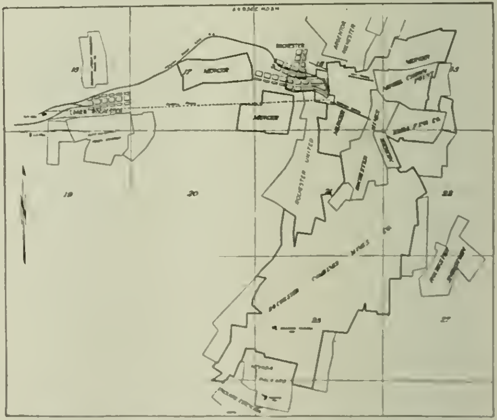
In discussing opportunities for trade development in western Venezuela, Consul Emil Sauer, in the Mar. 18, 1919, number of *Commerce Reports*, gave the following information about the undeveloped petroleum fields of Venezuela:

> Six or seven petroleum wells have been opened at Mene Grande about 10 miles inland from the coast of San Lorenzo, which is 70 miles southeast of Maracaibo on the east shore of Lake Maracaibo. San Lorenzo has a small refinery of sufficient capacity to supply the market of Venezuela only with kerosene, gasoline, and fuel oil.
>
> Only one well of the six or seven already opened is needed to supply this refinery, the others are sealed until it is possible to market the product. The one well which is being operated furnishes also a quantity of crude oil to a new refinery in Curaçao, whose present daily consumption is 1000 tons of raw petroleum, but whose capacity can be increased to 4000 tons per day. The Curaçao refinery appears to have been put up especially to refine the Venezuelan product, particularly the oil from the Caribbean Petroleum Co., which owns the wells at Mene Grande and the refinery at San Lorenzo. This company has also producing wells at Perija, on the west side of the lake and south of the city of Maracaibo, and is carrying forward development work in other parts, particularly to the northwest of Maracaibo, near Inciarte.
>
> Besides the Caribbean Petroleum Co., the Venezuelan Oil Concessions (Ltd.), a British company, is doing development work on the east side of Lake Maracaibo, north of the Caribbean concessions; and the Colon Development Co., an American corporation, has oil properties on the west side of Lake Maracaibo, south of the Caribbean concessions. Both the Colon Development Co. and the Venezuelan Oil Concessions (Ltd.) have productive wells, closed pending installation of facilities for marketing the oil. No pipes have been laid and no tanks erected by either of the companies. The wells of the Venezuelan Oil Concessions (Ltd.) are at La Rosa, about 30 miles from Maracaibo, near the east shore of the lake, and those of the Colon Development Co. at Cuba, 100 miles west of Encontrados. There are a large number of native petroleum concessions around Lake Maracaibo, but none is being developed at present. Recently American interests secured oil rights known as the Barco concessions, north of Cucuta, Colombia, on the Rio Catatumbo and its affluents. Because of the lack of railroad communication with the Rio Magdalena in Colombia, the concessions must be developed from the side of Lake Maracaibo.

To Merge Rochester, Nev., Mines

The proposed terms of the consolidation of Rochester, Nev., mining properties have been made public. The properties affected are the Rochester Mines Co., Rochester Merger Mines Co., Rochester Elda Fina Mining Co., Rochester Combined Mining Co., and Nenzel Crown Point Mining Company.

The consolidation agreement provides for the organization of the Rochester Nevada Silver Mining Co., with an authorized capital of $8,000,000, of which $2,200,000 should be returned to the treasury and sold for the benefit of the company to liquidate the indebtedness of all the companies entering the combination and for working capital. Eight hundred thousand shares are to go to F. M. Manson for his services in acting as mediator in bringing about the consolidation. Sixty % of the remainder, or 3,000,000 shares, are to go to the Rochester Mines Co. and the Rochester Combined Mines Co. Twenty per cent. of the remainder, or 1,000,000 shares, are to go to the Rochester Merger, and 20% to the Nenzel Crown Point and Rochester Elda Fina companies. A map is given in an accompanying cut showing the proposed consolidation.



MAP OF ROCHESTER NEV., AND IMPORTANT MINING CLAIMS IN THE VICINITY

The Blow of the Drill Bit, Sharp or Dull

By FRANK RICHARDS*

Among the various factors contributing to the efficient operation of rock drills is the drill bit itself. One explanation of the failure of steel to stand up in practice under action which may be demonstrated as being theoretically correct and efficient is found in the consideration of the forces which act and react in the drill-striking operation. With the dulling of the drill edge, the penetration is lessened, and the shock, communicated to the drill steel, results in a breaking down and often a shattering of the steel. Obviously, the cutting efficiency of the drill depends on maintenance of a proper cutting edge.

IT IS usually a source of satisfaction to bring theory and practice into coördination and to find them reciprocally confirming and strengthening each other. The method of computing the force of impact of a falling weight, or of the blow struck by the ram of a steam hammer, is essentially simple, but the practical application is generally far from satisfactory, on account of the indeterminate value of one of the essential factors. The final result in each case indicates that the force of the blow struck may be great or little, according to the suddenness with which the propelled mass is arrested. It is possible, however, without making the final particular specific, to reach a practical determination which may be most convincing.

A letter which has recently come into my hands seems to afford an excellent opportunity for a practical application of the principle involved in this line of investigation. The writer says: "At a drill test which is being carried out at a mine near here, and in which I am particularly interested, it has been stated that though the drill is effective it is at the same time hard on the steels. I was, in fact, shown ten pieces of steel that had been broken in a day's run. I am not a steel expert, and in this case I did not need to be, for at a glance I noted that every piece of steel that had been broken had been used in the test entirely too long; that it had been used, in fact, after it had lost its cutting power. On some of the pieces the bit end was entirely flattened, and no cutting edge at all was left. Noticing this was entirely by accident on my part, but it worked out all right in the next day's drilling. As soon as the cuttings ceased to drop out of the hole, the steel was changed, and we never broke a single piece of steel. On one of the drills we used a dull piece of steel, and in less than two minutes the steel broke."

If the theory of the hammer blow be applied to this case, a sufficient explanation is obvious. The drill steels did precisely as they ought to have done under the circumstances; the dull steels "went on a strike" against any more work when in that condition.

The method of computing the force of the blow of a rock drill may perhaps be more simply and clearly illustrated in the case of a reciprocating piston drill, although the results noted, under the same conditions, would be identical in the case of a hammer drill, which is now more generally used. The unit usually assumed in stating or in computing the force of a blow is the foot-pound. Supposing the operation to be conducted with a rock drill with a piston 3 in. in diameter and a stroke of 6 in., and that in the working stroke of the piston it is driven the entire distance by an effective air pressure of 50 lb. per sq.in. The area of the piston is almost 7 sq.in., and if the stroke of the piston were 1 ft. the accumulated force at the end of the stroke would be represented by 7 × 50 × 1 = 350 foot-pounds. As the assumed stroke of piston is ½ ft., the resulting force would be only one-half of this, or 7 × 50 × ½ = 175 foot-pounds. This number of foot-pounds of energy might have resulted from various other combinations of stroke and pressure, as, for instance, with a stroke of 1 ft. and a pressure of 25 lb., 7 × 25 × 1 = 175 foot-pounds, or, with a stroke of 3 in. (¼ ft.) and a pressure of 100 lb., 7 × 100 × ¼ = 175 foot-pounds. It is essential to get this fact clearly in mind, because in bringing the piston to rest, or in the striking of the blow, an opposing force or resistance is required precisely equal to the active force that was employed to produce the motion.

The resistance will, of course, be greater in proportion as the distance in which the force is applied is shorter. Thus, 50 lb. of resistance effective through 6 in. of stroke would be required to overcome the 175 foot-pounds of imparted energy, and 6 times this, or 1050 lb., would be required if the stoppage was done within a distance of 1 in. For convenience this last figure may be called 1000 lb. Then 4000 lb. of resistance would be required to stop the movement within ¼ in. and 16,000 lb. or 8 tons, if the stoppage was done within $\frac{1}{16}$ inch.

RESISTANCE DECREASES WITH CESSATION OF PENETRATION

This brings the computation to what may be assumed to be, approximately, rock-drill cutting conditions. If the drill bit penetrates the rock, say, $\frac{1}{16}$ in. at each blow, then 8 tons is applied, and, alternately, is stopped entirely, several hundred times a minute, and theoretical calculation here requires a constant or mean resistance of 8 tons for the entire $\frac{1}{16}$ in. of penetration of the rock. The fact undoubtedly must be that the resistance will be much greater than this at the beginning of the penetration and that it will diminish to nothing at the instant the penetration ceases. If the penetration of the drill bit was only one-half of this, or $\frac{1}{32}$ in., that is, if the bit was stopped within this distance, then the force of the blow struck by the bit would be double that noted, or 16 tons.

The bit strikes the rock with the same force as that with which the rock strikes the bit—the force must be precisely equal in each direction from the point of contact—and the greater the force at any instant with which the bit strikes the rock, the greater also must be the reacting force against the body of the bit.

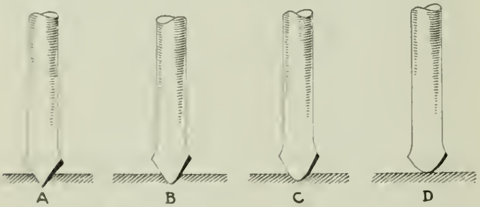
The accompanying sketch, which represents, with perhaps slight exaggeration, the action of one wing of a sharp drill bit, and then in several stages of wear, may help to a clearer understanding of the matter. At *A*, with the bit perfectly sharp, it is to be observed that it makes its deepest penetration into the rock. After coming in contact with the rock surface, it penetrates the rock a certain distance, during which penetration its force is expended upon the rock in one direction and backward into the body of the bit equally in the other direction.

---

*229 West 135th St., New York.

It is here assumed, of course, that the drill bit receives at each stroke an equal impulse from the air which drives the drill. Note at *B* that the bit has been considerably worn or blunted, and that although it has the same force behind it which it had at *A*, when it first touches the rock, it does not penetrate the rock to the same depth, but is stopped within a shorter period of travel, and, consequently, the force involved in the stoppage must be greater for the shorter period, both upon the rock and back into the drill bit.

No computations could assist in realization of the evident fact that the force of the blow upon the rock, and reactively back into the body of the steel, is successively greater when the bit is worn, as seen at *C* and *D*. At *D* the penetration of the rock must be extremely minute and the shock upon the drill bit incalculably great. What could be expected of the steel under such conditions, or approaching such conditions, than that it should "give up the job" and break? The fact that breakage occurs when the bits are too much worn is an endorsement of the efficiency of the drill which applies the power, and demands an appreciation of the drill, instead of condemnation. A drill which does not break its bits when, on account of dullness, they ought to break, must be defective in some particular.



SKETCH REPRESENTING BLOW OF DRILL BIT

From the preceding it will be noted that the action of the drill bit when it wears presents a paradox. The bit is least effective, has the least penetrative results, blow for blow, when it strikes the rock the hardest and feels the shock the most. It is the sharp bit that does the work; the dull bit is the inefficient victim of mistaken or neglectful practice. Drills must wear, but the limit of permitted wear should be sharply defined, and the systematic maintenance of sharp bits should be recognized as the most profitable investment possible in connection with rock-cutting operations. Especially is the power-drill sharpener to be commended, not only for its incomparably greater efficiency, as compared with hand sharpening, but also for its promotion and maintenance of the sharp-drill habit of thought and practice.

German Labor Market After the War*

Conditions in the German labor market after the war form the subject of an article in the *Konfektionär* by George Gothein, a member of the Reichstag, who says that trade-union circles take a pessimistic view of the problem of finding immediate employment for the eight or nine million men who were in the army and the millions of munition workers, and express the fear that there will be a large amount of unemployment. However this does not seem to reflect conditions in the mining and smelting industries.

The mining industry of Germany in 1913 employed 1,189,700 persons, of whom 1,133,709 were adult males. The mines also are finding employment for considerable numbers of prisoners, interned persons, and voluntary laborers from Poland. During the war dead work has been reduced to a minimum, and, owing to shortage of labor, the normal output of peace time could not be nearly attained. During the war no new seams of coal have been worked and no new galleries driven, but these must be started at once on the conclusion of peace. The mines will be in a position to absorb all the labor set free by demobilization and to employ fresh labor as well. This holds good, too, for potash and ore mines, even if, as regards the former, there is no need for new shafts. Both in foreign countries and in Germany there will be a large demand for coal, ore, and potash after the conclusion of peace, and the satisfaction of this demand will under existing conditions be largely a question of transport.

The smelting industry, of which by far the most important branch is iron smelting, will be faced by such an enormous demand that it will take many years to satisfy it. Endless work will be necessary to meet requirements both at home and abroad for street-car and railways rails and sleepers, and for thick sheet iron for shipbuilding, as well as for railway carriages and steam boilers, for girders and angle iron for tall buildings and bridges, for thin plates for accumulators and sheet-metal implements of all kinds, for iron for engines and tools, for tubing, and for wrought-iron goods. Production for the last four years has been almost entirely for the army, and peace-time requirements will be all the larger. France, Russia, Belgium, Italy, and Rumania will depend mainly on German iron for the work of reconstruction, and even England will find it difficult to dispense with it. Accordingly, the German iron industry may look forward to a time of prosperity, and will receive every skilled workman with open arms if it is not found necessary to restrict its coal requirements after the war. Matters are the same with the zinc, lead, and copper-smelting industries.

Denies Acquisition of Oil Company

El Universal, at Mexico City, published on Apr. 1 an article by H. A. Cunard Cummins, in charge of the British Legation in that city, denying press reports of the acquisition by the British government of a controlling interest in the Aguila Oil Co. This article quotes Mr. Cummins as follows:

"In view of the statements which have recently appeared in the press of this capital stating that the government of His Britannic Majesty has obtained control of the Compañia Mexicana de Petroleo, El Aguila, I would be very grateful if you should be good enough to publish in a prominent part of your newspaper the fact that I have received official authorization from my government to state that the government of His Britannic Majesty is not interested in any oil company which is operating or which may contemplate operating in this republic."

---

*Abstracted from Monthly Labor Review, February, 1919

Investigation of Wire Rope*

By J. H. GRIFFITH†

Data concerning the testing of wire rope are of interest, and the results obtained should be the subject of careful study. The following article deals with a series of tests that were made on wire ropes having diameters smaller than those of the average mine hoisting ropes, and the tests were made under conditions probably more severe than those usually encountered in mine operation.

THE Bureau of Standards for a number of years has conducted investigations, having for their purpose the collection of facts concerning the strength and other properties of wire rope. It is possible through the courtesy of the director of the Bureau to present herewith an abstract of some of the important data pertaining to the relative strengths of steel hoisting ropes when they are used on sheaves of different diameters, as in the case of the block and tackles for cranes and derricks.

It is shown in the dynamics of materials that a sudden application of a load, as in the case of the lifting of a weight by a crane, may cause strains that are double those experienced when it is applied gradually. On the other hand, a sudden reversal of stress may cause maximum strains three times those obtained when the reversal is made slowly. Kinetic effects may therefore be assumed to have static equivalents which in any case should not exceed the strength of the block and tackle, which will be limited, in turn, by the strength of its component parts, namely, the socket connecting cable to hook the sheaves. axles, and pins. It is known, moreover, that the "quick" modulus of elasticity for metals differs only slightly from the "slow" modulus. It was assumed in conducting tests that the behavior of a number of "fall lines" and sheaves in parallel may be approximated for practical purposes by the testing of a single loop of cable over two sheaves. The tests were conducted upon plow-steel cables of six strands of 19 wires each, varying in diameter from ⅝ to 1¼-in., the sheaves being 10, 14, and 18 in. in diameter, the sizes most commonly used in practice. The following results were obtained:

VARIATION OF RELATIVE STRENGTHS OF CABLES

Let it be supposed, first, that the strength of a cable when tested in direct tension represents a datum of 100%. The mean relative strengths of cables of diameters ⅝ in. to 1¼ in., as found by actual tests, may be approximately represented by linear laws as follows: The strength on 18-in. sheaves when tested in the manner previously described varies from 96% for ⅝-in. cables to 87% for 1¼-in. cables. The corresponding values for 14-in. sheaves vary from 95 to 82%, and for 10 in. sheaves from 84 to 77%. The mean departures from the linear law were about 1% (±) and the maximum about 2% (±) for the different cases, except in the case of the ⅝-in. cables on 10-in. sheaves, where it was 4% higher than the law calls for. In other words, the relative strength in this case was actually 88 per cent.

On the other hand, let the datum of 100% represent the mean aggregate strengths of the component wires as found from individual tension tests. The strength of cables in direct tension by the approximate linear law varied from 85 to 88% in a range of diameters ⅝ in. to 1¼ in. inclusive. The corresponding strengths on the 18-, 14-, and 10-in. sheaves vary approximately from 82 to 75%, 80 to 72%, and 71 to 67%, the mean departures in absolute values (±) being about 1½% and the maximum 3 per cent.

CABLE FRACTURE OCCURS AT TANGENT POINT

The cables usually fractured at the point of tangency with sheaves. The sockets, pins, and axles developed the strengths of the cables in each case. On the other hand, cracks developed in several of the sheaves either at hubs or rims, indicating that there were opportunities for improvements in design in this respect.

The following table shows the average tensile strengths of the straight specimens, this being one of the datums used in the preceding comparison, together with the strengths on sheaves:

STRENGTH OF PLOW-STEEL HOISTING CABLES OF SIX STRANDS OF 19 WIRES EACH

Diam. of Cable (Inches)	Average Strength, Tested in Direct Tension: In Pounds	Average Strength, Tested in Direct Tension: In Pounds per Sq.In.	Average Strength, Tested in Direct Tension: Modulus Pounds per Sq.In.	Tensile Strength of Cable on Sheaves: Diam. of Sheaves (Inches)	Tensile Strength of Cable on Sheaves: Average Breaking Load In (Pounds)	Tensile Strength of Cable on Sheaves: Average Breaking Load In Pounds per Sq.In.
⅝	32,000	205,000	7,600,000	18	30,700	197,000
				14	30,900	198,000
				10	28,170	180,500
¾	50,000	221,00	8,900,000	18	45,840	202,500
				14	45,360	200,000
				10	39,840	176,000
⅞	63,000	194,000	7,600,000	18	58,400	179,500
				14	56,300	173,500
				10	51,480	158,200
1	82,000	197,500	8,900,000	18	75,540	182,000
				14	71,680	172,500
				10	65,000	156,500
1¼	132,000	209,000	6,300,000	18	110,180	176,000
				14	106,330	168,200
				10	99,080	157,000

The load in direct tension in terms of the diameter for plow-steel hoisting cables of six strands of 19 wires may be approximated by the formula $L = 83,000\ d^2$.

In the case of the ¾-in. cables, some tests were conducted on two samples which had been in use about five years. It was found that the strengths of the individual wires was much decreased by wear, corrosion, or indentations. Many were found to be broken in service. Repeated load tests showed a considerable reduction in the resiliency, with a corresponding increase in the modulus. One specimen, in spite of its defects, bore a load of 50,000 lb., practically that of the average new specimens, whereas another failed at a load of 36,000 pounds.

RESULTS OF WIRE-ROPE TESTS

The following is a brief summary of some of the results found for the wires: (1) The elongations varied from a minimum of 1.25% to a maximum of 3%, with a mean of about 2%. (2) The permanent elongation and reduction were largely local, occurring mostly at the point of fracture. (3) The elastic limit of the twisted wires was about 65%. (4) The average tensile strength of the wires was approximately 225,000 lb. per sq.in. (5) It was found in these tests, as in others which have been conducted on used cables, that the item of lubrication is important in lengthening the life of a cable and preventing internal corrosion. The latter increases friction of the wires and prevents a proper distribution of load through the strand. It, moreover, impairs the strength through reducing the cross-sectional area.

---

*Abstract of a report by the Bureau of Standards, Pittsburgh, Pennsylvania.

†Associate engineer physicist, Bureau of Standards.

Future of Gold and Copper Mining In Australia

SYDNEY CORRESPONDENCE

High costs and low-grade ores impede production of gold and copper in Australia. Greater amounts of ore must be treated to keep up outputs, and neither the outlay for labor nor the cost of supplies shows much hope of improvement. Speaking generally, there are now only two ways to reduce costs—improving the ore grades, or increasing the use of labor-saving machinery. Most of the larger mines have so thoroughly explored their upper levels, where there is best prospect of higher-grade ores, that little can be expected in this respect from them. This is not the condition, however, with the majority of the smaller mines. Scattered over the Australian continent are hundreds of small mines and prospects and a great number of abandoned ones.

Anyone familiar with the smaller mines of Australia knows that there are many other causes than poverty of the ore that prevent production. Moreover, some of the abandoned mines were not left so because they were "duffers." Heavy water, wrong methods, cavings, want of capital, disputes, and mistakes—all have led to the closing of small mines without in many cases sufficient development to prove ore. The old timers' stories are not all fairy tales; properly sifted, there is a bedrock of fact to many of them. In consideration of the declining outputs of gold and copper mines in Australia, there is need for a systematic "stock-taking" of all small mines and prospects, already discovered, to ascertain those worth further development.

The machinery for gathering the data already exists in each state. Mine inspectors' and geologists' and office records enable each state to take stock of its existing resources and to assemble the data required by a buyer before he will send his engineers to inspect the property. In this way particulars of small mines, which, with a moderate capital expenditure, present some possibilities of operation, may be gathered.

The question of ownership should not be an obstacle, as, in Australia, the state only leases the mining lands. Obviously if the lessees are unable to bring the lands to production, or neglect to do so, the state can step in—not to operate the mines, but to allow outside capital to work them on fair terms to lessee and capitalist. Moreover, the capitalist would then come into direct touch with the owner, without having to pay the "option monger." In this way new producers can be developed to take the place of the older mines when they become exhausted. The outlined system of developing small but good mines is applicable to any country.

As a field for new discoveries Australia, with Papua, offers perhaps one of the best opportunities as compared to other mining countries. Results cannot be obtained in unprospected regions without much time, labor, and money. The same time, labor, and money expended upon careful development of existing small mines present far greater chances of success in much less time.

Opportunities for cost reduction by using more labor-saving machinery are restricted in the gold and copper mines of Australia by their present operating methods. In ore mining, whether from underground or open cut, there is little opportunity for the introduction of additional labor-saving appliances, and it is doubtful if any of the larger mines can achieve any notable reduction in mining costs.

Present treatment methods of gold milling and cyaniding, or copper smelting and converting, have also been carried to the point where, for each plant, little more labor-saving machinery can be used. No radical alteration in gold-saving processes appears imminent, but the situation is entirely different with copper recovery. The leaching methods successfully applied in the United States, with or without preliminary milling and floating, seem to offer the sole possibility for effecting a reduction of Australian copper-production costs. Such methods, successfully applied on a commensurate scale to the large reserves of low-grade ore known to exist in Australian copper fields, should make it possible for American methods of handling large tonnages of ore to be cheaply applied. Leaching is already practiced to a small extent in several parts of Australia, and many metallurgists are now engaged on the problem of leaching Australian ores. It remains for the capitalists to give the necessary financial support to their chemical engineers, in order not only to maintain but to increase the Australian copper output.

Exporters, and Passport Regulations

The passport agent in charge of the New York office of the passport agency, Department of State, explained recently to a representative of the American Manufacturers' Export Association that responsible exporting houses would experience little difficulty in obtaining passports. He pointed out that every effort was being made to help exporters who are desirous of developing the sale of American products in foreign fields.

Passports for European countries are being issued for urgent business reasons only, or when an imperative necessity for the voyage can be shown. Passports will not be issued to the wives of business men who go to Europe temporarily for commercial reasons.

As a rule, none of the following reasons is considered by the passport authorities in Washington as justifying the issuance of a passport to Europe at this time: Visiting parents, relatives or friends, attending to legal business, settling an estate, looking after personal property, renewing lease of apartment or other rented property, resumption of previous residence abroad, temporary residence abroad for health or education.

The restrictions have been considerably modified, however, with regard to the issuance of passports to the Far East, the West Indies, and to the Central and South American republics, to which countries passports may now be obtained for any legitimate reason. Business men are advised that the control and regulation of travel, passports, visès and the like are in many countries in the charge of the military authorities.

Coin Thrift into Victory Notes.

Determination of Available CaO in Lime*

BY C. A. MEIKLEJOHN

THE object of the work embodied in the following notes is to present as briefly and simply as possible the results of investigations carried out at the metallurgical laboratory of the Rand Mines, Ltd., to elucidate points which have arisen in connection with the determination of available CaO in the samples of lime supplied.

The method originally in use at the laboratory was, with slight modification of crushing the sample to —90 instead of —60, that described in the pamphlet issued by the South African Engineering Standards Committee, January, 1913. It is as follows:

METHOD FOR THE DETERMINATION OF "AVAILABLE ALKALINITY" (CaO)

The sample as delivered for analysis is contained in an air-tight vessel, having been passed through a 30-mesh sieve. It is crushed with a Wedgwood mortar and pestle. and the whole passed through a 60-mesh sieve, this operation being performed as quickly as possible. It is then placed in a clean, dry, wide-mouthed bottle fitted with a tight-fitting dry glass stopper so as to prevent any access of air. Two gm. of this is carefully weighed out and agitated with 1 liter of a 2% cane-sugar solution (or 1 gm. with ½ liter of 2% sugar solution). If a shaking machine is available, two hours' continuous agitation should be given; if not, six hours' intermittent agitation, every care being taken to prevent coagulation of the lime, in order that the lime and solution may be brought into the most intimate contact during this period. When the agitation is finished, the solution is filtered as quickly as possible, and an aliquot portion is titrated with N/10 or N/5 acid, using rosolic acid as indicator, avoiding delay so as to obviate undue exposure to the atmosphere.

The distilled water used in the above determination must be made neutral to rosolic acid to counteract the presence of dissolved CO_2. This method, though apparently clear and straightforward, was found to be full of pitfalls and to give low results. After considerable investigation, the following method was adopted for unslaked lump lime; the same method was also adopted for slaked and slaked air-separated lime, with some slight modification, to be mentioned subsequently. The results, so far, have been satisfactory.

1. The whole of the sample is passed through a disk pulverizer, and a relatively small portion taken and ground fine in an agate mortar.
2. Two gm. of the agate-ground sample is added to a Winchester quart bottle containing 1000 c.c. of 2% sugar solution in distilled water, with sufficient lime water added to neutralize to phenolphthalein any CO_2 present.
3. Agitated intermittently for two hours.
4. The sample is then allowed to stand overnight, and a measured portion of the clear solution drawn off, without filtering, and titrated with N/10 sulphuric acid, using rosolic acid as indicator.

Although there is nothing novel in this method of procedure, a description of the work carried out may be of interest.

Fine Grinding.—Although grinding the sample to —60 mesh was considered by the standards committee to be sufficiently fine, the agate grinding of the portion of sample for analysis would appear to be considered advisable if all the available CaO is to be taken into solution. In any case, the finer crushing in the agate mortar should insure more intimate contact of the lime with the sugar solution. It is, of course, understood that no time is lost unduly in the preparation and weighing out of the sample, and that during this time it is excluded as much as possible from contact with the air.

Neutralizing of CO_2 in Distilled Water Used.—The only difference here is the substitution of phenolphthalein for rosolic acid as indicator. When neutralizing the CO_2 the practice is to add two or three drops of an 0.5% solution of the indicator to each test and neutralize each one separately. It has been suggested that the presence of an indicator during agitation tends to give low results, but such has not been my experience.

Time of Agitation.—According to the method laid down by the standards committee, the time for agitation of the lime sample with the sugar solution should be either two hours' continuous or six hours' intermittent agitation. Not having an agitation machine, and wishing to adhere as closely as possible to the method laid down, I at first agitated intermittently for six hours. I had reason to believe that this time was excessive and was conducive to low results. As a consequence, a series of tests were made to determine the most suitable time of agitation. It was found that, generally, the maximum results were obtained with two hours' intermittent agitation, and that agitating beyond this time gave low results. The accompanying table will illustrate this.

TABLE I. TESTS ON SOLUBILITY OF LIME IN SUGAR SOLUTION

No of Series	Lime Taken for Test, Grams	Time of Agitation, Hours	Volume of 2 Per Cent. Sugar Solution, C.c.	CaO Found, Per Cent.
1	2	1	1,000	84.26
1	2	1½	1,000	84.56
1	2	2	1,000	84.70
1	2	2½	1,000	84.56
2	2	1	1,000	67.62
2	2	1½	1,000	67.76
2	2	2	1,000	68.04
2	2	2½	1,000	67.48
2	2	3	1,000	67.50
2	2	6	1,000	66.92
3	2	1	1,000	78.40
3	2	1½	1,000	78.26
3	2	2	1,000	77.84
3	2	2½	1,000	77.42
3	2	3	1,000	75.50
3	2	6	1,000	76.30

The solutions were titrated with deci-normal sulphuric and hydrochloric acids, the results being practically identical in each case. With the exception of Series 3, in which the highest result was obtained in one hour, maximum results were obtained with two hours' and minimum with six hours' intermittent agitation.

Amount of Sugar Required.—A 2% solution of sugar would appear to be the minimum for 2 gm. of unslaked lime per liter. To ascertain this a series of tests were made as shown in Table II. Two gm. lime to each test. Volume of solution, 1000 c.c.

It will also be seen that practically identical results were obtained when the solutions were filtered and titrated directly after agitation or when the titrations

---

*Abstracted from *Journ.* Chem., Met. and Min. Soc. of South Africa, December, 1918.

were made on the clear unfiltered solution after standing overnight.

It is hardly necessary to labor the point of filtering the solutions or allowing the same to stand until perfectly clear before testing. Testing the unfiltered solutions, even after allowing to stand for three hours, gave results as much as 3.5% CaO in excess of the true value of the sample.

Effect of Filter Paper on CaO in Solution.—Although the adsorptive effect of filter paper on alkaline solutions is well known, the effect on CaO in sugar solutions is perhaps not so widely appreciated. I found that the amount of solution required to saturate a filter paper before taking a portion for testing varies with the size and make of the paper, some papers requiring considerably more than would have been expected.

TABLE II COMPARISON OF RESULTS WITH FILTERED AND UNFILTERED SOLUTIONS

Weight of Sugar, Grams	Time of Agitation, Hours	CaO Per Cent in Unfiltered Solutions After Standing Three Hours	CaO Per Cent in Filtered Solutions	CaO Per Cent. in Unfiltered Solutions After Standing Overnight
10	3	79.80	76.30	76.30
15	3	84.28	81.34	81.20
20	1	. .	84.28	.
20	1½	....	84.56	
20	2	.....	84.70	
20	2½	.....	84.56	
20	3	....	83.80	
25	3	85.26	84.00	84.14
30	1	..	84.28	..
30	3	85.26	83.86	84.00
20	¾ hr and occasionally for 3 hours	85.54	84.00	84.00

The tests in Table III were all made on 1000 c.c. of 2% sugar solution. The time of agitation was three hours; and after agitation the solutions were filtered, the first 50 c.c. being rejected, and successive portions taken for testing.

It will be seen that differences up to 1% were obtained on titration of successive portions from the same solution, the differences being greater with the later portions of the solutions. The filter papers used were 30 cm. in diameter, and it would appear that, with a paper of this size and make, at least 250 c.c. of the solution should be allowed to pass through the paper before taking the portion for testing.

TABLE III TESTING FOR LIME WITH VARYING AMOUNTS OF SOLUTION

No. of Series	Weight of Sample Taken, Grams	Order of Test and Volume of Solution Taken, C.c.	CaO, Found, Per Cent.
1	2	(1) 50	70.28
1	2	(2) 100	70.70
1	2	(3) 50	71.26
2	2	(1) 50	70.00
2	2	(2) 100	70.42
3	1.4	(1) 100	70.20
3	1.4	(2) 50	70.80
3	1.4	(3) 100	71.00
3	1.4	(4) 50	70.80
4	1.4	(1) 100	70.20
4	1.4	(2) 50	71.00
4	1.4	(3) 100	70.80
4	1.4	(4) 50	71.00

Modification of Method With Slaked and Air-Separated Limes. As previously stated, a modification of the forementioned method is used in testing samples of slaked and air-separated limes. This modification lies in the treatment of the sample before taking the portion for assay, as follows:

The top layer of, say, 1 in. is removed from the sample and rejected. The remainder of the contents of the tin is rapidly and evenly spread on a sheet of paper, sampled with a spatula, and a portion for assay ground in an agate mortar to reduce the coarse particles.

It may be suggested that this is an unnecessary refinement, and that the slaked and air-separated limes—particularly the latter—are sufficiently finely divided to sample directly from the tin. This may be so under certain conditions, but I have found that duplicate tests by sampling directly from the tins gave results varying by as much as 8.2%, as shown below:

TABLE IV. RESULTS OF DIRECT SAMPLING FROM TINS

	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4
Original result	55.2	54.9	48.5	46.0
Repeat 1...	49.6	55.2	53.2	50.1
Repeat 2.....	47.0	50.1	....	....
Repeat 3...	47.9	51.3	55.5	....

It was evident that some method of sampling less open to criticism must be adopted, and to this end comparative tests with different methods of sampling were made on a sample of "Taungs" air-separated lime. As a preliminary, the top layer of about 1 in. was removed and rejected, and the remainder of the sample treated as under:

(*a*) Sample dipped directly from the bottom of tin. No grinding.

(*b*) Mixed in tin. Hole made in center. Sample taken from side of hole and ground in agate mortar.

(*c*) Remainder of sample passed through disk pulverizer.

Four determinations were made in each series. The results were as follows:

TABLE V EFFECT OF SAMPLING ON ANALYSIS OF LIME

Method of Taking Sample	Sample (*a*) Per Cent.	(*b*) Per Cent.	(*c*) Per Cent.	(*d*) Per Cent
1	50.4	49.9	49.9	50.4
2	49.9	48.5	48.2	48.8
3	47.4	47.9	49.0	49.0
4	46.8	47.1	50.2	48.2
Average	48.7	48.4	49.3	49.1
Maximum difference	3.6	2.8	2.0	2.2

The most concordant results are obtained from (*c*) and (*d*), and of these (*c*) possibly lends itself to less abuse than (*d*).

A number of additional tests were made to further investigate the effect of passing these slaked and air-separated limes through a disk pulverizer; also the time of agitation necessary. Invariably it was found (1) that the CaO content was lower after passing the pulverizer, and (2) that samples of white slaked limes from Taungs required longer time of agitation than the northern slaked limes. As a result of this and the work previously described, the forementioned modification was made with two hours' intermittent agitation for "blue" and three hours' for "white" slaked and air-separated limes.

Much of the work described in the foregoing may appear to have been unnecessary. It has been necessary to investigate, however, practically every step to determine the cause of the low results obtained when using the method described by the standards committee.

In conclusion, it would appear that the main points to emphasize in connection with the estimation of available CaO in lime samples are:

1. Sampling of slaked and air-separated limes.
2. Time of agitation.
3. Treatment of solution after agitation.

The most consistent results are obtained with two hours' intermittent agitation (three hours' with Taungs slaked limes), followed by settlement overnight before titration. If it is necessary to titrate the solution directly after agitation, care must be taken that sufficient of the solution is passed through the filter paper before taking the portion for titration.

The Use and Abuse of Electric Headlights on Mine Locomotives*

The necessity of maintaining good headlights on mine locomotives, and keeping them in good condition, is well known, and a thorough understanding of certain characteristics of each of the three types is required, so that the necessary repairs may be made as needed and the mechanism kept in good working order. The electric headlight is simpler than the motors, controller or wiring which comprise the electrical equipment of a mining locomotive, but its mechanism often becomes faulty through the tinkering which is done by motormen, or others not competent to perform the repairs, who attempt to do the work that properly should be done by the shop electricians.

The luminous-arc headlight possesses the inherent advantage of high illuminating efficiency, owing to the composition of the lower electrode. It is the most efficient of all types of headlights commercially available, unless it is possible to operate the extremely low-voltage, high-current Mazda lamps, such as the 6-volt, 18-ampere lamp. The maintenance cost of this headlight is low, as it requires no enclosing globe for the arc and the upper electrode is practically non-consuming, while the lower electrode has a life of from 125 to 150 hours burning. Owing to the fact that the upper electrode is practically non-consuming, the arc is always maintained at the focal point of the lens or reflector. Adjustment of this upper electrode is necessary only once in two or three months' time. A headlight of this type has a disadvantage, in that a certain amount of fume is given off from the arc, which must be wiped away, and the headlight is not quite as simple as an incandescent headlight, because it has several movable parts. One other disadvantage which it possesses in common with all arc headlights is that the natural travel of the arc around the electrodes causes the beam to wander slightly from side to side, but its many advantages offset this.

One of the greatest causes of poor illumination from luminous-arc headlights arises through failure to take proper care of the upper electrode. This electrode should be adjusted once in every two or three months, but instances have been noted where adjustments had not been made for perhaps a year. This means that the upper electrode is burned away from one-half to three-fourths of an inch, and the arc is struck that distance above the center line of the headlight, resulting in a poor illumination along the track.

The earlier forms of luminous-arc headlights were of the single-compartment type, that is, the arc and mechanism were in the same compartment. Later development brought out the two-compartment headlight in which the front compartment containing the electrodes, between which the arc is struck, is hermetically sealed from the rear compartment that contains all the operating mechanism. In this type of headlight the fumes given off by the burning arc cannot accumulate on the mechanism parts. Therefore, the headlight works more freely and gives practically no trouble from a "sticky" mechanism. The chief advantage of this two-compartment headlight is that the mechanism is out of the way, and, therefore, unauthorized persons are not so likely to tamper with it. This very advantage sometimes works to a disadvantage, for, when major repairs are necessary, the headlight must be entirely removed from some locomotives, because it is mounted too close to the frame of the locomotive to permit repairs to be made. Notwithstanding this, the two-compartment headlight has proved more reliable and more economical than its predecessor, the single-compartment light.

---

*Extracted from a paper read by K. W. Mackall before the Coal Mining Institute of America, Dec. 5, 1918.

Iron-Ore Deposits in Celebes*

The discovery of large iron fields in the middle Celebes, in what is known as the lake district, has created a stir in mining circles of Netherlands India, according to Consul A. E. Carleton, at Batavia. The latest details from government investigation substantiate the original reports as to the extent and value of these deposits.

An exhaustive study has been made of the Larona district, which is situated near the outflow of the Towoeti Lake at a height of about 984 ft. above sea level and at a distance of 12.4 to 18.6 miles from a point on the coast from which shipment may be made. The Larona field occupies a surface of approximately 2.7 square miles. The other fields in this district are either less important or less favorably situated for exploitation. Further investigation of iron-ore fields in other parts of the archipelago will be made by the government.

It is claimed that the Larona ore is similar to that of Cuba and the Philippines. With the exception of the chemical composition, the physical properties of these ore beds are equal to the Cuban. This district is said to yield common iron ore, chrome iron, nickel, and manganese ore. The average standard of the ore is 49 or 50% metallic iron.

It is known that the quantity of iron ore in the Larona field is at least 5,000,000 tons of surface ore and 155,000,000 tons of clay ore, a total of 160,000,000 tons; but the estimate may reach 7,000,000 tons of surface ore and 206,000,000 tons of clay ore, a total of 213,000,000 tons. The ore can be extracted easily and cheaply. The fields cover a large territory, but the ore layers do not extend more than 46 ft. in depth.

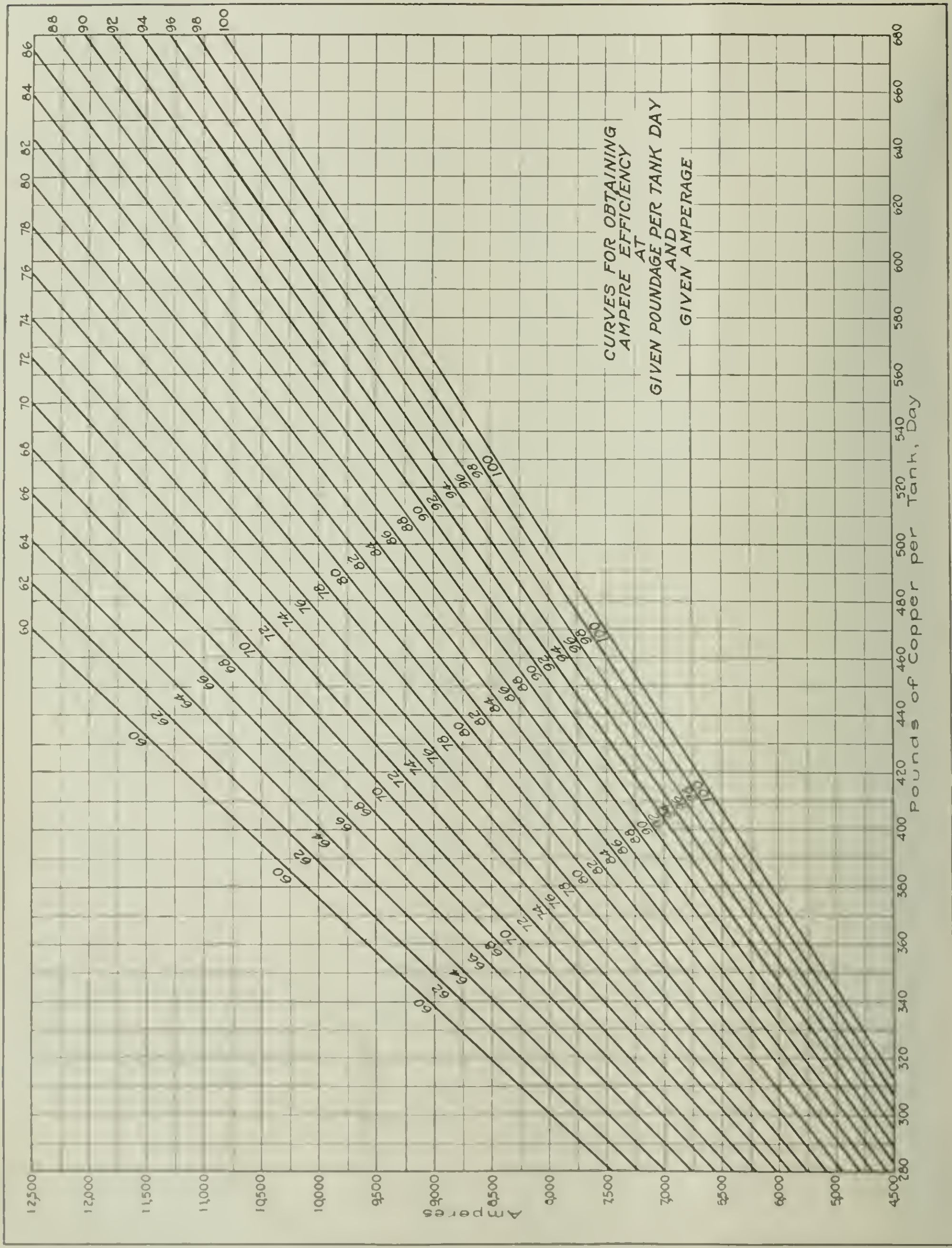
Considerable study has been made by the Dutch engineers as to the working of these fields. It appears that two methods are practicable, the smelting of the ore by the carbonization of coal, the coals of Ombilin and Lematan being well adapted for carbonization, or by electrical smelting. The latter method is preferred, as it is believed there is sufficient water power in the neighborhood of the ore beds, and the establishing of electrical machinery for the purpose can be effected at a low cost. An examination of the water-power possibilities is now being made.

The question as to the part the government will take in the exploitation of these iron deposits will be settled later, when all the facts are known, but it will no doubt retain certain rights, whether the fields are worked entirely by private operators or developed in part by the government.

A Plant for Treating Rare Metals is being established at Deepwater, N. S. W., by the Sydney Export Co., of Sydney, with which has been merged the British Ore Works, also of Sydney. A similar plant is already in operation by this company at Pyrmont, N. S. W. The new concern is being managed by J. T. Hardman, formerly manager of the Wild Cherry tin mine, at Ardlethan, New South Wales.

---

*Abstract from *Commerce Reports*, Apr. 13, 1919.



AMPERE EFFICIENCY AT GIVEN POUNDAGE PER TANK-DAY AND GIVEN AMPERAGE

Ampere Efficiency in Copper Refining

By M. H. Merriss*

Ampere efficiency is the rough-and-ready criterion in every copper refinery, by which the work of the tank room is judged. After the copper from a tank or series of tanks is pulled and weighed, the tank-room foreman wants the efficiency computed as quickly as possible, that he may know what his inspectors and short-circuit men have done in that part of his room. The following procedure is typical:

The number of tanks in question is multiplied by the actual number of days, and fractions thereof, during which the current has passed through the tanks. The total weight of copper is divided by the product, giving the pounds of copper produced per tank per day (1). One ampere passing through one tank for one day will deposit 0.06272 lb. of copper at 100% efficiency, according to the latest official measurements by the U. S. Bureau of Standards. The average number of amperes which has passed through the tanks, multiplied by 0.06272, gives the pounds of copper per tank-day which would theoretically have been deposited at 100% efficiency (2). The actual pounds per tank-day, (1), divided by the theoretical pounds per tank-day, (2), gives actual ampere efficiency.

The ampere-efficiency chart shown on p. 742 simplifies and quickens these calculations. Actual pounds of copper per tank-day and actual amperes passing through the tanks must be determined as above, but with these two figures in hand and a chart similar to that shown, no further calculation is needed. It is only necessary to find the point at which the given amperage line intersects the given poundage-per-tank-day line. This point will, in general, lie between two of the slanting lines representing percentage of ampere efficiency, and all that is required is to interpolate to get the latter exactly.

An example will make this clear. Assume that, at 6500 amperes, 358.8 lb. of copper was produced per tank-day. The intersection of the line representing 6500 amperes with the line running at right angles to it, indicating 258.8 lb. per tank-day, is found to lie exactly on the slanting line representing 88% efficiency.

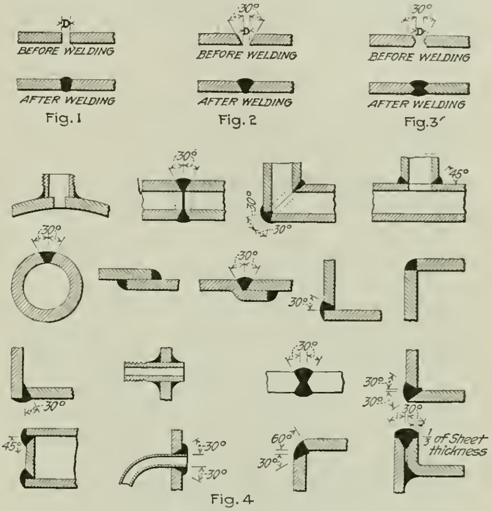
The chart has been framed in an endeavor to cover such a wide range of amperages and poundages as to include the conditions of almost all modern tank rooms. Each foreman who desires to use the chart will, of course, segregate that part which applies to his own particular conditions and enlarge it. Additional slanting efficiency lines can be put in, down to tenths of 1% if desired, thereby eliminating the necessity for interpolation.

Tables are used at some plants as aids in obtaining efficiencies, but a single chart, such as the one shown, is more compact and more rapid after an operator becomes familiar with it.

Notes on Electric Arc Welding†

Arc welding, with metallic and carbon electrodes, has been used extensively in the construction of transformer tanks at the Pittsfield works of the General Electric Co. for a number of years, and has proved to be a reliable and economical factor in the building of large and small tanks made of sheet steel varying in thickness from $\frac{1}{16}$ in. to $\frac{3}{8}$ in. More than 4000 large boiler-plate tanks have been produced, representing 400,000 ft. of welding with the metallic electrode, and more than 50,000 corrugated light steel tanks representing 2,500,000 ft. of welding with the carbon electrode.

The sketches shown in the accompanying cut illustrate some of the more common methods employed in making preparations for various kinds of welds. When long butt seams such as are shown in Figs. 1, 2 and 3 are to be welded, it is important, if the weld is to be made continuously and in one layer, to allow for a contraction of the joint as the weld progresses; and unless this is done, undue warping and excessive internal strains may result. The amount of the allowance for this contraction varies slightly with the speed at which the work is done, and is usually about 1½% of the length of the weld. That is, if the seam is 10 ft. long the space between the plates at the beginning of the weld would be ⅛ in., and at the end 1½% of 10 ft. plus ⅛ in., or 1.9 in. Clamps are used to hold the plates apart the proper distance, and these are gradually released as the weld approaches them. The welder watches the opening; if it closes too quickly, he hurries his welding; and if it does not close quickly enough, he waits for it.



METHODS OF MAKING VARIOUS TYPES OF WELDS

PREPARATION OF SEAMS FOR BUTT WELDING

Dimensions in Inches

Thickness of Plate	Space *D*, Shown in Figs. 1, 2 and 8
0 to 1/16	1/32
Above 1/16 to 1/8	3/32
Above 1/8 to 1/2	4/32
Above 1/2	5/32

These precautions need not be taken in the case of short butt welds, lap welds, or in long welds between bases and shells of tanks. These welds are either too short to develop any serious strains or the parts have an opportunity for "breathing" that dissipates the strain over a wide area.

---

*Superintendent, electrolytic refinery and silver department, Raritan Copper Works, Perth Amboy, New Jersey.

†Abstracted from an article by R. E. Wagner, entitled "Electric Arc Welding in Tank Construction," which appeared in the *General Electric Review*, December, 1918, p. 899.

Recent Improvements in Sintering Equipment and Practice

A TYPE of grate cleaner to be used with the Dwight & Lloyd sintering machine is shown in Fig. 1. It has given excellent satisfaction in many cases. This cleaner in its present form has only recently been adopted in this shape, and in the true sense of the word is not a cleaner but a "keep-clean" device, that is to say, it is not intended to actually clean dirty grates, but to prevent grates from getting dirty.

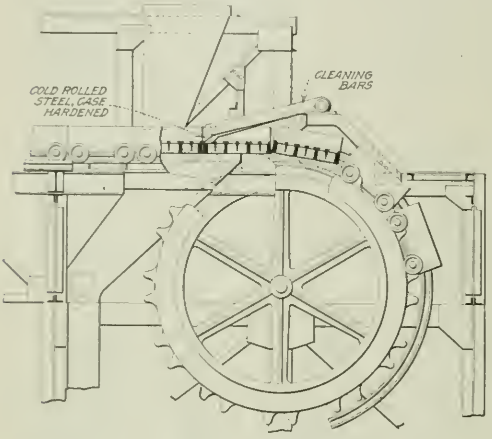


FIG. 1. GRATE BAR CLEANER DEVELOPED AT PORT PIRIE, AUSTRALIA

As will be seen from its design, the cleaner is for use with the straight-slot type of grate, and was evolved during experimentation and usage with the Riddell-Davison model. This grate is of the raised-bar type, with alignment devices; Fig. 2 is a detail of one design.

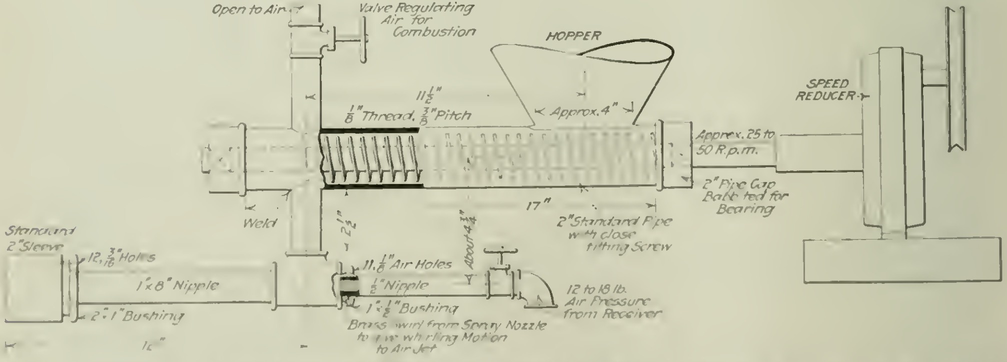

Open to Air
Valve Regulating Air for Combustion
HOPPER
SPEED REDUCER
$11\frac{1}{2}''$
$\frac{1}{8}''$ Thread, $\frac{3}{8}''$ Pitch
Approx. 4"
Approx. 25 to 50 R.p.m.
2" Pipe Cap Babbitted for Bearing
17"
2" Standard Pipe with close fitting Screw
Weld
$2\frac{1}{2}''$
About $4\frac{3}{4}''$
Standard 2" Sleeve
12, $\frac{3}{16}''$ Holes
1"x8" Nipple
2"-1" Bushing
11, $\frac{1}{8}''$ Air Holes
$\frac{1}{2}''$ Nipple
$1''\times\frac{1}{2}''$ Bushing
Brass swirl from Spray Nozzle to give whirling Motion to Air Jet
12 to 18 lb. Air Pressure from Receiver
16"

FIG. 3. BURNER AND MUFFLE FOR POWDERED COAL USED FOR TESTING IGNITION OF D. & L. SINTER CHARGE

The herring-bone type of bar has the largest grate area opening of all analogous types; the straight-slot type of bar is a close second, having approximately 90% of the opening in the herring-bone; the Trail grate has only 53% of the herring-bone opening. Many users of the Trail-type of grate bar are satisfied with it and think highly of it. It is only fair, however, to remark that the largest tonnages per machine-day are not reported as having passed over this particular type of bar.

There is a general tendency among those smelters who are making the largest tonnages per machine-day to increase the width of the slots in the grate bars, even at the expense of a somewhat larger return of fines from the first wind-box, as they consider it is easier, simpler and cheaper to re-work the slightly larger amount of fines than to keep the narrower slots open. The widest grate slot so far reported as doing good service is $\frac{3}{8}$ in., and, in this particular case, the charge run was mainly flotation concentrates. Where the wide slots have been used and also the type of grate bar cleaner as shown in Fig. 1, an appreciable increase in tonnage per machine-day has been noted. The costs of installation of the three types of bars do not vary widely, except in the case of the Riddell-Davison bar, which is somewhat more expensive than either of the two others.

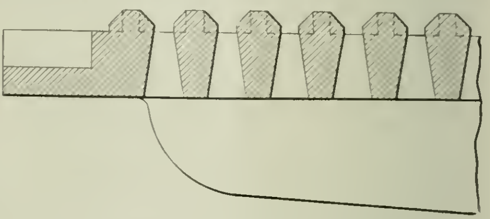


FIG. 2. SECTION THROUGH RIDDELL-DAVISON GRATE BAR USED IN D. & L. SINTERING MACHINE

With regard to keeping the grate clean, this is a problem which has to do particularly with the type of ore treated, and in general it may be said that, in the practice of the several smelteries, each operator has solved his own problem in his own particular way, but generally by care in the assembling and mixing of the charge, as well as by carefully keeping its chemical characteristics constant.

In the working of charges that are very hot and fiery, and also those that require a high heat for sintering and which of themselves lack plasticity, a good solution of the problem has been achieved by screening the resultant sinter so as to make three products, the first being plus ½-in. ring, the second being minus ½-in. ring plus ¼-in., and the third product being minus ¼-in. The first product is final and goes to the next operation. The second product is returned to the grate bars mechanically in a layer from ½ in. to 1½ in. thick, but without fuel, and the sinter charge is laid on over this protecting layer. This procedure protects the grate bars and prevents their binding, and also almost entirely counteracts the tendency which a very non-plastic charge has to pull through the grate-bar openings during the process of sintering.

The third product is treated as though it were an original ore, and is mixed in the regular stream in its proper proportions. This seems to have a good effect on the operation as a whole, making the charge more porous. The partly sintered material or pieces of very finely divided sinter seem to form a nucleus for the beginning of the sintering operation, in much the same manner that returned slag acts in the smelting operation in the blast furnace. The returning of fines actually speeds the sintering operation, and larger net tonnages are usually attained when following the practice outlined; incidentally, the sulphur content of these fines is usually somewhat higher than the average of the entire product of the sintering machine, and, when fines are thus re-worked, the sulphur content of the sinter is customarily much lower.

The second product will generally be found to be constant in volume after a short time; and should this, for any reason, be formed in excess of the needs for the protecting layer, part of it can be bypassed and used with the first product; or should it be less than actually needed for the protecting layer, the deficiency can be made up by re-crushing some of the first product.

Grinding Pebbles and Tube-Mill Liners

A falling off in the production of pebbles and liners for use in tube mills, as shown by final figures for 1918 compiled by the U. S. Geological Survey, Department of the Interior, reflects both uncertainty of market and changes in grinding practice.

Natural pebbles for grinding rock, ores, minerals, cement clinker, and many other materials were obtained in 1918, as in preceding years, from the beaches between Oceanside and Encinitas, San Diego County, Calif. The production of these pebbles in 1918 was considerably smaller than in 1917, probably in large part because the growing use of steel balls is supplanting the use of pebbles, but the decrease was due in part to the uncertainty of the market, which deterred pickers from collecting and sorting stocks that they might have marketed.

The output of "artificial pebbles" in 1918 was considerably greater than in previous years. These so-called artificial pebbles are either roughly cubical or mechanically smoothed and rounded blocks of quartzite manufactured by the Jasper Stone Co., Sioux City, Iowa, or mechanically smoothed and rounded blocks of silicified or chalcedonized rhyolite manufactured by Omer Maris, Manhattan, Nevada.

Only approximations are available as to the quantities of flint pebbles imported. The records of the Bureau of Foreign and Domestic Commerce indicate that the quantity of grinding pebbles imported in 1918 was probably a little over 10,000 short tons, about 70% of which came from Denmark and the remainder from France.

The total new supply of grinding pebbles contributed to domestic markets in 1918 appears to have been about 20,000 short tons, as compared with approximately 25,500 tons in 1917, 32,000 tons in 1916, and 31,000 tons in 1915. This diminishing supply is evidence of the growing use of steel balls or other substitutes for grinding pebbles.

The domestic output of flint or quartzite tube-mill lining in 1918 was 2535 short tons, valued at $46,634, compared with 3050 short tons, valued at $59,250, in 1917. In 1918 there were only two producers—the American Flint Co., Iron City, Tenn.; and the Jasper Stone Co., Sioux City, Iowa.

Permissible Self-Contained Mine-Rescue Breathing Apparatus

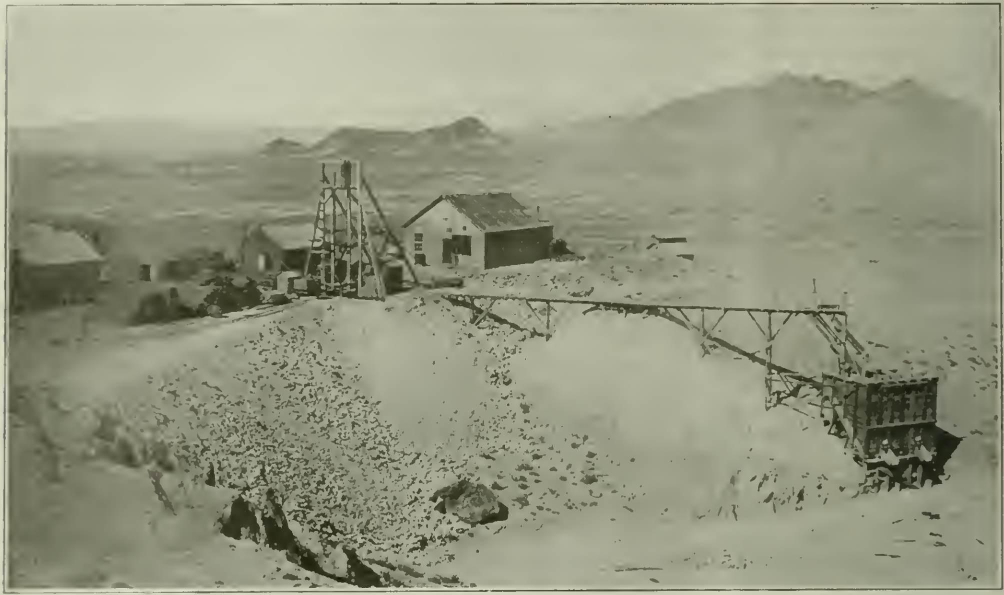
Under the title "Procedure for Establishing a List of Permissible Self-Contained Mine-Rescue Breathing Apparatus," the Bureau of Mines has published a schedule (No. 13) which defines the character of the tests, the conditions under which various apparatus will be tested, and the fees that will be charged for such work when done by the Bureau, which is prepared to make all of the required tests at its Pittsburgh station. In considering "permissible" types of self-contained mine-rescue breathing apparatus for use in irrespirable and poisonous gases, the Bureau recognizes only those appliances that conform to the requirements and pass the test for safety, practicability and efficiency that have been established by the Bureau of Mines.

Regulations as to the examination and inspection of the apparatus and the general requirements as to oxygen supply, regenerative properties, and mechanical construction are stipulated in the schedule, which also gives a detailed description of the tests, which include actual practice work done by the Bureau men wearing the apparatus which is undergoing the test.

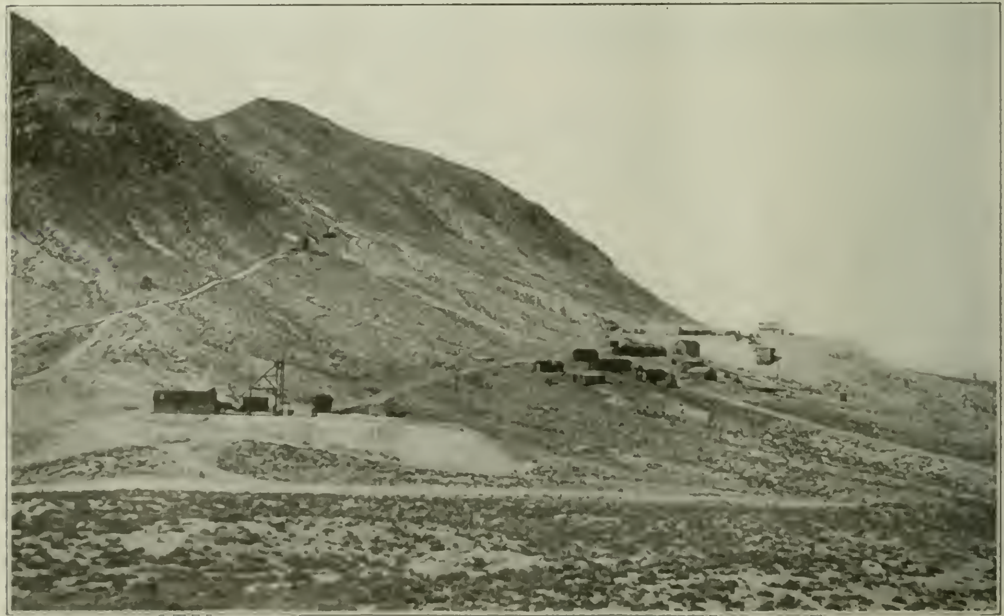
Careful investigation has been made regarding the necessary expenses involved in testing mine-rescue breathing apparatus at the Pittsburgh experiment station of the Bureau. The following schedule of fees to cover expenses to be charged on and after Mar. 5, 1919, has been established and approved by the Secretary of the Interior, in accordance with the provisions of the statute previously quoted: Complete mine-rescue breathing-apparatus test, $100; separate preliminary inspection and test, $10; separate regenerator test, $5; separate inspection and test of reducing valves, $10. Application for tests should be addressed to the Director of the Bureau of Mines, Washington, D. C. The application must be accompanied by check or draft made payable to the Secretary of the Interior, and by a complete written description of the mine-rescue breathing apparatus to be tested, and a set of the drawings, as specified in Schedule 13. Duplicate copies of the application and drawings should be sent to the Mine Safety Engineer, Bureau of Mines, Pittsburgh, Pennsylvania.

Save and have—Buy Victory Loan Notes.

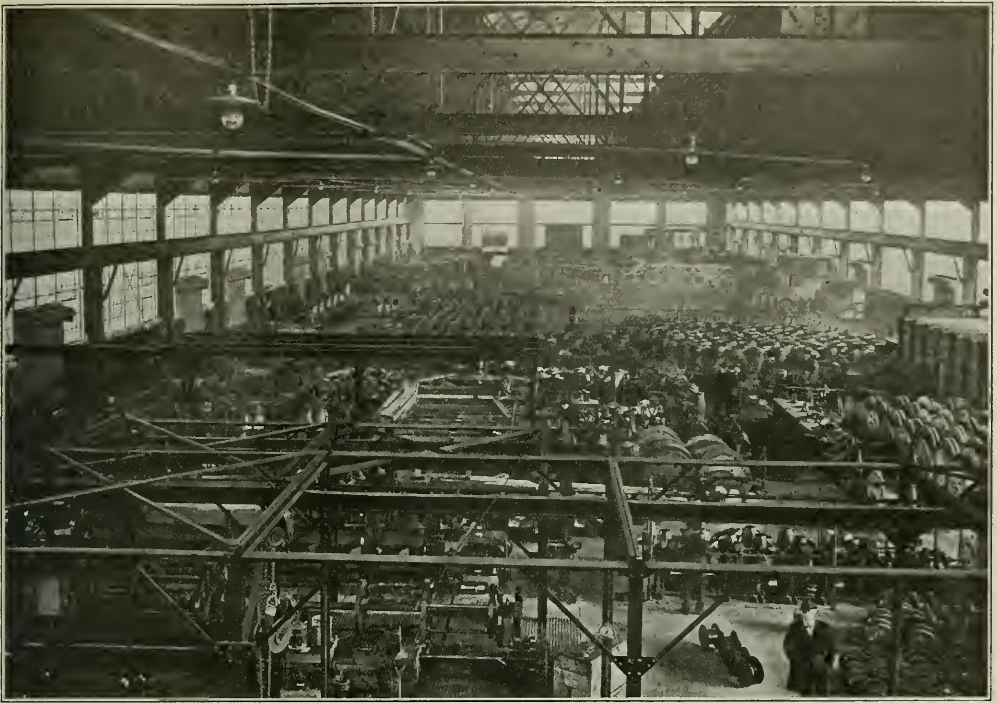
Photographs From the Field



TONOPAH DIVIDE MINE, DIVIDE DISTRICT, NEVADA. VEIN OUTCROP IN LOWER LEFT FOREGROUND



GOLD ZONE AND TONOPAH DIVIDE MINES, DIVIDE, NEVADA



INTERIOR VIEW OF ROD AND WIRE MILL OF ANACONDA COPPER MINING COMPANY

ROD AND WIRE MILL, ANACONDA COPPER MINING COMPANY, GREAT FALLS, MONTANA

Industrial Coöperation[*]

BY CHARLES P. STEINMETZ[†]

One of the most recent and at the same time the most vigorous organizations that have come into existence during the past year is composed of the editors of the great technical and trade press. This body, known as the Editorial Conference, meets periodically for the discussion of matters of common interest and national import. On Apr. 11 a special session was held at the Hotel Astor, New York, at which the members of the conference were addressed by a number of men of high repute and specialized acquaintance with three subjects that are demanding attention at the present time—industry, finance, and the relations between capital and labor. Owing to the professional and national standing of the various authorities who addressed the conference, and the soundness, pertinence, and clarity of the views expressed, it was decided that the speeches deserved a wider appreciation. The paper which follows will be read with interest and profit.

IF THE axioms that in union there is strength and a house divided against itself cannot stand are true of anything, they are true in Mother Industry, and particularly today, when modern civilization has practically become bankrupt, and we now, as receivers, have to reorganize the world again. Our industries must have coöperation to be successful and efficient; to be able to take care of the world's work as it has to be done to redeem our civilization from what has occurred in the last few years. But is it possible?

The socialistic-radical labor agitator tells us there can be no peace between capital and labor; that the two are inherently antagonistic, and must fight to a finish because the interests of one are against the interests of the other. In industrial depression the employer, as well as employed, suffers. The old-time corporation president preaches to us that capital and labor interests are identical; that if the individual interests are trusted to his keeping they will be taken care of. At the same time every child sees and knows that a dollar more paid out in wages means a dollar less profit, and that the interests of capital and labor are different—entirely opposite in some respects. We cannot get any further in solving the problem if we take an extreme view one way or the other. Capital and labor interests are not identical, but are the same in some respects and opposite in other respects. In general, in any industry, those interests which have to do with industry on the outside are usually identical.

Within the industry, the interests of employer and employee are often antagonistic. There are relations in which capital and labor interests are identical and some in which they are not identical. Take buyer and seller, manufacturer and customer, landowner and renter. They are not going to fight merely because there are some phases of their relations where the interests are opposite. In all those conditions where the relations exist as between employer and employee there is no possibility of settlement by fighting and warfare; but, on the contrary, there are often, usually very often, friendly relations between the manufacturer and customer. It is not the historical relation, as we unfortunately find, in this one feature.

Why, is it necessary that employer and employee, capital and labor, cannot get along in the same manner by coöperation? The reason is historical. Originally, the employer and employee bore an equal standing regarding industrial power in the days of small manufacture. The organization of employers as represented by the formation of industrial corporations meant an increased power on the side of the employer, and a disadvantage to the employed, until labor organizations were formed; but conditions had already become hostile.

How to bring the coöperation about—how to return to such conditions as should have remained operative—is the main problem, because we must bring about coöperation within our industry if we wish to meet the demands of the new world.

It has taken two generations of development to bring about the present unfortunate situation where differences are settled by fighting. We cannot expect to secure this coöperation by merely wishing, or talking about it. It is a long, slow, difficult work which will mean many setbacks, and we have to remain at it and fight for it.

Adjustment must come first from the employers, but not for any moral reason. The present situation is not the fault of labor more than of capital. It is merely historical development of a situation beyond the control of man. The employer must have a broader view than the employee. We must not forget that there are still many imperfections in our civilization, and among the most serious is that a large majority of men cannot obtain a broad education, as would be desirable for making the most of themselves, and heads of industry as a rule have the benefit of the broader education and must take the broader view of things. We cannot expect the same broad view of the one who left school at 14 years of age as the one who has enjoyed a more extensive education.

That the initiative must come from capital is realized. In all groups of occupations and industries we have talk of coöperation, but we must realize it does not mean the spending of a few dollars here and there, but the work is probably the most important development in the industrial field which faces us today. Men must devote their time and attention to it, and must give high-grade service. Positive results cannot be expected until we are really willing to approach it more seriously in time, interest, quality of men and amounts of money devoted to bringing about industrial coöperation.

Cooperation implies two parties working together, not one settling the matter and telling the other "you must do that and that, and then we will coöperate." Unfortunately most of the serious efforts made in this direction have been of that character—the employer has worked out plans and then asked the employees to coöperate on those plans. Very often those plans are good, and the whole scheme would have been satisfactory if it could have been worked out jointly, but it came as paternalism, and was therefore tainted from the beginning. That is not coöperation.

---

[*] A speech delivered at a special session of the Editorial Conference held at New York on Apr. 11.

[†] Consulting engineer, General Electric Company

It is easy to say we must have coöperation; also to find fault. It is not easy to make suggestions as to how it should be done, and how the present strained relations between capital and labor should be overcome. Probably there is no single way to bring about true coöperation. It depends largely on local and social conditions. In short, there is not a broad and single way. Before we try to find out, let us discover the relation of Mother Industry.

One attitude, the attitude of the old-time employer, is that industry is the private property of the one who supplies the capital. That is the old-time relation where industry is private property of the owner, which recognizes only capital and not labor. This relation was destroyed forever at the moment when President Roosevelt interfered in the anthracite coal trouble and brought both sides to terms.

The other extreme is the socialistic conception that all wealth is created by labor, that all wealth therefore belongs to labor, and that capital is a parasite on labor due to having acquired a monopoly of the means of production. At present industrial production requires capital and labor. Both are necessary. Labor unrest is a demand for a share of the profits of industry and a share in the management of industry. This is the final foundation of all our social unrest. As both capital and labor are necessary, it is right that they both demand a share of the profits and management of industry. There are several ways—mostly unsuccessful.

One way is by welfare work, which is important and useful but offensive and insulting, when forced on labor in a paternalistic manner. It is appreciated when not done as welfare work but merely for corporate self-interest. We must realize that the quality of work depends on conditions under which work is done. That makes the difference in the self-respect and quality of the man. This will not bring about coöperation. We must not use the term "welfare work." It should be managed by an industrial-relations department or committee, instead of by a welfare department. The most difficult thing in coöperation is to put yourself in the other's place and see things as he sees them.

Another attempt which has been made was in the form of an effort to promote closer relation by the bonus system, giving bonuses during times of industrial prosperity and getting the employee interested in the industry. To some extent that is all right, but it savors somewhat of paternalism. It may be applicable in Germany, where people have been trained to look up to their masters as superiors, but it leaves a bad taste among Americans. They are prone to ask, "Why not give us an increase of wages instead of a bonus?" The bonus system has the disadvantage of sharing only in profit, and not in management.

Another attempt is the committee system, claimed to have been successful in England. There are several forms. There are the committees elected by employees, which take up with employers all relations of mutual importance and interest, such as arbitrating wages or hours. Another form is the joint committee, half of which is elected by employees and half by the corporation. This appears to have much in its favor. There are, however, some difficulties, the most serious one being that labor has its own organization, and labor unions are liable to complain that they are being ignored. Labor unions claim that they represent the employees. Facts show in many cases that they are right, because although union men may often be in a minority among employees, when serious questions arise, experience shows that the majority of non-union workers take the lead of the unions rather than of the non-union committees. Shop committees are likely to be considered as eliminating the labor unions by putting up a rival union.

Although leaders of industry recognize the necessity of coöperation, most labor organizations have not yet realized the advisability of coöperation in industry. But there is another side. Do we want the committee system? Let us assume it is successful: a board of directors on one side and a labor committee or committees on the other. Is this not another warfare by organizing two different parties?

Mother Industry requires capital and labor. Therefore both are entitled to share in the profits. Capital is entitled to a fair rate of interest on the money invested, and labor is entitled to a fair rate of wages for the work done. All profits beyond that belong to capital and labor. These should be divided as dividends, being dividends on capital stock, and also as dividends on labor stock as found by yearly wages. This system is in operation in a number of corporations—in electric utilities companies and others. It lacks provision for share in the management. But we could carry it further and recognize labor as equivalent to capital, and give the labor stockholder the same right as the capital stockholder in the management. This would be revolutionary, but both would share in the profits and get dividends, one on capital and the other by labor stock. Both share in the management (labor union officials could hold the proxies). This does not set up rival administration, but brings about joint control by evolution and not by revolution.

How far should employees be recognized as stockholders? Should a man, even if he joined yesterday, be allowed to vote today? There are many things that show that only those who have been with the organization for a number of years should be recognized as wage stockholders, taking part in dividends and management. We could set the limit at ten years. There would not be many, and every year or so we could change the minimum, going down to six or five years. This would eliminate any opposition except from the extreme socialists who refuse to recognize capital at all.

Finally, leave only the laboring men as stockholders. This revolution could be brought about by evolution if desired. This could be carried to full socialization of society by evolution, as the final outcome of our industrial development. We all believe we want to bring about this change by evolution and not by revolution.

Employment for Engineers

For the convenience of engineers returning from military service, a list of agencies is here given which may be helpful to those who are seeking employment:

Engineering Societies Employment Bureau: Walter V. Brown, secretary, 29 West 39th St., New York City.

Division of Engineering, United States Employment Service: A. H. Krom, director, 29 South La Salle St., Chicago, Ill.

Professional and Special Section, United States Employment Service: George W. Kirchwey, state director, 16 East 42d St., New York City.

Depletion of Mineral Deposits And the Federal Income Tax[*]

One of the most widely discussed features of the Federal Income-Tax Law is depletion in relation to mineral deposits. Paul Armitage, in the abstract that follows, presents an important discussion of the significance of this term as it is applied, and shows how the development of modern mining enterprises has reached a position that emphasizes the necessity for a new definition of depletion.

CERTAIN features of the question of depletion of mineral deposits are new and novel, and I shall confine my discussion entirely to that subject and therefore refer only to those sections of the law that cover it. Mining engineers have to resolve two characteristic problems in determining this tax: one the valuation of mines and the other the question of depletion.

Depletion is a deduction from income. The law is a tax upon net income, and, therefore, the larger it is possible to make the deductions from that income the less will it be necessary to pay as a tax. Depletion, therefore, is in the nature of exempted income, and the larger the sum of depletion the greater the exempted income.

There are three theories of depletion. The first is termed the "accountants' theory." That is the theory that depletion is the return of all the capital invested; in other words the cost of the article. In that sense it is analogous to the cost of raw material to the manufacturer. As the tax is levied only upon the net income, the cost must necessarily be determined and deducted from the gross income. This theory as applied to the complexities of modern business has failed entirely. As applied to the income tax it has failed entirely, and the reason it has failed is simple. In the first place, it is practically impossible to determine the cost of a mine; and by the cost is meant the original cost. The only exception is in the rare case where the mine was bought for cash and the cash was paid within a recent time, so that it is known. In other instances it is impracticable to go back into the early history of the mine by beginning with the original prospector, who put in his little sum of money, and tracing it down to the last corporation that built its great smeltery of today. That is an insuperable task. As one instance of the difficulties, what is to be included in that cost? Is the cost to be limited to the actual expense that has been incurred in developing that particular body of ore, or is it to go further and to include the sums involved in the unsuccessful attempts to discover bodies of ore in the neighborhood or elsewhere? These should justly be allowed in determining cost, because it is not only the successful attempt that represents the cost of the mine, but the unsuccessful attempts as well. When these and like disbursements are added, where are the limits to be placed? Are they to stop with the unsuccessful attempts of that specific corporation, in that particular neighborhood, or are they to go into all the unsuccessful attempts of the concern elsewhere?

Another reason why the cost theory of depletion is impracticable is because it assumes that the ownership of the mine remains unchanged. That idea does not apply to a modern corporation. There is a constantly fluctuating personnel of stockholders, changing from day to day and from year to year. The stockholders have invested their money at varying rates and in different amounts. The different rates and different amounts are each a different investment of capital. Therefore, though it may be proper to say that the original cost is so much to the man who paid 50c. for his shares, it is unfair to the man who has recently paid $200 a share, which is the basis on which he has invested his money in that organization. To say that the mine is worth only 50c. a share, to capitalize it at 50c. a share, when he has invested at $200 a share, is unjust.

An additional reason is because the Government cannot tax the principal and income which have accrued since Mar. 1, 1913, because prior to that the Federal Constitution did not provide for an income tax. Therefore the covenant had no right to tax income which had accrued before that date. Hence, in computing depletion, more must be allowed than the original cost of the mine which has been acquired before Mar. 1, 1913; that is, it is necessary to make an additional allowance for the increment of value, which has accrued in that mine up to Mar. 1, 1913. Increment of that value up to Mar. 1, 1913, is not income that is taxable; it is capital after that date and cannot be taxed.

The law recognized this constitutional difficulty; the Treasury Department recognized it. So it created a different and new theory of depletion, which may be designated the second theory of depletion. This theory is what may be termed "the statutory theory of depletion." The theory says: "We will allow the man who has bought his property or the corporation that has acquired its property before Mar. 1, 1913, to deplete the value of Mar. 1, 1913, but everybody else must deplete on the basis of the cost." This theory is not a practicable theory; it is not a just theory. The reason is that there are two definite and distinct modes of measuring depletion, one applied to the man who has acquired his property since Mar. 1, 1913, on the basis of cost, giving him no increased value—cost giving him nothing but what he has put into his mine; and the other giving to another concern which has acquired its property before Mar. 1, 1913, the value as of Mar. 1, 1913. This is more than the cost. This allows to be added to his cost the value of after-discovered orebodies. It is not a just test of depletion. It is a perfectly artificial method of determining depletion based solely on the date that one man or concern has acquired his property. As a practicable proposition it produced all sorts of inequality and injustice. It allows one that acquired his mine before Mar. 1, 1913, to include the value of the ore reserves right up to Mar. 1, 1913, and denies another who has bought his mine or discovered it after May 1, 1913, any additional value that he may have discovered; it limits him solely to the cost. The law thus has failed utterly in the effort to apply these two distinct theories of depletion. The net result has been confusion and injustice.

---

[*] An abstract from a paper presented by Paul Armitage at the Feb. 27, 1919, meeting of the M. and M. S. of A.

Now, these theories find their source in an entirely erroneous concept of a mining property, a concept which has arisen partly from some statements of certain eminent mining engineers and in a measure from the wrong aspect in which it is customary to view mining property. One distinguished mining engineer said mining property was like an account in a bank which is being liquidated by a receiver. He referred to it as "an asset in the process of dissolution." Mining property isn't that kind of an asset. It isn't that kind of an enterprise. A great mining corporation of the present isn't a corporation in the process of dissolution. It is not the duty of the directors of that concern to get out that ore, as rapidly as possible, sell it and distribute the profits among the stockholders and dissolve the company. If they do, at the end of a short period their corporation will be dead; their mine will be dead. Any great mining corporation of the modern day is a continuing enterprise. The directors and the stockholders and the managers of that mine ought so to arrange its affairs that it will go on permanently; so that it will have a fund to keep it alive continually. It is not their sole duty to extract all the ore from the company's mine, sell it and distribute the proceeds to the stockholders. The directors should set aside a portion of the funds to acquire and develop new mines, so that the concern can keep going on indefinitely.

The third theory of depletion is that depletion is a reserve for replacement; that it is a reserve which should be set aside by the mining corporation for the purpose of continuing the life of that enterprise or acquiring new property, acquiring new orebodies, or to be used in discovering and developing them; not a fund to be distributed among stockholders. If that is the correct theory of depletion, if this is its purpose, then depletion should not be confined to the original cost, but should be extended to the form of a present-day value of the ore reserves. It should be a fund that makes it possible to replace the ore which has been taken out from year to year on the basis of the present value. This would permit a reappraisement of orebodies at the beginning of each fiscal or taxable year, and depletion could be figured upon that basis.

The last theory compels consideration of the disputed question, What is capital and what is income? In Professor Seligman's definition of income he described it as a "flow," as distinguished from capital.

The Income-Tax Law recognizes income as the amount that is received over a stated period of time. The definite period over which the tax is to be imposed is the taxable year. Therefore anything which has been acquired in the preceding period or year is not taxable except within that taxable year. In a mine, the orebody developed, discovered, or blocked out is earned in the year in which that discovery, blocking out, or development was made.

The Treasury Department up to the present has consistently refused to recognize this. It says that there is no income until the ore has been got out and sold. The return then becomes income, from that date. It says that in the year in which the ore is sold the income is earned. That is radically and fundamentally wrong. That income was earned in the year that the operating organization or individual discovered that orebody, developed it, and blocked it out. It should be allowed in that year. That value of the orebody at the beginning of the taxable year should be allowed as capital, and be fixed as the value for depletion.

When Congress came to formulate the last act, the mining industry appointed a committee to endeavor to have incorporated in the statute better provision for depletion than was embodied in the old law. The committee endeavored to have a provision allowing a fund for replacement put into the law. It was suggested that there be an allowance for depletion, and, in addition, a fund for replacement. The suggestion is given in the following quotation: "First, reasonable amounts for depletion, and, second, reasonable amounts to replace the ore mined during the year, equal to the estimated cost of replacement of a like quantity in the ground." Congress declined to accept the amendment. It was then suggested that an allowance be made in the form of a reserve for hazard. It was the same idea. Hazard was the extra cost of developing or discovering new orebodies over and above what the old ones had cost. The suggestion was incorporated in the bill as applied to oil. It was put in the bill in the House and was stricken out in the Senate. The committee succeeded, however, in getting a reasonable allowance for depletion on the basis of the cost, including the cost of development. Then it added the following clause: "Provided further, that in the case of mines, oil and gas wells, discovered by the taxpayer, on or after Mar. 1, 1913, and not acquired as the result of purchase of a proven tract or lease, where the fair market value of the property is materially disproportionate to the cost, the depletion allowance shall be based upon the fair market value of the property at the date of the discovery, or within 30 days thereafter." What is the value of property 30 days after discovery? Thirty days after discovery one may say it has no value. The time was originally 12 months; now it is 30 days. But, it will be noted here, the reference is to the "discovery of a mine." It is not the discovery of ore, not the discovery of a vein or lode. In the case of a mine discovered by a taxpayer, it says that a mine is not merely the discovery of ore.

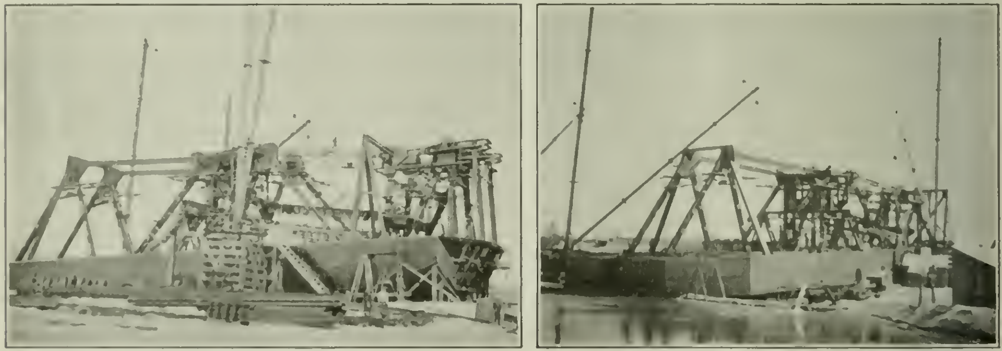
The word "mine" has two very clear and well-settled significations. In the first place, "mine" means an excavation, a hole in the ground for the purpose of getting out ore from the ground. That is not the meaning or sense in which it is used in the law. No man ever discovered a developed mine, except perhaps in some rare case where a wanderer in the wilds of Mexico or Peru discovered an ancient mine that had been abandoned. The other meaning of the word "mine" is that it is an abundant quantity of something, a great store of something. Using mine in this sense, the law means—in the case of a mine—an abundant store, a great quantity of ore discovered by a taxpayer. That means that the taxpayer has done more than merely discover ore; he must have discovered a quantity of ore—a sufficient quantity to warrant the undertaking of a mining operation. That is what the law means, and the Treasury Department has adopted that interpretation. A copy of the regulations just published by the Treasury Department, defining what is meant by discovery of a mine, declares: "The discovery of a mine or natural deposit of mineral ore shall be taken to mean (a), the bona-fide discovery of a commercially valuable deposit of ore; (b), the development and improving of a mineral or ore deposit which has been abandoned, apparently worked out, sold or leased or otherwise disposed of based on a sample from the development of a body of ore or mineral of sufficient size, quality, and calibre to determine by examination that the physical and geologic conditions indicate that it is going to be a commercially valuable deposit of ore."

That means that every man who has discovered his body of ore by Mar. 1, 1913, gets full value, as of that date, for depletion, and every man who discovered a body of ore after that date gets full value under this clause for purposes of depletion. In other words he gets exactly what I have stated as the third theory of depletion, a replacement value. There is only one other thing that at first seems not to be covered in this law, and that is the question of the extension of existing orebodies at depth. It is not in the law in that form. The law says that the value for depletion is as the market value of the property as of Mar. 1, 1913. In determining that market value of the property on Mar. 1, 1913, there is included both proved and prospective ore. In the prospective ore is included the value of the extensions of existing known orebodies.

Latest Yuba All-Steel Placer Dredge

By Lewis H. Eddy[*]

Yuba Consolidated Gold Fields No. 18 dredge was launched in Yuba River at Hammonton, Calif., on Feb. 28, 1919, being the fifth unit of a fleet of the largest all-steel gold-placer dredges ever built, all equipped with 18-cu.ft. buckets, and having an aggregate capacity of 1,500,000 cu.yd. of gravel per month. The hull dimensions of Yuba No. 18 are: Length, 165 ft.; beam, 68 ft.; depth, 11 ft. 6 in.; draught, 7 ft. The equipment dimensions are: Digging ladder, 154 ft. long, carrying 100 close-connected two-piece 18-cu.ft. manganese-steel buckets; tailing stacker, 175 ft. long; two spuds, each 70 ft. long, 38 x 60-in. section and weighing 90,000 lb.; revolving screen, 52 ft. long and 9 ft. in diameter. There are 10 motors. The main drive motor is of 500 horsepower. Pumping equipment consists of two 14-in., one 6-in. two-stage, one 4-in., and two 6-in. vertical pumps. The total weight of the completed dredge will be 2500 tons.



YUBA NO. 18 ALL-STEEL PLACER DREDGE READY FOR LAUNCHING AT HAMMONTON, CALIFORNIA

At left, stern and port side view of steel hull and superstructure ready for equipment installation. At right, bow and starboard side view. Two derricks, one on either side, are clearly shown.

The dredge is designed to dig 84 ft. below the water line, against a 10-ft. bank, or a total digging depth of 94 ft.; the buckets dumping at the rate of 20 per minute. The digging capacity is equal to handling 12,000 cu.yd. of gravel in 24 hours, or 360,000 cu.yd. per month. The first two of this fleet, Yuba Nos. 14[1] and 15[2], were originally equipped with 17-cu.ft. buckets, but later standardized to 18-cu.ft. buckets. No. 16[3] is provided with two tailing stackers, placed approximately at right angles to the hull, at the stern, each 225 ft. long, or 50 ft. longer than the stacker of No. 18. The new dredge is so designed that it also can be provided with two stackers, but the single stacker will be used at the beginning of its operation. The two-stacker type of gold-placer dredge is a departure in construction, and was adopted in Yuba Basin in the design and operation of Yuba No. 16 for the purpose of reconstructing the river channel. It began digging Apr. 1, 1917, and has proved entirely satisfactory.

The four all-steel dredges of this fleet, now in operation in the Yuba Basin at Hammonton, have each a rated capacity of 300,000 cu.yd. of gravel per month and have handled as high as 325,000 cu.yd. per month. The cost of handling gravel on such a scale has averaged 3½c. per cu.yd., which includes not only actual working costs, but also interest on the investment of about $750,000, in each instance, and depreciation, insurance, and all overhead costs.

For probably 15 years, dredging ground will be available in the Hammonton district for the Yuba Consolidated Gold Fields company, which has, under present operation, an equipment of all-steel and wooden-hull boats larger than is operated by any other company.

Besides the fleet of 18-cu.ft. bucket dredges, the company has installed and operated 13 wooden-hull dredges, and as the limit of life of the wooden boats is reached they are replaced by steel hulls. Two of these smaller boats were rebuilt with steel hulls, and with the completion of No. 18 the all-steel dredges in this district will total seven. No estimate can be made of the life of the all-steel dredges operated by this company.

All of the steel dredges were designed and built by the Yuba Manufacturing Co., of Marysville, Calif., which company has also constructed 42 other high-grade dredges, mostly for operation in California, but some operating in other states, as well as in Alaska, Siberia, the Philippines, and South America; and a small dredge is now under construction for the Chinese government.

---

[*] Associate Editor, Rialto Bldg., San Francisco.

[1] *Eng. and Min. Journ.*, Mar. 28, Apr. 4 and 11, 1914

[2] *Eng. and Min. Journ.*, Aug. 19, 1916.

[3] *Eng. and Min. Journ.*, Jan. 20, June 9, Dec. 1, 1917.

All these dredges are designed especially to conform to the conditions under which they are to operate, and they have attained notable success. Fifty per cent. of the number of dredges operating in California today are the product of the plant of the Yuba Manufacturing Co., and these constitute 75% of the total digging capacity of California dredges and represent an aggregate value of more than $15,000,000.

Victoria, B. C., Correspondence

In the Ainsworth-Slocan district, as well as throughout the province, there is a tendency toward the lowering of miners' wages. A reduction of 25c. per shift has gone into effect at the Florence mine, and it is likely that similar reductions will take place in connection with other operating properties. It is stated by the management of the Cork-Province mine that operations on the South Fork will not be resumed unless a 50c. per shift reduction is accepted by the men. During the last year or so the prevailing scale has been $5 a shift for miners. This rate is still in force in the mines around Slocan. No doubt justification for the smaller scale will be found by the operators in the fact that reductions of $1 per shift have been made in the Cœur d'Alenes and Butte, that forces are being reduced steadily, and that the uncertainty of the metal markets, particularly with reference to lead and zinc, makes wage reduction necessary.

Custom Charges at Trail Smeltery

From an unofficial but authoritative source it is learned that the committee of investigation, engaged on the question of custom charges made by the Consolidated Mining and Smelting Co. at its Trail smeltery, has received little information or serious formal complaint from shippers of ore to Trail. The committee, however, has proceeded with its work of investigation at the smeltery, has acquired a large amount of definite practical data, and has so far digested the material as to justify the engagement of the services of R. O. Whitaker, of Denver, Colo., and an accountant to assist him. With this aid the preparation of the committee's report will be expedited to as great a degree as is possible.

New Mining and Railroad Enterprises in the Yukon Territory

Confidence in the Yukon's resources is exemplified by two new post-war enterprises. One is the Forty-Mile Power and Dredging Co., backed by New York capitalists. The company is said to have acquired 96 miles of river claims and hydraulic benches along the Forty-Mile River near Dawson. Its capitalization is $5,000,000. The second enterprise is headed by Lewis Titus, pioneer Yukon dredgeman, and A. McVicar, of Seattle, Wash., who have secured a dredge which will be taken from McQuesten River this season to dredge the Highet Creek placers. All old-time dredge and hydraulic companies on the Klondyke River are preparing to start the season's operations in May. Plenty of labor is said to be available there.

The construction of a line of railway through Northern Alberta and Northern British Columbia to the Yukon is the chief proposal in a somewhat ambitious program which is being urged by the Yukon Development League in a determined endeavor to bring Canada's great northland in closer touch with other sections of the dominion. The Federal Parliament has been asked to provide funds for a survey of the proposed railroad, it being suggested that the line should tap one of the transcontinental roads. It is asserted that such a road would open up a richly timbered farming and grazing country, as well as a practically unexplored mineral region.

The Yukon Territory, containing about 192,000 square miles, more than half of which is habitable, is still practically without railway connections. It is pointed out, in support of the Yukon's claims, that it sent over 600 men to the Great War; gave cash contributions to the war greater per capita than any other section of the British Empire, and up to the present has produced over $200,000,000 in gold.

Maps of Gogebic Range in Wisconsin

The following announcement is made by the Wisconsin Geological and Natural History Survey, Madison, Wisconsin:

In 1915 the Wisconsin Geological Survey began a survey of the Gogebic Range in Wisconsin. Owing to the war and other causes it has been impossible to complete the field and office work and publish the final maps. As numerous inquiries have been made regarding the geology of this area, it has been found advisable to issue preliminary maps, in order that the information at hand may be made available immediately. Accordingly maps have been prepared showing a strip about one mile wide along the range, on the scale of eight inches to the mile, with one sheet for each township. Each map shows dip and dial readings, outcrops, streams, roads, and the southern boundary of the iron formation. These prints will be ready for distribution about May 15, 1919.

The townships covered are: Township 44N., Ranges 2, 3, 4, 5, and 6W, and Township 45N., Ranges 1W. and 1E. The whiteprints will be sold at the cost of printing. A single copy may be obtained for 25c., or the entire set for $1.75, from W. O. Hotchkiss, State Geologist, at Madison, Wisconsin.

Weights and Measures Conference

Weights and measures officials of the United States will meet in annual conference at the National Bureau of Standards, Washington, D. C., for four days, May 21-24, inclusive. Owing to the demands incident to the war upon weights and measures officials, especially those of the Bureau of Standards, no annual conference has been held since 1916. The objects of these conferences are to bring an exchange of views between the men who are engaged in the important task of inspecting weighing and measuring apparatus and to secure greater efficiency and uniformity in the work. Each state legislates independently on the subject of weights and measures laws, and it will be readily realized that there has developed a lack of uniformity. A model for a uniform state law, as well as one for a city and county law, and a uniform table for tolerances on weighing and measuring apparatus were drafted. These have been widely adopted throughout the country, and as a consequence much has been accomplished toward eliminating the chaotic conditions that have developed through non-uniformity in weights and measures laws.

The Principles of Industrial Relations

A STATEMENT of the principles of industrial relations, prepared with a view to furnishing a basis on which American industry can build a national labor program, was submitted recently to a referendum vote of the membership of the Chamber of Commerce of the United States. The principles, 13 in number, were prepared by a special committee of the chamber after a long period of study of the entire subject of industrial relations.

Members of the committee signing the report are Harry P. Kendall, manufacturer, of Boston; Henry Bruere, vice-president, American Metal Co., formerly director, Bureau of Municipal Research, New York; Joseph H. Defrees, lawyer, Chicago; William Butterworth, manufacturer, Moline, Ill.; John W. O'Leary, manufacturer, Chicago, and Harry A. Wheeler, banker, Chicago.

The committee itself included in its report only the principles of industrial relations which it recommends. As is usual in the procedure of the chamber, however, there have been placed in the pamphlet, used for a referendum vote on the report, outlines of considerations which organizations in the chamber's membership may wish to bear in mind when they decide to vote for or against any of the principles. There is to be a separate vote upon each of the principles.

The principles, together with the substance of these outlines, are as follows:

1. Industrial enterprise, as a source of livelihood for both employer and employee, should be so conducted that due consideration is given to the situation of all persons dependent upon it.

For. The proposition states a fundamental point of view. The management of an enterprise may recognize in proper instances a positive duty to strive to have the enterprise earn means to increase compensation to workmen, or to better their condition in other ways, quite as clearly as it recognizes a duty to make the enterprise successful for the owners. Owners and workmen, of course, share responsibility with the management. According to this point of view, competition should not be the governing factor in determination of wages. It should be modified by due consideration of all persons dependent on an industry as a source and means of livelihood.

Against. The proposition may err because it deals only with the interests of participants in an industry, and does not provide for consideration of the public interest. Freedom for individuals to obtain the compensation to which their abilities entitle them has been maintained through competition. From this point of view, competition alone can bring about the proper adjustments in a complex economic structure and alone can cure the abnormal conditions resulting from war. If workers are at a disadvantage in disposing of their services by competition, the remedy should be through legislation, and not in a principle which might embody industrial paternalism.

2. The public interest requires adjustment of industrial relations by peaceful methods.

For. Methods of force exerted by either side result in social and industrial unrest. Prevention of these causes of unrest accords with all the ideals of democracy, and also saves both direct and indirect material loss to participants and to the public.

Against. There is a possible difficulty in concrete application of such a principle. An employer, finding that his workmen are disposed to disregard his limitations with respect to cost of production, might wish to cease operation until he could find new employees who would work on a basis that would permit successful operation of his plant. And employees who normally are not prepared to go to distant localities to seek work are reluctant to abandon freedom to strike when they see in it the only immediate means of obtaining what they are seeking. Most attempts to do away altogether with strikes and lockouts have failed.

3. Regularity and continuity of employment should be sought to the fullest extent possible, and should constitute a responsibility resting alike upon employers, wage earners, and the public.

For. Two problems are involved here. Unemployment which results from fluctuation arising from conditions that affect individual industries or groups of industries, such as seasonal industries, represents disadvantages both to employers and employees, to the latter because it reduces the earning capacity, and to the former because the industry has to provide production capacity to carry the peak of the load. Continuity of employment, which means the prevention of unnecessary and undesirable labor turnover, eliminates a large amount of economic waste.

Against. Although desirable, regularity and continuity of employment may not be generally obtainable in many industries. Regularity often is affected by such uncontrollable factors as the weather. As to continuity there may be a question whether employees will not, in the long run, find best opportunity to develop their abilities if they follow their own choice as to when they shall change their jobs.

4. The right of workers to organize is as clearly recognized as that of any other element or part of the community.

For. That all elements and parts of the community should be treated equally, and that they should have the same right to organize, is a proposition fundamental to American law. The circumstance that an organization might abuse its power is not an argument against the right to organize, but rather a reason for legislative action to prevent such abuses. Organization in formal or informal manner is inevitable.

Against. A statement of the right of workers to organize should be preceded by formulation of methods by which abuses of organization detrimental to the public interest may be prevented. Though formulation of such methods might be difficult, it may not justify departure from such an order of events.

5. Industrial harmony and prosperity will be most effectually promoted by adequate representation of the parties in interest. Existing forms of representation should be carefully studied and availed of in so far as

they may be found to have merit and are adaptable to the peculiar conditions in the various industries.

For. Representation goes far toward preventing ill-will, unrest, hostility, and withholding of effort on the part of participants in industry. Representation and adequate discussion remove dissatisfaction where this dissatisfaction arises, not because of conditions in an industry, but because participants have no say in making conditions.

Against. It is questionable if any form of representation can take the place of enlightened and efficient management. Any representation which shifts the responsibility of the management decreases the efficiency of management upon which all participants in industry rely for the promotion of their interests. The line of development should be toward better management. Representation in some industries is hard to get, as illustrated in those which employ large numbers of unskilled workers. Representation must provide advice, suggestions, and discussions with an understanding of problems involved and experience with the point of view of management. Representation implies a degree of equality among participants in discussion as to knowledge of the things to be discussed.

6. Whenever agreements are made with respect to industrial relations they should be faithfully observed.

For. Unless there is faithful observance of agreements that may be made, conditions of uncertainty arise, dissatisfaction follows, and there is loss in efficiency. Faithful observance is essential to the stability necessary in the interest of all participants in industry and the public.

Against. To say that agreements, if made, should be faithfully observed may not be enough. Agreements reached in collective bargaining regarding industrial relations are not contracts in the regular sense. They merely are statements of the usage that is to prevail, of methods of dealing to be followed by persons engaged in a trade. Consequently, any means of enforcing agreements might deprive individuals of liberty to make their own contracts.

7. Such agreements should contain provision for prompt and final interpretation in the event of controversy regarding meaning or application.

For. Insertion in an agreement of provisions having to do with means used for settlement of a controversy is an efficient way of preventing misunderstanding from arising. Such provisions should determine in advance all details that it is possible to foresee, and as far as possible should come into operation automatically when a dispute arises. Much of the recent progress in settling industrial disputes has been in accordance with this principle.

Against. To the insertion, in any agreements made, of adequate provisions for interpretation in the event of controversy, ordinarily there may be no objection, except that elaboration of such provisions may delay conclusion of an agreement on points of more immediate importance; and, further, the existence of such provisions may tend to give undue prominence to relatively unimportant questions which otherwise would not arise.

8. Wages should be adjusted with due regard to the purchasing power of the wage, and to the right of every man to an opportunity to earn a living at fair wages, to reasonable hours of work, to a decent home, and to the enjoyment of proper social conditions.

For. Adjustment of wages as recommended would place the wage standard on an equality with the American standard of living. Compensation which does not permit the recipient to have a part in the life of the typical American community means immediate public detriment, because it creates an element that is apart from the rest of the community and it may also mean an eventual public charge for the maintenance of persons rendered incompetent for any industrial service through the inadequacy of wages. Industries are dependent for stability and permanence upon contented workers. Again, wide markets are essential to industrial success where industrial achievement is in great output at low cost. Such markets are created by workers as consumers. The purchasing power of wages should not be impaired.

Against. Determination of what constitutes a living wage is no easy matter. The living wage is not by any means a universal standard. In the United States a living wage might vary considerably when there is taken into account the dissimilarities in race so marked as between negroes and whites, and by variations in the living standard by immigrants from other lands. High wages depend fundamentally upon effectiveness in the application of labor, and upon the production of labor.

9. Fixing of a basic day as a device for increasing compensation is a subterfuge that should be condemned.

For. A basic day is a measure of wages and usually a means for increasing wages. It is not a limitation upon hours of work. A basic eight-hour day does not mean an eight-hour workday, but the wage is taken as due for eight hours of work, and for further hours in the actual day overtime is paid. Under these conditions the social and other advantages usually ascribed to a short-hour workday are not sought.

Against. In an occupation where, for example, a short-hour day has not for physical reasons of operation as yet been found possible, it may be proper to take the first step toward an actual workday with fewer hours by stating such a day as the measure of wages for the day's work, with additional work to be paid for as overtime. In fact, the Federal law respecting railroad employees has brought about an actual eight-hour day in railroad yards, and in some instances for workers on trains.

10. Efficient production in conjunction with adequate wages is essential to successful industry. Arbitrary restriction on output below reasonable standards is harmful to the interests of wage earners, employers, and the public, and should not be permitted. Industry, efficiency and initiative, wherever found, should be encouraged and adequately rewarded, and indolence and indifference should be condemned.

For. Limitation upon production is not even logical in immediate self-interest for persons who seek wage adjustments or other remedies. In an even more fundamental way, limitations have a detrimental effect upon workers by dulling the interest and zeal which follow successful work. Successful efforts develop intelligence and initiative, desirable qualities in members of a democracy. The declaration against limitation in production applies not only to employees but also to any employers who may restrict output as a method, for example, of keeping up prices.

Against. Means have not yet been devised to insure to individual workers the advantages to them of increased production. Continued employment to the individual is often his most immediate concern. He often is so situated in industry that only a limited amount of work is to be done and any increase in efficiency may mean that some individuals engaged in the task will be discharged. Considerations such as these may lead to limitation on output. Again, limitations are sometimes said to be necessary from the workers' point of view to prevent "speeding up" which would be detrimental to health.

11. Reduction in wages should not be considered until all possibility of reduction of costs in other directions has been exhausted.

For. A fundamental argument for this proposition lies in the circumstance that the wage affects the human element in whose welfare and continued efficiency the whole community has an interest. Besides, reduction should begin in the largest factor of cost. In the United States the cost of materials for manufacturing is, in the aggregate, more than twice the cost of wages.

Against. When prices are falling reduction in wages is equitable, and inevitable when wages have advanced with rising prices. Wages fall with a decline in production. That the rate of wages is maintained does not mean a great deal, because the work-time for employees decreases and their earnings therefore diminish. There has been a considerable decline in earnings since the armistice was signed, although rates of wages generally have been maintained.

12. Administration of employment and management of labor should be recognized as a distinct and important function of management, and accorded its proper responsibility in administrative organization.

For. Many wastes can be prevented through concentration of expert and sympathetic attention upon problems of personnel in large establishments. These wastes include the costs to industry due to turnover in labor, wastage of materials, and disorganization of routine and esprit de corps, the loss to industry of the training and experience of men who leave, losses to the public in production, and losses to workers of opportunities to advance in accordance with skill and experience they have developed.

Against. At best the movement for employment management is in an early stage, and even the general trend of what will prove successful in certain parts of this field is not evident. The movement still is a matter of propaganda; there has not been time for a critical analysis which will uncover such defects as may exist. Employment management contains a possibility of error in development of a paternalistic attitude toward employees, undesirable because of its influence upon employers and employees.

13. A system of national employment offices, with due provision for cooperation with existing state and municipal systems, can be made, under efficient management and if conducted with due regard to the equal interests of employers and employees in its proper administration, a most helpful agency; but only if all appointments are made strictly subject to the Civil Service law and rules. Policies governing the conduct of a national system of employment offices should be determined in conjunction with advisory boards—national, state, and local—equally representative of employers and employees.

For. The inadequacy of private employment agencies, the limitations upon facilities offered by labor organizations and employers' associations, and the possible need of a national system of employment exchanges to coördinate and supplement state and municipal agencies were set out in a report made by a committee of the National Chamber in 1916. The purpose of employment offices of the kind in question is to provide a centralizing agency to which employers will resort with confidence that they can ascertain all possibilities of meeting their needs, and to which persons desiring employment can go with equal certainty that they can learn of the opportunities that may exist.

Against. There are considerable difficulties about a proposal for Federal employment offices of any kind in normal times. As a matter of administration it may be almost impossible to prevent local Federal offices from departing from their proper functions of coördination and supplement and operating in such a way as to duplicate state and local public offices, thus introducing a degree of the confusion they are intended to prevent. Regarding the present service, for instance, it has been alleged that its local offices have in some instances been adding to congestion by striving for a "record" in placing discharged soldiers where they happen to apply for work rather than in seeking to direct them to their home communities where their services may be needed and where it is to the public interest that they should go.

Brazilian Diamond Mining

Under the title Companhia Brazileira Diamantifera, a corporation was recently organized in Rio de Janeiro to develop the diamond mines at Moribeca and Bôa Vista, in the region of Diamantina, State of Minas Geraes, Brazil, says a recent consular report.

The declared capital of the corporation is 3000 contos of réis (about $750,000 in American currency), divided into 150,000 shares of 20,000 réis each (about $5 in American currency), 40% being realized, the rest to be paid in installments of 10%.

The directorate of the company comprises the following: Dr. André Gustavo Paulo de Frontin, president; Antonio Luiz dos Santos, secretary; Dr. David Draper, technical director; Dr. Zozimo Barroso and Robert Holland, directors.

Michigan Iron-Ore Reserves

Iron-ore reserves of Michigan are estimated as 191,675,651 tons on Jan. 1, 1917, according to figures prepared by the state geological survey. Reserve tonnage reported amounts to 107,954,081 tons; developed ore, 83,721,570 tons, and 5,132,343 tons are held in stock, bringing the total ore estimated to 196,750,502 tons. This exceeds the estimate of Jan. 1, 1916, which was 106,502,493 tons.

Details of Practical Mining

The suggestion contained in the article "Air Booster for Centrifugal Pumps" merits the attention of operators who are considering the installation of additional pumps, made necessary by an increased flow of water. In this instance, by means of a simple connection, it was possible sufficiently to increase the pumping capacity of the installation.

Monorail and monocable hoisting, though not extensively used underground in this country, offers a practicable substitute for a double-track, inclined-skip hoist. Its application is limited, but, as is the case with many other mine devices, the adaptation of the methods used in this system may in some form or other prove of value in mine operation.

The Jackhamer needs little introduction to the mining world, and its versatility in mine operations is well known. The first of the last two articles describes a wood-cutting operation that was successfully carried out by means of a Jackhamer. The last article describes a mounting, the utilization of which facilitates the use of this type of drill.

Air Booster for Centrifugal Pumps

By H. H. Hunner*

Two single-stage centrifugal pumps were insufficient to keep down the water at the Algoma mine, Ironton, Minn., when the flow increased owing to the cessation of pumping at an adjoining property. One pump was driven by a 75-hp. motor at 1750 r.p.m., rated at 1290 gal. per min. against a 165-ft. head, and was pumping at approximately this head. The second pump was direct-connected to a 100-hp. motor making 1750 r.p.m., and was rated at 1500 gal. per min., with a 170-ft. head. Suction and discharge for both pumps were 6-in. diameter pipes.

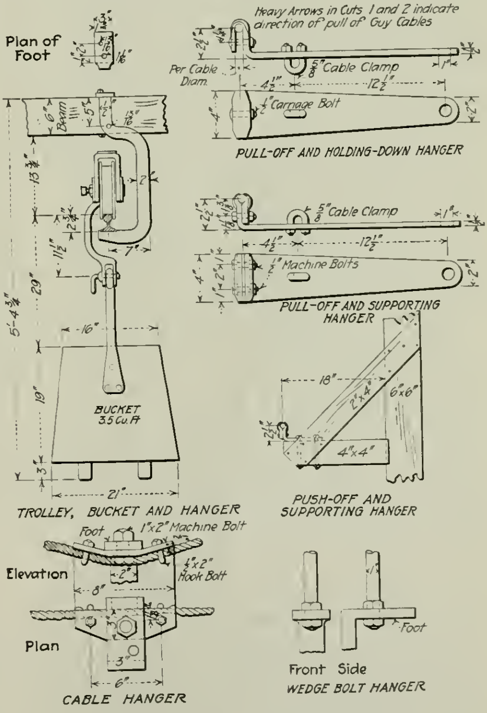
Elbows on the discharge pipes were tapped for 1-in. pipe connections about 5 ft. from the pumps, connected to an air line, and the valves were slightly opened on a 90-ft. air pressure. The added pressure increased the capacity of the pumps by 200 or 300 gal., which was sufficient to take care of the increased flow of water. The small amount of air used was not noticeable on the air line.

Monorail and Monocable Hoisting

By C. C. Hoke†

The following notes, in conjunction with detail shown in the accompanying cuts, will serve to indicate the construction and application of monorail hoists for mine work, as well as of monocable adaptations:

The monorail hoist was first put into extensive use in South Africa, and, as its name indicates, consists of a bucket carried by a two-wheeled trolley, running on a single rail. Travel is usually accomplished by an electric motor or engine-driven hoist, the winding cable being attached to the trolley. The system is best adapted to work on flat inclines where a skip hoist running on two track rails is neither justified nor feasible. It is especially suitable for lowering ore in places where it is not possible to throw it down, such as in irregular, tortuous or relatively flat stopes with irregular footings.



DETAILS OF STANDARD MONORAIL UNDERGROUND HAULAGE SYSTEM

In certain applications of the system, a track of light steel rail may be used, this being supported on stulls by means of the hanger shown in the cut, by carrying the rails on hangers suspended from transverse cables, or from wedge bolts driven in the roof of the working. Details of these hangers are also shown.

A track rail is in any case not desirable or feasible, and for this reason a standing cable system may be employed. The use of the track cable instead of a rail results in a flexible and, usually, a cheaper installation. With hangers properly designed and applied, the cable may be carried through winding stopes having any kind of roofs or footings. The hangers may be carried on stulls or brackets, if convenient, but more often—particularly in stopes or workings having rock side walls and footings—it is desirable to use guying cables for the purpose. These must, of course, be applied in proper direction, so that the resultant pull will carry the cable as required. The guy cables are easily secured to wedge I-bolts driven in the walls, floor, or roof. Details of typical hangers for use with guy cables, as well as a "push-off" hanger for curves where a "pull-off" hanger cannot be applied, are shown in the illustration.

---

*Superintendent, Onahman Iron Co., Ironton, Minnesota.

†Mechanical engineer, Cia. Minera de Peñoles, Mapimi, Dgo., Mexico.

The size of standing cable required naturally depends on the size of the bucket, the span between hangers, and other factors, but it is usually ¾ in. Old hoisting cable can often be economically utilized in this connection. The haulage cable will probably be of $\frac{5}{16}$ to ½ in., the size also depending on the duty required.

The hoist for operating the system will usually be placed at the head of the incline, but may, by the use of a head sheave and return haulage cable, be at the foot of the incline, or at any intermediate point desired. If placed at the foot of the incline, the hoist operator may also dump the buckets, in case self-dumping ones are not used. Generally speaking, the placing of the hoist at the foot of the incline complicates the installation, because of the additional run of haulage cable, for which idlers will, in most cases, be required. It is imperatively necessary to provide idlers to prevent wear on the haulage cable as a result of friction against the rock walls, and considerable difficulty is often encountered in placing them properly. This is a matter of judgment, to be settled in conformity with the demands of each particular case. It will have a great deal to do with the success of an installation, unless the latter is the simplest kind, because of liability to delays for repairs and attendant cost. The idlers should not be too small in diameter, to obtain the best results, although 3- or 4-in. pipe rollers are frequently used. Better idlers, unless long ones are required, will result by making them of cast iron, 10 or 12 in. in diameter.

Cutting Timber With a Jackhamer

By Frank B. Bryant*

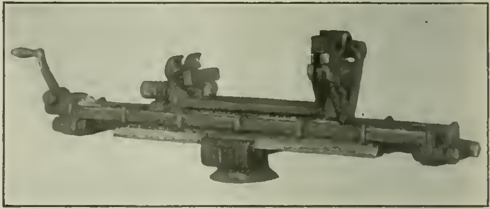
In sinking a shaft through old, caved, square-set stopes at the Kendall mine, Kendall, Mont., considerable timber was encountered. The work of chopping this out with an ax, in addition to the blasting that was necessary, impeded progress, but the delay was overcome by the use of a Jackhamer drill and a special chisel bit made as follows: A piece of Jackhamer steel 18 in. in length was drawn and flattened at one end to the shape of an ordinary wood chisel. The bit was 2 in. wide at the cutting edge, which tapered back to a thickness of ⅜ in. at about 1 in. from the edge. The shank of the bit was ground round so that the chuck would not grip it; therefore, there was no rotation of the bit. This was used in cutting off lagging, plank, and ends of timber, and by chipping, after the manner in which an ax is used, it was possible to cut through 14-in. timbers in a short time.

---

*Mining engineer, Kendall, Montana.

The Jackhamer Drill Mounting

The versatility of the Jackhamer in mining work is already well known, and, with the introduction of a mounting, the scope of usefulness of this type of drill is further increased. Primarily the Jackhamer represents a type of drill which is so designed as to overcome the cumbersomeness of heavier machines and at the same time combine efficient service with ease of operation. In the design of the mounting, shown in the accompanying cut, the Ingersoll-Rand Co. have carried out a similar idea in construction, and the adoption of this attachment has met with great success in the drilling of flat holes, for it permits the work to be done continuously and without fatigue to the workman.


MOUNTING FOR A LIGHT DRILL

The mounting is made to hold either the dry or the wet Jackhamer. It is but an instant's work to clamp the standard Jackhamer in the carriage of the mounting. Therefore a single drill may be used conveniently for the twofold purpose of drilling flat holes in the heading and down holes on the bench without loss of time in making changes. The clamp which grips the handle of the drill is provided with a cushion spring to take up the shock when a steel is being pulled out of a hole. The forward clamp on the carriage does not grip the machine firmly, but serves only as a support and guide.

DETAILS OF JACKHAMER MOUNTING

Weight, lb.	63
Weight with Jackhamer, lb.	104
Length, in.	39¾
Height, in.	10¾
Distance from center of drilling machine to mounting, in.	2⅜
Length of screw feed, in.	24½
Slide of cone on shell, in.	19½

The carriage is moved by a feed screw which is supported at both ends, these supports acting as tops to prevent the carriage from being fed out of the shell. The feed screw is operated by crank, one turn of which moves the carriage ½ inch.

The mounting is adapted for use either on the arc of a column or horizontal shaft bar or on a tripod, as the standard 5-in. cone upon which the shell rests will fit into any 5-in. Sargeant saddle or clamp. The cone is made to slide on the shell, which gives a quick adjustment when setting up and can be used to increase the length of feed whenever necessary.

The column or shaft bar most commonly used with the Jackhamer mounting is of a light single-screw column type. The mounting is built for hard usage, steel casting and drop forgings being employed throughout its construction. Essential details appear in the table.

Ore Dressing and Metallurgy

All types of mills operate more efficiently with an automatically regulated feed. An arrangement is shown which is simple and positive in action, and which could be modified for use with other machines than the one for which it was designed.

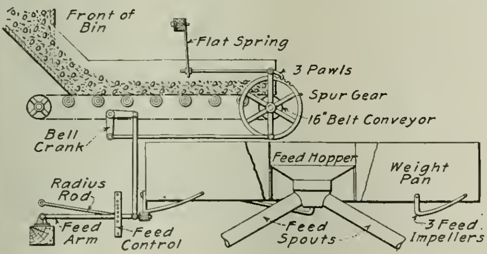
Flotation operators are finding that many improvements in small details are worth while. Froth removal is discussed in an interesting note, and a useful type of scraper is described and illustrated.

Wet screening of mill pulp is receiving increased attention on account of the need of a more efficient separation than is practicable with hydraulic classifiers under certain conditions. The machine illustrated has several novel features.

An important factor in the reduction of operating costs is the ability to economize in connection with the necessary repairs and renewals. A description of a zinc-condenser machine is given, with an illustration of the device, which should prove of interest.

Automatic Feeder for Lane Mill

The illustration herewith reproduced is from a paper on the "Fine-Grinding Plant of the Barnes-King Development Co.," by J. H. McCormack, which was presented at the Colorado meeting of the A. I. M. E. in September, 1918. It indicates a type of feeder which has been adopted in that installation to insure maintenance of a uniform depth of ore between the tires and dies of the Lane mills in the grinding department.



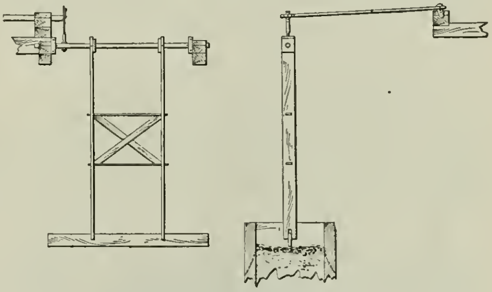
AUTOMATIC FEEDING DEVICE FOR LANE MILLS

The amount of feed is controlled by an adjustable stopper against which the feed arm rests. Movement of the latter is insured by three cams which are attached to the weight pan of the mill. The movement is transmitted through a crank, as shown, and finally causes a pawl to engage the teeth of a spur gear, which, in turn, is connected with a belt-conveyor type of feeder.

Froth Removal From Flotation Cells

By Claude T. Rice

There is an increasing belief in the Cœur d'Alene district that it is advisable to scrape the froth off a flotation machine when the gangue in the ore has a tendency to float with the mineral. As a result, the use of a scraper to remove the froth as it rises in the cell is gaining favor. At the Hercules plant small cells with Callow bottoms are used to clean the concentrate, and are equipped either with a paddle wheel to discharge the froth over the end, or else with a traveling belt carried by two wheels, one the driver, and both mounted on the sides of the cell itself. The speed of operation is only a few revolutions per minute, so that the discharge is slow, and only the top two inches or so of the froth is scraped off. The same idea is also used in the Bunker Hill flotation cell, designed by R. S. Handy; but the scrapers in this machine move the froth up an inclined plane, so that it has a tendency to rid itself of excess oil and entrained matter.



THE THRONDSON FROTH SCRAPER

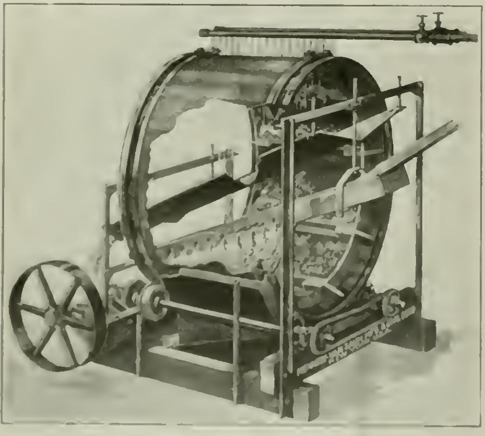
At several of the mills where there is siderite in the feed, side-boards are used on the Callow cells, and the froth is permitted to discharge only along the last two feet of the machine next the end. The purpose of this is to raise the froth rather violently at the front end, and then to let it settle in a deep bed before discharging. As yet, other than in the case of the small cleaner cells used at the Hercules by Joseph Franz, in none of the plants in the district except the Sweeney is froth being scraped off the Callow cells.

At the Sweeney mill, the superintendent, H. M. Throndson, has devised an ingenious scraper he uses on his Callow cells. On the rougher cells, the scraper blades are long enough to take off forth over the sides along the whole length of the cell. On the cleaner cells, he uses side-boards and scrapers on the last two feet of froth. On one of the cells, used sometimes as a rougher and sometimes as a cleaner, is both a short and a long scraper. When the cell is used as a rougher, both scrapers can be used; when operated as a cleaner, side-boards can be added and only the last two feet scraped off.

The Throndson scraper takes the froth off the side of the cell. It consists of a blade which is toenailed into a slot in the carrier arms, so that it can be adjusted to take off the depth of froth desired. The arms are made about 5½ ft. long, so that the blade travels through a flat arc, and consequently dips only slightly deeper into the froth at the center than at the sides. These arms are carried by a 1¼-in. pipe, to which they are fastened by pins. This pipe is, in turn, carried from supports in wooden bearings, in which the wear is slight, for the motion of the scraper is slow and it has little weight. The crank arm that drives the scraper shaft-pipe consists of a ¼-in. rod which is carried in a hole punched through the pipe and held by lock nuts. At its end are three holes an inch apart for making adjustments. A rod connects this crank arm with one from a drive-wheel carried by another 1¼-in. pipe, flattened at its end and bent up to form a crank arm. Holes are punched at one end in the connecting rod to adjust the length of this crank arm, and thus regulate the travel of the scraper. The drive wheel is belted to the shaft that drives the vanner on the floor below, so that it rotates at about 9 r.p.m. Consequently the scraper blade swings across the top of the cell about every three seconds, making two strokes or swings to every revolution of the drive shaft. The shaft, in turn, carries arms for driving the scraper on the next cell; and by using pipes a light shaft can be obtained. The device is good enough for the work and will last for years without giving trouble. It has been in operation for two years or so at the Sweeney plant.

Wet-Pulp Screening Device

A new type of screening device has recently been brought out by the Kennedy-Van Saun Corporation and is known as the Maxton screen. It consists of a cylinder open at both ends, revolving horizontally upon two sets of rollers, as in the tire-type tube mill. The body of the tube is the wire-cloth screening medium. It is supported by heads at each end and by longitudinal ribs connecting the heads. Projecting radially from the inside of the tube are the lifters, or ribs. These run longitudinally between the heads and project a short distance into the tube. The feed is delivered through a distributing launder along a line running the entire length of the tube near its lowest point. An inclined apron provides for the delivery of the feed upon the screen without impact.

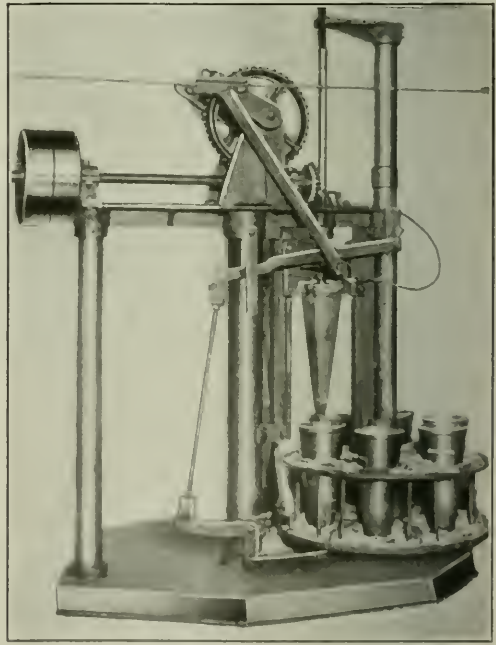


THE MAXTON SCREEN

The undersize passes through the screen into a collecting pan. The oversize remains upon the screen surface. As the screen revolves, the travel of the oversize is limited by the ribs, which hold it and carry it up and, at a sufficient elevation, deliver it into the oversize launder, which is above the feed-entry launder. Two water-spray pipes, placed above the screen, assist in discharging the oversize material, and serve to keep the screen openings entirely clear. Another spray pipe may be placed under or alongside the feed-entry launder, to assist, if necessary, in washing the oversize clear of adhering slime or colloid particles. The accompanying diagram illustrates the features of the screen.

Zinc-Condenser Machine

An improved type of zinc-condenser machine is shown in the accompanying cut, and has a capacity of from 70 to 250 retorts per hour. It is of simple though efficient design. The plunger is of cast metal, and has a number of grooves planed throughout its length, to receive strips of flat steel. These strips take the wear, and can be easily renewed. The centering of the plunger is insured by a crosshead and rigid guides.



MACHINE FOR MAKING ZINC CONDENSERS

The machine is self-contained, and where an electric motor is used for power it may be mounted on wheels and moved where needed. It requires about 2½ hp. and is driven by a 3-in. belt. Its height is 7½ ft. and the over-all floor dimensions are 4½ by 7 ft. It is being manufactured by A. W. Stafford, at Van Buren, Arkansas.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief Commission

After listening for two days to the arguments in favor of the $900,000 claim made by the Chestatee Pyrites and Chemical Co., the War-Minerals Relief Commission asked that a second hearing be held on May 5. The members of the commission desire time to study the evidence and wish to have their accountant to go over the figures submitted. The second hearing probably will be in the nature of a cross-examination.

The claimant has asked that part payment be made on the claim. It is contended that the evidence presented is conclusive as to the general merit of the claim, which would allow the payment of a portion of the amount. The commission took the proposal under advisement, but the intimation was that no payments could be made until after all the claims are in.

Many demands are being made that the commission consider a claim from any property where an honest effort was made to produce the war minerals of which the Government was in great need. The commission has promised to suspend its interpretation of that section of the law which provides that the metals must have been sought or produced "in compliance with the request or demand" of the Government, until the chrome cases have been argued. Whether the commission will be able to give some flexibility to that part of the law remains to be seen. It is anxious, however, that any person who made an honest effort to supply the need of the nation in the minerals coming under the act should present his case.

Claims are reaching the commission at the rate of ten a day. There are now about 225 claims on the docket, asking for almost $4,000,000. Several large claims are known to be outstanding, as are the bulk of the chrome claims and most of those which offer particular difficulties in preparation.

The commission will hold no hearings outside of Washington until after June 2, which is the final date on which claims may be filed.

Allocating Surplus Explosives

The War Department authorizes the following statement from the office of the Director of Sales:

All surplus TNT and other explosives owned by the War Department and which can be used in clearing land, building roads, general construction work or in any way as a substitute for the ordinary commercial dynamite, have been turned over to the Department of Interior. These explosives will be used on public works, and a portion may be used for the clearing of lands for honorably discharged soldiers, provided the Soldiers' Settlement Bill is passed by the next Congress.

This material, which at one time was considered practically worthless, now has an estimated value of $15,000,000. There will be no public sale of explosives by the Army, and if any surplus of this material is found in the future, it is thought that it can be used by the Department of the Interior.

Lake Shipping Rates Approved

The Shipping Board on Apr. 18 formally approved the rates of shipment for ore, grain, and coal on the Great Lakes for the coming season, following a joint meeting with officials of the Food Administration's grain corporation and the representatives of vessel owners and shippers.

Rates agreed upon are: Ore, 80c. per ton; coal 42½c. per ton and grain from Lake Superior to Lake Erie and from Lake Michigan to Lake Erie, April and May loading, 3½ and 3c. per bu. respectively; September, October and November grain loading, including winter storage of vessel, 5 and 5½c. respectively.

The Shipping Board stated that the action taken was designed to effect a stabilization in the shipping business on the Great Lakes, so as to maintain an equilibrium in the labor situation and to aid as much as possible the transition from war to a peace basis with the minimum disturbance in all lines of business allied with Lake shipping. The action is expected to produce extensive beneficial results in all Lake industries.

Revising the Mining Laws

Another attempt to revise the mining laws will be made at the forthcoming session of Congress. Previous efforts to achieve such revision have failed largely on account of difficult parliamentary situations. With a calendar crowded with legislation of the most pressing character, and with the end of a session nearing, there is much opposition to the introduction of a subject of so controversial a nature as the mining laws.

It is hoped that the plan can be launched at the beginning of the session, so that time may be allowed for the members of the committee to become familiar with the bill and be impressed with the importance of the subject.

The main contention in committee on previous occasions has been the apex law. The real truth of the situation, however, is admitted to be a lack of information as to what the mining industry wants. No comprehensive effort ever has been made to gather data on the subject. For this reason it is probable that the actual revision of the law must await a systematic study of the needs of the mining industry. Congress will be asked to make possible such a survey.

Chemical Warfare Service

The Chemical Warfare Service is to be continued. Immediately after the armistice it was thought that the service would be abandoned. This belief was based on the assumption that the peace treaty would specify that gas warfare would not be resorted to in the future. It has become increasingly apparent, however, that, until some better way of assuring the abolition of the gas weapon is devised, the United States cannot afford to abandon the research and practice which the Chemical Warfare Service is conducting.

Monthly Copper Production for 1919

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE-COPPER PRODUCTION, 1919

	January	February	March
Alaska shipments	5,618,504	5,176,033	1,471,398
Arizona:			
Arizona Copper	3,600,000	3,360,000	2,800,000
Calumet & Arizona	4,786,000	6,612,000	4,602,000
Cons. Ariz. Smelting	1,070,000	1,000,000	720,000
Inspiration	6,500,000	6,600,000	6,700,000
Magma	900,000	1,211,175	1,000,212
Miami	5,273,260	4,462,578	4,551,115
New Cornelia (a)	2,848,000	2,014,000	1,980,000
Old Dominion	2,812,000	2,360,000	2,574,000
Phelps Dodge	9,425,733	7,410,000	6,434,000
Ray	4,470,000	4,150,000	3,792,000
Shattuck Arizona	622,226	376,166	2,452
United Verde	5,350,000	2,850,000	*Nil*
United Verde Extension	4,045,038	1,239,120	*Nil*
California:			
Mammoth	1,670,000	1,506,000	1,475,000
Michigan:			
Calumet & Hecla	11,758,500	9,263,868	9 652 053
Other Lake Superior (b)	6,500,000	6,500,000	....
Montana:			
Anaconda	15,900,000	12,400,000	13,900,000
East Butte	2,291,950	633,560	1,700,230
Nevada:			
Mason Valley	1,111,000	947,336	*Nil*
Nevada Cons	4,400,000	4,150,000	3,650,000
New Mexico:			
Chino	4,241,000	3,552,676	3,770,000
Utah:			
Utah Copper	10,500,000	10,335,000	8,366,000
Eastern smelters (b)	1,400,000	1,400,000	....
Total reported	117,093,511	99,509,512	....
Others, estimated	18,640,000	12,140,000	....
Total United States	135,733,511	111,649,512	....
Imports: Ore and concentrates, etc	9,926,390	13,824,200	....
Imports in blister, etc	5,065,683	33,369,626	....
Grand total	150,725,584	158,843,338	....
British Columbia:			
Granby Cons	3,156,486	2,610,737	....
Mexico:			
Boleo	1,654,240	1,807,680	2,039,520
Cananea	3,000,000	3,000,000	3,200,000
Phelps Dodge, Mexican properties	2,453,000	1,775,000	1,900,000
Other foreign:			
Cerro de Pasco	5,836,000	4,586,000	4,838,000
Chile	6,800,000	5,376,000	4,568,000
Katanga	3,306,900	3,877,890	3,262,800
Backus & Johnston	1,897,642	1,642,898	....

(a) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery. (b) Estimated.

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce, and includes Kennecott production from its Alaskan mines.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Granby, Cananea, Braden, Cerro de Pasco, and Chile. As a matter of record, however, the individual figures are given after the total. We also report the copper output of the Boleo and Katanga companies, which does not come to the United States.

Fatality and Injury Ratios

That the inability to read and understand English places the foreigner in danger of his life is the striking fact brought out in the last monthly statement of mine fatalities by the U. S. Bureau of Mines. The rate of accidents among the non-English speaking miners is not only greater in all the great mining districts of the country, but the increased ratio is uniform in all districts. This demonstrates clearly that the inability to read warning signs, to comprehend fully the company's instructions, and to understand their foremen, places an unnecessary hazard upon the foreign born.

The figures given show the difference in the rate of serious accidents in the mines among the English speaking and those from the countries of Continental Europe, almost entirely non-English speaking. In the Pennsylvania anthracite mines, 43% of the employees are English speaking, and this number is charged with only 28.8% of the fatalities; whereas the other 56% bore 71% of the fatalities. The comparative ratio is 669 to 1288 against the non-English speaking. In the Pennsylvania bituminous mines the ratio is 771 to 1123, and in the West Virginia district 790 to 1424.

Director Manning concludes his report with the statement: "Had the fatality and injury rate for the English-speaking American been maintained throughout the three groups, there would have been avoidance of 716 fatalities and 900 serious injuries, a strong argument for Americanization and education of the miner."

Income-Tax Returns in Alaska

The office of the Commissioner of Internal Revenue, Treasury Department, announces that because of the fact that it has been impossible to put into the hands of taxpayers residing in the Territory of Alaska the blank forms and instructions prescribed by the Treasury Department for the use of taxpayers in making returns pursuant to the new revenue act in time for such returns to be filed on or before the due date, Mar. 15, 1919, an extension of time to June 15, 1919, has been granted to all taxpayers living or residing temporarily in the Territory of Alaska. This extension should not be construed as extending the payment of the second installment due June 15, 1919, and subsequent installments. Two installments will be due June 15, 1919.

Decline in Steel Corporation Orders

Unfilled orders on the books of the United States Steel Corporation on Mar. 31 were 5,430,572 tons, compared with 6,010,787 tons on Feb. 28, a decline of 580,215 tons, according to *Iron Age*. This decrease compares with one of 673,481 tons in February, 694,884 tons in January, and 745,511 tons last December. This brings the decrease in orders in the last four months to 2,694,091 tons. The unfilled orders a year ago, Mar. 31, 1918, were 9,056,404 tons. The table below gives the unfilled tonnage for the Steel Corporation at the close of each month beginning with January, 1916:

UNFILLED ORDERS OF U. S. STEEL CORPORATION

	1919	1918	1917	1916
January	6,684,268	9,477,853	11,474,054	7,922,767
February	6,010,787	9,288,453	11,576,697	8,568,966
March	5,430,572	9,056,404	11,711,644	9,331,001
April		8,741,882	12,183,083	9,829,551
May		8,337,623	11,886,591	9,937,798
June		8,918,866	11,383,287	9,640,458
July		8,883,801	10,844,164	9,593,592
August		8,759,042	10,407,049	9,660,357
September		8,297,905	9,833,477	9,522,584
October		8,353,293	9,009,675	10,015,260
November		8,124,663	8,897,106	11,058,542
December		7,379,152	9,381,718	11,547,286

The largest total of unfilled orders was on Apr. 30, 1917, when it was 12,183,083 tons; the lowest was on Dec. 31, 1910, when the total was 2,605,747 tons.

The Interstate Commerce Commission has sustained the Du Pont Powder Co. in its claim that the rate on nitrating acid from a Colorado point to the Mississippi River is unreasonable. The case is based on shipments of nitrating acid aggregating 1,090,480 lb., which were shipped from Louviers, Colo., to the Du Pont plant at Hopewell, Virginia.

Germany's Sulphuric-Acid Supply

Washington Correspondence

During the war American chemists were puzzled as to the source of the enormous amount of sulphuric acid which the Germans were able to secure. Information is now in the hands of the Bureau of Mines showing that at no time during the war was there any particular stringency in Germany's supply of this acid. During the early months of the war, before conventions could be made with neutral countries, large shipments of pyrites were made to Germany. In fact, importation of pyrites into Germany continued in some volume throughout the war. The large reserve built up at the beginning of the war gave Germany time to find new resources of sulphuric acid. A noteworthy development of the Meggen pyrites deposits took place. Other pyrites beds were opened in Germany and Hungary, and a considerable amount of sulphur was obtained from Asia Minor.

In addition, Germany made important use of its rich beds of blende and galena. A method was evolved by which the lead dust, which had been a source of trouble in the contact process of manufacture, was eliminated. In addition, kaiserite and plaster of paris provided sources of sulphuric acid. Some sulphur was obtained by purifying gas at coke plants.

As a matter of fact, sulphuric acid was so plentiful in Germany toward the close of the war that restrictions on its use in industrial plants were rapidly being lifted.

Teaching Discharged Soldiers Mining

By Francis A. Thomson*

There is a school room on the 1400-ft. level of the Morning Mine of the Federal Mining and Smelting Co., at Mullan, Idaho, in which returned soldiers are being taught the art and practice of mining lead-zinc ore. This work, which has been initiated by the School of Mines of the University of Idaho, is, so far as is known, the first attempt to apply to actual, underground mining work the new system of vocational education provided for by the Smith-Hughes Act; and the experiment is being watched with interest by miners and mine operators alike throughout the Western states.

The school room is far underground, and it is devoid of blackboards, books, and benches. Pupils and teacher alike are dressed in overalls and mining boots, and the equipment consists of rock drills, driven by compressed air; drill steel, picks, shovels, timber, dynamite, caps and fuse, and all the paraphernalia needed for those who go down to the mine in skips.

The teacher is Lieut. Frank H. Skeels, officer of engineers of the U. S. Army, recently released from service for this work. Before going into the Army, Lieutenant Skeels was a mine manager, to which position he had risen after spending all his life since boyhood in and about the mines of the Cœur d'Alene district.

Admission to the school is obtained by application to the Federal Employment Agent at Wallace; and preference is given to returned soldiers who are young enough and bright enough to be teachable. The work in hand is drifting—driving a horizontal gallery or working lengthwise of the vein. The pupils operate the rock drills in turn, learning the intricacies of the "drift-round," studying the number of holes necessary to break out the predetermined section of rock, the angles at which they must be driven to make the greatest progress with the least amount of drilling, and the smallest possible supply of dynamite that will effectually do the work. In addition, the placement of timber to support a weak wall or a "slabby" roof, and all the various kinks of the underground trade are taught, and taught by making the student do them in actual workmanlike fashion to pass the scrutiny of a critical mine foreman and a lynx-eyed safety engineer.

Then there is the more prosaic work of "mucking," or shoveling, and of tramming the broken ore or waste to the shaft or dumping place. In addition to learning the trade of a skilled miner, the men who attend the school receive compensation for their time, because the school is carrying on drift work by contract, and payment is made per foot advance. Whatever is left over after paying for explosives and other supplies, is divided pro rata among the men, the salary of the instructor being paid jointly by the State of Idaho and the Federal Government.

Experienced miners and employers alike deplore the great decline that there has been in recent years in the skill of mine workmen; and it is the purpose of those concerned in the work that the establishment of this miners' trade school may prove a step toward the solution of this problem. Although at present there is a school in one mine only, it is expected that within the next month or two, schools will be organized at each of the other four or five big properties in the Cœur d'Alene district, from which Idaho supplies practically one-half of the lead production of the entire country.

In common with every other novel enterprise, the school has, of course, had to overcome much skepticism and passive opposition on the part of some of those who should be most concerned in its establishment, but this is gradually disappearing as the practicability of the plan is being demonstrated. In fairness it must be said that many of the most practical men have been in favor of the plan from the start. The applications for enrollment far exceed the capacity of the school as at present established.

The Tintic Mining District of Utah

Professional Paper 107, "Geology and Ore Deposits of the Tintic Mining District, Utah, by Waldemar Lindgren and G. F. Loughlin, With a Historical Review by V. C. Heikes," has recently been published by the U. S. Geological Survey. It describes in detail the geology of the district, the ore minerals, and the character and distribution of the ore deposits. The report discusses the relation of the ores to the geologic structure, outlines their probable mode of origin, and contains descriptions of each of the numerous mines in the district, geologic maps and sections, and, in addition, many illustrations.

A report on the Tintic district was published by the U. S. Geological Survey, Department of the Interior, in 1898, but copies of it are no longer available for distribution. The years that have elapsed since that report was published have recorded notable progress in geologic science, and though no new theories have been advanced or notable discoveries made during this time, there has been a steady improvement in both field and laboratory methods and a steady trend toward exactness in map delineation and quantitative accuracy in results.

---

*Dean, School of Mines, University of Idaho, Moscow, Idaho.

The recent report will be of interest not only to mining operators but to all students of stratigraphy, structure, petrology, and ore deposits. Copies may be obtained by application to the Director of the U. S. Geological Survey, Washington, D. C.

Exports of Mining Machinery

The exports of mining machinery from the United States during February, 1919, according to the figures of the U. S. Bureau of Foreign and Domestic Commerce, were as follows:

Countries	Oil-Well Machinery	All Other Mining Machinery
France.	$23,741	$43,512
Norway		18
Portugal		892
England.	2,933	110,347
Scotland		71
Ireland		407
Canada	2,743	101,767
Honduras	9	2,697
Nicaragua		1,139
Mexico	51,304	119,720
Trinidad and Tobago	12,234	321
Cuba	255	21,039
Dominion Republic	300	
Bolivia		45,434
Brazil		25,748
Chile.		263,061
Colombia		3,883
British Guiana.	200	
Peru	16,438	29,895
Uruguay		921
Chosen		584
British India	94,400	712
Straits Settlements.	32,634	5,557
Dutch East Indies.	111,444	4,233
French East Indies.	8,730	
Japan	13,181	18,965
Australia.		43,163
Philippine Islands	3,300	16,028
British South Africa		209,491
British East Africa		865
French Africa.	20,081	
Morocco	3,395	
Portuguese Africa		247
Egypt..	719	
Totals.	$398,041	$1,070,717

Geological Survey for Cuba

WASHINGTON CORRESPONDENCE

Cuba is about to establish a geological survey. General Agramonte, the Secretary of the Department of Agriculture, Commerce and Labor of Cuba, has asked Secretary Lane, of the Interior Department of the United States, to coöperate in the establishment of the new bureau. To that end George Reno is in Washington conferring with Secretary Lane and with George Otis Smith, the director of the Geological Survey.

The need for a geological survey in Cuba was called forcibly to the attention of officials of that government last year on the occasion of the visit of E. F. Burchard, of the U. S. Geological Survey, and of Albert Burch, of the U. S. Bureau of Mines. These specialists were in Cuba investigating deposits of chrome and manganese.

Disposition of Nitrate

WASHINGTON CORRESPONDENCE

Chilean nitrate to the extent of 151,000 tons is being distributed direct to farmers by the Department of Agriculture. It is being sold at cost under the authority of the Food-Control Act. The price being charged is $81 a ton. Had the farmers purchased in the open market the department estimates that the same amount of nitrate would have cost $1,500,000 more than the total the department is receiving.

Government Reconstruction Information

The U. S. Council of National Defence announces its readiness to place at the command of the business world the information contained in the voluminous collection of data brought together by its reconstruction research division. It also offers the services of this division in the procurement of such further special information as may be desired and which may aid in the reorganization of industry and the resumption of trade, or in any other manner promote progress in reconstruction. Requests should be addressed to the Reconstruction Research Division, Council of National Defence, 18th and D Sts., N. W., Washington, D. C.

Data on the Installation of Induction Motors*

The National Electrical Code does not specify the size of wire which should be used to connect up any given motor, nor does it give the sizes of the starting and running fuses to be used. A committee of the Western Association of Electrical Inspectors therefore compiled tables based on the code rules which give this much-needed wiring information for single-phase, two-phase and three-phase motors. Excerpts from the report and the recommendations for three-phase motors follow:

AMPERAGE FOR SQUIRREL-CAGE THREE-PHASE INDUCTION MOTORS EQUIPPED WITH COMPENSATORS

Average Hp.	Full-Load 220 Volts	Amp. 550 Volts	Starting Fuse Amp. 220 Volts	Starting Fuse Amp. 550 Volts	Running Fuse Amp. 220 Volts	Running Fuse Amp. 550 Volts
0.5	1.8	0.7	5	5	5	5
1	3.5	1.3	10	5	5	5
2	6.5	2.6	20	10	10	5
3	9.5	3.8	30	10	15	5
5	15.4	6.2	40	15	20	10
7.5	22.4	9	60	25	25	15
10	29	11.8	70	30	35	15
15	42.5	17.4	85	40	45	20
20	55	22.5	110	55	60	25
25	68	27	140	65	75	30
30	80	32	160	70	90	35
35	94	37	190	75	110	40
40	105	42	210	85	115	45
50	130	52	260	110	145	60
60	155	62	310	125	170	70
75	192	77	390	160	210	85
100	252	101	500	200	280	110
150	368	148	730	300	410	160
200	484	195	920	390	530	215
250	595	240	1200	480	650	265
300	710	285	1420	570	780	315

No consideration was given to limiting the voltage drop at the motor. Motors without a starting device and those operating at less than 600 r.p.m. require, in the majority of cases, one size larger wire or cable than the table calls for. The wires in the table are calculated for two and one-half times the full load current of motors up to 30-amp. rating and for twice the full-load current of larger motors.

Wire or cable sizes for other types of continuous-duty induction motors should be based on the following multiples of the full-load current: Squirrel-cage motors up to 7.5 hp. without starters, three times full-load current; squirrel-cage motors with star-delta starting switch, one and one-half times full-load current; wound-rotor motors with resistance in rotor, one and one-tenth times full-load current, and single-phase repulsion motors up to 15 hp., twice, and single-phase motors with split-phase starting, three times full-load current.

"The Power a Man Puts Into Saving measures the power of the man in everything he undertakes."—(Frank A. Vanderlip.) Buy Victory Notes.

---

*Reprinted from *Electrical World*.

Editorials

To Every EMPLOYER and Every EMPLOYEE Everywhere

THE heroic dead have a message for all of us when they tell us that we must "keep faith with those who sleep in Flanders' Fields."

HOW CAN WE KEEP THE FAITH?

By oversubscribing the Victory Loan.

By doing justice to every worker and by meeting, with patience and in a spirit of compromise, the troublesome industrial problems ahead.

By rendering a fair day's work for a fair day's pay!

By insisting that the way of sound progress is by evolution, not revolution.

By making, each in his particular job, whatever sacrifices are necessary to bring about that reign of justice for which our sons and brothers suffered and laid down their lives.

They died that we might live in peace and happiness. Shall we cast away their blood and scoff their death by strife and disorder and injustice?

Trust Legislation

THE Chamber of Commerce of the United States has taken a referendum vote of the business interests of the country represented in trade and commercial organizations, the result of which is a recommendation that Congress give early reconsideration to all anti-trust legislation. The chamber further asks that standards of general business conduct be formulated, and that this matter be administered by an enlarged Federal Trade Commission acting as an advisory body.

In the spring of 1917 the organizations in the membership of the Chamber of Commerce of the United States voted that there should be remedial legislation to permit coöperative agreements, under Federal supervision, in industries which involve primary natural resources, on condition that the agreements should tend to conserve resources, to lessen accidents, and to promote the public interests. The resources in question were timber, the ores and deposits of useful metals, and deposits of minerals which are sources of heat, light, and power.

Anti-trust legislation will be one of the chief subjects of discussion at the seventh annual meeting of the chamber, to be held in St. Louis from Apr. 28 to May 1. At this meeting it is proposed, in view of the experience of the last few years, to urge that these principles be given even wider application, to include the conservation of all economic resources. The prevention of waste in industrial and commercial activities—waste of labor, waste of executive direction as well as waste of material—must all be avoided in the public interest.

The mineral and metal industries may be vitally interested in any new legislation having to do with conservation, and it is hoped that at the coming discussion these interests will be capably represented.

Protection for the Small Shipper

AMONG the smelters and purchasers of ore the small shipper is not infrequently regarded as a chronic kicker and the cause of constant irritation, and the same small shipper often regards the plutocrats who purchase his ores as unjailed robbers who lack conscience or common honesty. There is sometimes enough reason for complaint on either side to cause state authorities to investigate and look for remedies that may tend to protect the small operator and encourage him to become an important producer and a real asset to the community.

The State of Nevada has taken cognizance of this condition, and has attempted, in a practical way, to assist the miner; if not to remove the cause of complaint, at least to determine to the satisfaction of shipper and purchaser whether any real cause for complaint exists. In 1917, Governor Boyle of Nevada appointed a State Assayer and Inspector, whose duty is, at the request of the ore seller, to be present in person or by deputy at the sampling of ore shipments produced at some point within the state and purchased within the state. It is also his duty to take duplicate samples for moisture and for assay and to check the purchaser's weight. In other words, he is the representative of the seller, and furnishes him with an accurate analysis of his ore at approximately the same cost as charged by the independent sampler or purchaser.

A report of the State Assayer and Inspector has recently been issued setting forth the results of 16 months' operation of the law. It is interesting to note the percentage of producers that took advantage of the state's liberality. The number of shippers within the state is not definitely known. The State Assayer has the names of 761 operators who have been more or less active since the law went into effect. Purchasers within the state report having received ore from about 280 Nevada operators. Of this number 75 made requests for the service of the State Assayer and Inspector.

Apparently it was only the small shippers, those whom the law was particularly designed to benefit, that availed themselves of the opportunity to obtain the services of the State Assayer. Though about 27% of the total number of shippers had their samples supervised by the state official, their ore amounted to only approximately 1% of the total ore purchased in 12 months in the state. In other words, it is evident that the large shippers, those making shipments of more than one car during the year, either employ their own representative or are entirely willing to trust the sampling of the purchasing agents.

The direct cost to the state for this work was 72c. per ton of ore sampled, $20.12 per lot sampled, or $50.85 per person benefited. As a direct cost, this is a high price per unit for the state to assume and does not appear to be good business.

The most important element entering into the consideration of the undertaking as a business venture for the state, however, is omitted from this report: namely, in how many of the 189 shipments did the State Assayer fail to make a substantial check against the purchaser? This is the important point that should determine the life and usefulness of the law, and the point concerning which officials of other states would like to be informed.

Has the small shipper been justified in his complaints, or were they groundless? Is the state protecting the small shipper against a real or an imaginary wrong? Will the maintenance of this law result in any real increase in the production of ores from the state?

It is not the protection of the owners of 99% of the tonnage sold that interests the State of Nevada, because those owners can, or evidently think they can, look after themselves. But the correction of one important error in one small shipment of the other 1% may be worth to the state many times the cost.

It is to be hoped that the good work started in Nevada may be continued until the foregoing questions can be definitely resolved.

Teaching Mining in Mines

OPERATING mines possess exceptional facilities for providing vocational training along practical lines; and men who have been honorably discharged from the Army or Navy are taking full advantage of the opportunities afforded by the experiment which was recently instituted at Mullan, Idaho, and is described in detail in another part of this issue. A feature of the innovation is that the men earn while learning, and the cost to the company, per foot of work done, will be no more than if it were carried out by its own employees.

Miners who have been trained under such a practical system must inevitably become more efficient underground than their less fortunate fellow workmen. The ultimate results of such a practical training promise to be of benefit alike to employer and employee, and at the same time will go far toward a solution of one phase of the unemployment problem. The plan to allow the men to share the surplus of money earned for the work accomplished, after the cost of supplies has been met, is a sensible scheme. It will create a new interest in the work, providing an immediate and tangible reward for diligence and application.

No better plan could have been devised to demonstrate to the miners of the future the advantages of efficiency and system. On the other hand, the provision of a competence for these men may be considered as a part payment, small though it be, of an obligation that must be recognized.

Aërial Transportation

RECENT years have been more fruitful of change and invention than any other period of the world's history. This being so, one must avoid any air of finality in nomenclature and word definitions, so that progress and advancement may be anticipated. The startling results of intensive research have brought many seemingly impossible feats into the realm of everyday happenings. Only a few years ago, comparatively speaking, the phrase ". . . no more possible than to fly in the air" was common. Today it would sound paradoxical, because of progress and advancement. And so it is that nomenclature needs constant revision to insure clarity, orderly ideas, and logical classification.

Those who attended the recent meeting of the American Institute of Mining and Metallurgical Engineers in New York had this fact brought home to them forcibly. A number of members are interested in mining in South America, and many anticipated with interest the paper by George M. Dyott on "Aërial Transport in Mining Districts." The difficulty of getting material over mountain trails and across undeveloped and undrained country is appreciated by many engineers, and a number of types of so-called aërial tramways and ropeways have been designed and put into operation for carrying passengers, stores, and ore.

It was doubtless a surprise to some when they turned to Mr. Dyott's paper to find that it dealt with a comparatively new phase of the subject—real aërial transportation; not the pseudo-aërial transportation to which we usually have been accustomed. The paper discussed types and varieties of airplanes and heavier-than-air craft of the Zeppelin class, developments in the design of the various machines during the last few years, atmospheric conditions, altitude, landing places, motors, and cost.

It must be admitted that the author had chosen a correct title for his paper, and we must realize that henceforth the word aërial must be eliminated from use in connection with cableways, ropeways, and the like. In many types of rope transportation the method adopted is no more aërial than is an ordinary railway. In some of the South African diamond mines the "aërial" tramway runs on two wire-rope "rails," so that there is no justification for the use of a word which implies complete disconnection with the earth, or the distinction inferred between such a system and haulage through an ordinary inclined mine shaft.

Real aërial transport has arrived. Its application to ordinary industrial conditions will probably revolutionize mining in isolated mountainous districts; and, from now on, rope or cable tramways and monorail systems should be designated by their logical appellations in order to facilitate proper classification and indexing, and to prevent misunderstanding and confusion.

Proper Drilling Methods

MINE operators have concerned themselves not a little with investigations and experiments to determine the best methods and equipment necessary to efficient drilling, and this practice has been supplemented in a great measure by similar work of the various manufacturers of drilling equipment. As a matter of fact, the latter are the pioneers in this work, and it is due to their activities that power drilling has reached the high standard that it maintains today. Among the several points, or parts, that are necessary in the consideration of a successful equipment, may be included the drill steel.

The specifications or physical requirements to which the steel must conform are well established; size is a matter of choice or adaptation to the machine, and, assuming that similar rock conditions prevail, it may be expected that a certain uniformity of results may be obtained in drilling operations. But this condition does not always exist, and an excellent reason for the variation is brought out in the article, appearing in this issue, "The Blow of the Drill Bit, Sharp or Dull," in which the author emphasizes and explains the cutting action of dull and sharp steel and the relation that exists between the actual blow delivery on the steel, as communicated to the rock being drilled and to the drill steel itself. The conclusions reached in the article bear out practice and theory alike, and Mr. Richards' paper constitutes a valuable contribution to the literature already published on the subject of rock drilling.

Another point that is well brought out is the tendency on the part of operators to criticize machines which fail to produce certain results, when in reality the fault does not lie in the machine itself or in any of its appurtenances, but rather in the operation thereof. Machines, after all, are not infallible, and their successful working is subject to certain conditions, the limits of which are increased by proper manipulation.

Results in drill work can best be furthered by providing a continuous supply of sharp bits. The power-drill sharpener needs no further recommendation.

The Labor Covenant

THE labor covenant which is advanced as a part of the proposed League of Nations contains among its provisions the following interesting and important points:

> That eight hours be the maximum working day for labor.
>
> That human labor must not be considered or treated as a commodity.
>
> That all countries compel the payment of wages adequate for the proper support of human life.
>
> That the principle of equal pay for men and women for equal work performed be recognized and established.
>
> That child labor everywhere be prohibited.

These simple proposals are eminently fair and will appeal to the sense of justice of every thinking individual. Incorporated in an international agreement they should go far toward equalizing labor conditions in the industrial nations of the world. In the keen international competition that will follow the settlement of peace, it is obvious that, unless the game is played in accordance with fixed principles of a code which is commonly accepted by competing nations, injustice will be done to the wage earners of the weaker nations. There will also be the temptation to exploit labor. The proposals cannot be expected to cover the entire situation, but they are in themselves an excellent start.

Our Sydney correspondent, in another place in this issue, advocates a systematic stock-taking of abandoned prospects with the object in view of rehabilitating the declining mining industry of Australia. By the use of mine inspectors' and geologists' records it is proposed to select the most promising of these prospects and concentrate work upon them through the agency of private capital. It is worthy of note that a similar plan, without, however, any great assistance from official records, has been in operation for some years in Western mining states. Not only have the fringes of well-known mining districts been combed over by the agents of mining companies for the purpose of finding mines, but the possibilities of abandoned districts as well have been investigated. Old flooded shafts have been unwatered and workings penetrated by examining parties. In Nevada, the later developments upon the Comstock and at Aurora, Tuscarora, Belmont, Silver Peak, and Candalaria are excellent examples of the painstaking work that has taken and is taking place. Other examples in California, Colorado, Utah. Idaho, and Montana might be named. The discovery of manganese ores in the Phillipsburg district and at Butte, Mont.; the oxidized zinc ores of the Leadville district, and the later discovery of tungsten ores in association with well-known gold deposits are proofs that the older districts have not been entirely exhausted and often repay close scrutiny by experienced men. Though a considerable proportion of such enterprises prove unprofitable, enough are successful to constitute an incentive to continue and expand the work.

BY THE WAY

"The chief hotel in Virginia City," wrote J. Ross Browne in 1861, "was called the 'Indication' or the 'Hotel de Haystack' or some such euphonious name. It professed to accommodate 300 live men, and it doubtless did so, for the floors were covered from the attic to the solid earth—300 human beings in a tinder box not bigger than a first-class hencoop! But they were sorry-looking sleepers as they came forth each morning, swearing at the evil genius who had directed them to this miserable spot—each man a dollar and a pound of flesh poorer. I saw some, perhaps, who were short of means, take surreptitious naps against the posts and walls in the barroom, while they ostensibly professed to be mere spectators."

"Dos't thee naw, m'son," said Cap'n Dick, "that tha copper situation is h'alarmin'? 'Ere we are with a bloody gert h'accumulation on 'and an', dam-me, there be no one 'oo seems to naw w'ot's to do with un. On h'other side, the fitin' is h'over; they're talkin' o' stabilizin', an' standardizin', an' settlin' daown an' a 'underd things moor. An' meantime, over 'ere, we're pilin' h'up these 'ere surpluses o' copper. I h'always 'as claimed that ut's a h'ill wind that blaws nobody good luck, an', dam-me, it 'as h'ccurred to me that this 'ere pro'ibition may h'offer some solution. So 'ere, m'son, w'ot's to stop these 'ere surpluses o' copper from bein' bought h'up an' used for to make stills? W'y, m'son, tha possibilities be tremendus. May be like tha chap 'oose blanket was too small, so 'e cut piece h'off tha top an' sewed un on tha bottom to make un longer. But thee mus' h'admit, m'son, there is grave need to do sumthin'."

"I told a story the other day," says the Old Timer in the *Salt Lake Mining Review*, "and it caused one of the listeners to ask what kind of company I kept in my younger days. And that reminds me that in mining a man rubs elbows with all descriptions of men, and he must know how to treat them all. There was a case in point several years ago—and it also happened in Bingham. I was working in the old West Mountain placers there, and one day we ran across an enormous boulder which had to be broken before being taken to the top. Shooting was out of the question, because of the loose ground; and we all took a chance at it with a big rock hammer. But it was a tough one, and we scarcely dented it. Finally a big Italian happened along. He grabbed the hammer and made the big rock into little ones with neatness and dispatch. 'Pete,' said the foreman, 'that was a good job. Where did your learn how?' And Pete answered with apparent pride: 'I learna him in the Utah penitentiary.'"

Personals

Bennett R. Bates is now with the Dorr Co. at Denver, Colo.

George B. Holderer recently returned to New York from an extensive trip through Mexico.

J. B. Tyrrell was recently elected member of Council of the Institute of Mining and Metallurgy.

Robert Bryce, of Toronto, was recently elected a councilor of the Canadian Mining Institute.

James L. Bruce, manager of the Butte and Superior Mining Co., was in Washington on business recently.

R. S. Ellison, governor of the Colorado Chapter of the American Mining Congress, is spending several weeks in the East.

P. K. Lucke, consulting mining engineer, has changed his address to the following: Avenida Isabel La Catolica Num. 25, Mexico City.

L. D. Davenport, chief mining engineer for the Oliver Iron Mining Co. in the Hibbing district, has returned from a pleasure trip in California.

D. L. Vivian has resigned as superintendent of stamp mills at Gay for the Wolverine and Mohawk mining companies after 15 years' service.

Ralph Benedict, formerly with the Sullivan Machinery Co. at Spokane, Wash., and more recently with the 27th Engineers, has returned to civilian life.

T. J. Flynn, superintendent of Matachewan gold mines, was in New York for some time and has again returned to the property, where work has been resumed.

J. G. Graham, Butte manager for Sullivan Machinery Co., recently underwent an operation for appendicitis, and it is expected will be in the hospital for several weeks.

Richard O. Hocking and **Jacob A. Stampe**, of Hibbing, and **Clifford Nichols**, of Buhl, have returned to their homes after 16 months' service with the 27th Engineers.

Joseph Satterley, who drew the plans for the Ahmeek stamp mill and has been its superintendent from the day it went into operation, has resigned, to take effect May 1.

W. J. Hamilton, consulting engineer of the Cerro de Pasco Copper Co.; **J. M. Boutwell**, consulting geologist, and **C. V. Drew** have sailed from New York en route for Lima on the "Orlana."

J. E. Hodge, member of the firm of E. J. Longyear Co., accompanied by **Mr. Cooper**, also of that company, spent several days in the Birmingham district during the first week of April inspecting the work at Woodward Iron Co.'s shaft No. 4.

H. C. Carlisle, of the Mandy mine in The Pas district, Manitoba, is leaving for France to study the reconstruction problems of the devastated battlefields. The Mandy will shut down operations pending the construction of a railroad to The Pas.

H. E. T. Haultain, professor of mining in the University of Toronto, is in charge of the Vocational Training branch of the Department of Soldiers' Civil Re-establishment, and the whole department is in charge of **W. E. Segsworth**, a mining engineer of Toronto.

John T. Reeder, **James MacNaughton** and **R. L. Agassiz** were elected directors of the Mineral Range Ry. at the annual meeting. James MacNaughton was elected to the directorate of the Duluth, South Shore & Atlantic. The Mineral Range is a subsidiary of the South Shore, serving copper mines only.

Courtenay DeKalb was in Washington recently for several days prior to leaving for Spain, where he has been appointed by the Department of Commerce to investigate the mining and metallurgical resources of that country.

D. H. McDougall, president of the Nova Scotia Steel and Iron Co., will represent the Canadian Mining Institute at the annual meeting of Mining Society of Nova Scotia. Mr. McDougall has also been suggested to act as the representative of the mining industry on the Industrial Commission, provided such a representative is permitted by the dominion government.

Capt. W. J. Rose and **Lieut. H. Warlow Davies**, who before the war were Australian mining engineers, have been in Butte recently on leave of absence and inspected mining properties in the district for the purpose of obtaining information as to the treatment of lead and zinc ores. They have already visited plants in New Jersey, Missouri, Utah and Idaho, and left Butte to visit Trail, B. C. They will sail for Australia from Vancouver.

Albert D. Brokaw, formerly in charge of economic geology at the University of Chicago, petroleum expert for the U. S. Shipping Board and temporarily in the service of the mining and oil section of the Internal Revenue Bureau; **A. Faison Dixon**, for three years geologist for Tata Sons & Co. in India and Burma, and engaged in exploration and development of oil properties in Latin America for the last six years; **L. G. Donnelly**, formerly chief geologist for the Sinclair Gulf Oil Co., and until recently collaborating in the estimation of oil and gas reserves for the Internal Revenue Bureau; **A. H. Garner**, formerly geologist and field manager for the General Asphalt Co., and engaged in geological exploration and development work in South America for the last six years; and **H. Harler McKee**, who spent three years in Venezuela as geologist for the Caribbean Petroleum Co., and for the last four years has been making geological examinations in Kentucky, Oklahoma, North Texas and Louisiana for Cosden & Co., Sinclair Gulf Oil Co. and others, have announced the formation of a partnership under the name of Brokaw, Dixon, Donnelly, Garner & McKee, geologists, petroleum engineers, 120 Broadway, New York.

Obituary

Julian T. Dixon, aged 50 years, died Apr. 10 at his home, 715 South 33d St., Birmingham, Ala. He was paymaster for the Republic Iron and Steel Co. at the time of his death, having been with the company for about 19 years.

Michael Meehan, a Cobalt pioneer, died at Sudbury, Ontario, on Apr. 5, of an affection of the liver, aged 48 years. He came to Sudbury district in 1889, and was for a number of years engaged in railway construction. In 1906, in partnership with P. J. Green, of Sudbury, he went prospecting and discovered the Green-Meehan mine. He leaves a widow and four children.

Albert Smith, a mining engineer, who made a survey of the mineral resources of Porto Rico in 1916 for American capitalists, and previously had been engaged in extensive exploratory work in the Andean regions of South America, died in New York on Apr. 18 at the age of 76 years. He was born in Illinois and had been a personal friend of Abraham Lincoln for many years. He established himself in New York 40 years ago. He is survived by his widow, "May Riley," a poetess of note.

George Ferdinand Becker, a prominent geologist, who had been connected with the U. S. Geological Survey for the last 40 years, died on Apr. 21 in Washington, D. C., at the age of 72 years. Dr. Becker was born in New York in 1847 and was graduated from Harvard in 1868. He then spent the following year at Heidelberg. In 1871 he passed the final examinations at the Royal School of Mines in Berlin. From 1875 to 1879 he was instructor of mining and metallurgy at the University of California. He examined the gold and diamond fields of South Africa in 1896, and was detailed as geologist with the army in the Philippines during 1898 and 1899. At the time of his death he was in charge of the division of chemical and physical research of the Geological Survey. Among the various organizations of which Dr. Becker was a member are the American Institute of Mining and Metallurgical Engineers and the Geological Society of America.

Edward Leonce Dufourcq, prominent as a mining engineer and actively engaged in the development of mining properties in South and Central America, Mexico and the United States, was murdered recently by Mexican bandits. He had been connected with the Teziutlan Copper Co., New York, for the last two years, as assistant general manager at Teziutlan, State of Puebla. The details of the murder were given out by the company officials to the effect that Mr. Dufourcq, accompanied by a Swiss engineer named Orme Gaismann, set out from Teziutlan on the company's railroad line on Apr. 15 for the purpose of testing a new railway gasoline-driven motor car, and were attacked about four miles from the mine by a band of Mexican outlaws. Dufourcq's injuries later caused his death, he being discovered dead with his unconscious companion by employees of the company the following day. Mr. Dufourcq was born in New York City, Apr. 6, 1870, and was graduated from Columbia University. In 1898 he joined the firm of Olcott, Fearn & Peele, consulting engineers, in New York. In 1901 he became manager of the Andes Mining Co., Chimbote, Peru, and later was superintendent of the Montezuma Lead Co., Santa Barbara, Mexico. He had been a member of the American Institute of Mining and Metallurgical Engineers since 1909. He is survived by his widow and a daughter by a former marriage.

Societies

Mining and Metallurgical Society of America, New York Section, will hold a meeting on Apr. 30 at the Columbia University Club. The subject for discussion will be "Some Economic Aspects of the Labor Situation."

Joint Meeting of Engineers was held in Seattle on Mar. 27 to hear Calvin W. Rice discuss the problems which engineers face along organization lines. The four national, engineering societies were represented as well as the American Chemical Society, the Pacific Northwest Society of Engineers, and the Associated Engineering Societies of Seattle. About 65 members of these organizations were present.

American Institute of Electrical Engineers and **Colorado Association of Members American Society of Civil Engineers** held a joint meeting on Apr. 9 at the Denver Athletic Club in honor of Lieut.-Col. H. S. Crocker. After the usual dinner, Colonel Crocker addressed the meeting on the construction of the Army supply base at Brooklyn, N. Y., one of the largest engineering projects of the U. S. Army.

Iron and Steel Institute, London, S. W., will hold the annual meeting on May 8 and 9. Papers on the following subjects will be included among the many to be presented: "Modern Steel Metallurgy," by C. H. F. Bagley; "Estimation of Phosphorus in the Presence of Tungsten," by G. Watson Gray; "Report on the Condition of Belgian Iron and Steel Work After German Occupation," by L. Greiner; "Use of Powdered Coal" by L. C. Harvey; "A Review of the Work of the United States National Research Council," by H. M. Howe.

Engineers' Society of Western Pennsylvania held a meeting on Apr. 12, when Lieutenant Commander George T. Ladd made an address on the "History and Description of 14-in. Naval Railway Battery and 7-in. Caterpillar Tractor Mounts." On Apr. 15 a meeting was held and a paper on "Gas Warfare at the Front," by Lieut. Col. B. C. Goss, was presented.

Industrial News

Charles Hardy, Inc., announces the removal of the company office on May 1 to the Park Row Bldg., New York.

McGraw-Hill Company, Inc., has established an office in Buenos Aires, Argentina, at Calle Corrientes, 685. Colonel Duncan N. Hood is in charge.

Mark R. Lamb's Paris office has secured an order for two 6-ft. Hardinge Conical Mills to complete the fine-grinding flotation plant of the Peñarroya Co. in Spain.

E. I. du Pont de Nemours & Co. announce that, effective Apr. 1, T. E. Doremus has been transferred to the E. I. du Pont de Nemours export company as general eastern manager, with headquarters in Shanghai, China.

Chicago Pneumatic Tool Co. announces that T. J. Hudson has been appointed acting manager of the pneumatic tool sales division, effective Apr. 15, succeeding F. H. Waldron, who returns to Minneapolis, Minn., as district manager of sales.

Bailey Meter Co., Cleveland, Ohio, announces the removal of its main office and works from Boston to Cleveland, Ohio, effective May 1. The Boston office, with H. D. Fisher as manager, is retained to handle sales and engineering service work in the New England district. For the present, New York and Philadelphia districts will be covered from Boston and all other districts will be covered from Cleveland.

S. K. F. Industries, Inc., will be the name of a new company formed by the combination, effective May 1, of the Hess-Bright Manufacturing Co., the S K F Ball Bearing Co., the Atlas Ball Co. and the Hubbard Machine Co. The new company will offer a comprehensive line of ball bearings, including the Hess-Bright deep-groove type, S K F self-aligning radial and thrust bearings, and ball-bearing pillow-blocks and shafting hangers.

The Marathon Mill and Machinery Works, First National Bank Bldg., Chicago, is a new company that has been organized to take over the Marathon mill and other equipment formerly manufactured and sold by the Johnson Engineering Works. The Marathon mill business, having grown to such large proportions, will be conducted by the new company, which will devote its entire attention to Marathon products. The Johnson Engineering Works will develop other inventions now being perfected.

Merrill Metallurgical Co., engineers, of San Francisco, announce change in name to The Merrill Co. The expansion of the business and professional work, owing to the increased use of its apparatus and processes and the acquisition of other processes, products, agencies and devices, has necessitated the enlargement of its staff and facilities and made advisable the incorporation of the company. The Merrill Co. takes over the patents and commercial business of its predecessor and will continue to enlarge its scope as new devices and products become available. Charles W. Merrill is president.

Trade Catalogs

Local Battery Telephones. Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Bull. 1024; 8 x 10; 24 pp.; illustrated. Descriptive of various types of telephones and fittings. Contains data on shipping weights, code and piece numbers, and dimensions.

Pyrometers. The Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia. Bulletin 867-B.; 8 x 10½; 24 pp.; illustrated. The pamphlet discusses the importance of maintaining standards and of checking in pyrometry. It points out sources of error and the remedies for troubles in thermocouples, millivoltmeters, cold junctions and potentiometers, and outlines a commercial checking laboratory, including a special checking furnace, precision potentiometers and standardized thermocouples.

Circuit Breakers. The Automatic Reclosing Circuit Breaker Co., Columbus, Ohio. Bulletin 301; 8½ x 11; 4 pp.; illustrated. Describes a circuit breaker which opens automatically in case of overload or voltage failure, remains open a definite time interval, regardless of cause of opening, and makes no attempt to reclose if a short circuit exists, but closes instantly upon removal of short circuit or overload. The theory of operation, adjustments and application of the device to various uses are included.

Steam Jet Air Pump. Wheeler Condenser and Engineering Co., Carteret, N. J. Bulletin 113; 8 x 10½; 8 pp.; illustrated. Descriptive of the Wheeler steam jet air pump being manufactured under exclusive rights granted by the Schutte & Koerting Co., of Philadelphia. The patent covers the valuable feature of two or more steam jets working in series with a condenser between the jets, permitting thereby the attainment of a higher efficiency. A description of surface condensers, jet condensers, barometric condensers, vacuum pans and evaporating apparatus is also included.

Electrical Supplies. Westinghouse Electric and Manufacturing Co., of East Pittsburgh. Annual catalog; 1264 pp.; illustrated. Descriptive of all electrical supplies sold by the company. Every effort was made to arrange data for the convenience of the customer. A score of pages are devoted to a cross index, index to style numbers and a table of "approximate cost multipliers," which latter feature is for the purpose of figuring the approximate cost of all supplies listed. A great amount of information of a technical and engineering nature is given, and practical suggestions are included for the use of many kinds of apparatus for the transmission and utilization of electric power.

New Patents

United States patent specifications may be optained from "The Engineering and Mining Journal" at 25c. each.

Annealing Furnace. Victor E. Lane, Detroit, Mich. (U. S. No. 1,292,617; Jan. 28, 1919.)

Breast Car for Mines. Rasmus Christiansen, Black Diamond, Wash. (U. S. No. 1,294,619; Feb. 18, 1919.)

Concentrator and Amalgamator. Erastus B. Bennett, Denver, Colo. (U. S. No. 1,292,-684; Jan. 28, 1919.)

Dump Car. Jay B. Rhodes, Kalamazoo, Mich., assignor to Western Wheeled Scraper Co., Aurora, Ill. (U. S. No. 1,294,832; Feb. 18, 1919.)

Electric-Arc Furnace. Ivar Rennerfelt, Djursholm, Sweden. (U. S. No. 1,294,830; Feb. 18, 1919.)

Electric Furnace. Frederick von Schlegell, Evanston, Ill., and Charles B. Fletcher, Indianapolis, Ind. (U. S. No. 1,294,837; Feb. 18, 1919.)

Gravity-Concentrator. John Becott, Durango, Colo. (U. S. No. 1,294,603; Feb. 18, 1919.)

Iron, Preparation of Pure. Reinhold K. Muench, Goldfield, Colo. (U. S. No. 1,292,-630; Jan. 28, 1919.)

Magnetic Separation. Apparatus for Treating Ores Preparatory to Magnetic Separation. Robert W. Erwin, Waukon, Iowa, assignor, by mesne assignments, to Mississippi Valley Iron Co., Wilmington, Del. (U. S. No. 1,295,719; Feb. 25, 1919.)

Metal Dust. Apparatus for Manufacturing. Minton H. Newell, San Francisco, Calif., assignor to the Alloys Co., San Francisco, Calif. (U. S. No. 1,295,573; Feb. 25, 1919.)

Muffle Furnace. Carl T. Torsell, Warren, Ohio. (U. S. No. 1,295,637; Feb. 25, 1919.)

Nitrogen—Process for Obtaining Nitrogen from Air. Nobile Carlo Tommasi, Basel, Switzerland, assignor to Usines Electriques de la Lonza, Gampel, Switzerland. (U. S. No. 1,295,635; Feb. 25, 1919.)

Ocher. Method of Making Paint Bodies. Edwin T. Goldthorpe, Chicago, Ill., assignor of three-eighths to Fred Von Essen and three-eighths to William H. Dicks, Chicago, Ill. (U. S. No. 1,295,730; Feb. 25, 1919.)

Ore-Treating Apparatus. Thomas J. Pennington, Naugatuck, Conn. (U. S. No. 1,294,531; Feb. 18, 1919.)

Pyrometer. George F. Machlet, Elizabeth, N. J. (U. S. No. 1,294,688; Feb. 18, 1919.)

Rotary Amalgamator. Joseph Garside, Brawley, Calif. (U. S. No. 1,292,753; Jan. 28, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Apr. 19

Argonaut Mine was reopened after recent fire on the 39 level for inspection on Apr. 12, and no sign of fire was discovered. A small fire revived above the 39 level on the night of Apr. 12, and bulkheading was necessary at the 33 level. No damage was done to the electrical equipment, and the water was soon under control. One million cubic feet of carbon dioxide was used. Normal operations are expected to be resumed soon.

Mill Shipments From Comstock Northend Mines in the second half of March totaled 1164 tons, of a total value of $24,877. The entire tonnage was from the Ophir and Consolidated Virginia. In the week ended Mar. 22 Ophir shipped 291 tons and Consolidated Virginia 229 tons, having a total value of $10,410. In the week ended Mar. 29 Ophir shipped 340 tons and Consolidated Virginia 304 tons, having a total value of $14,467. The average of ore from Ophir ran from $17.91 to $25.75 per ton and from Consolidated Virginia the average was from $18.79 to $22.70 per ton. Ophir produced ore in the second week running as high as $35 and $53 per ton. These higher grades of ore came from the 1900 level. Consolidated Virginia extracted ore from the 2150 level running as high as $24. The Mexican mill ran 87% of the time in the first week and 90% of the time in the second week and shipped 11 bars of bullion, valued at $26,000, to the Carson mint.

DENVER, COLO.—Apr. 20

The Leadville Labor Situation is rather complex. Owing to the drop in metal prices, the mine owners say they are unable to pay $4.50 per day and operate at a profit. They are offering $3.75, but this is declined by the men, who claim they cannot live on that wage, and the owners admit there is much truth in this argument. Therefore, without some change in the situation, the Leadville properties must close down. There is an absence of bitterness, as the companies have made a frank declaration and the men understand the conditions. It has been suggested that the employers, in order to establish their position, turn the mines over to the men to operate, which would be an interesting experiment and probably would remove all doubts as to the prospect of profit under the high scale of wages under which these properties have been operatiing. The employers declare that if it were not for the fact that a great many of their workers have their homes in the vicinity of Leadville, they would advise them to seek employment in mining districts where a $4.50 wage is paid.

WALLACE, IDAHO—Apr. 19

State Bureau of Mines and Geology was created at the last session of the Idaho Legislature, with an appropriation of $15,-000 for its maintenance for the years 1918-19. The bureau will be under the supervision of a board composed of the Governor, Inspector of Mines, Dean of the School of Mines, head of department of geology of the School of Mines and president of the Idaho Mining Association. The board met at Boise on Apr. 6 to effect organization. The work of the bureau will be largely in coöperation with the U. S. Bureau of Mines, and the Federal Government will appropriate an amount equal to that provided by the state, and will publish bulletins from time to time giving the result of mineral and geological investigations and research work.

SALT LAKE CITY, UTAH—Apr. 17

The Utah Copper Co.—charging illegal assessment and collection of taxes against Salt Lake County—has filed suit to recover $158,520, alleging that the company under protest had paid a tax of $79,804 and in 1918 a tax of $78,625 on mill tailings from the Garfield plants of the company and calling into question the right of the county assessor to levy the tax. Damages of $3000 are asked on each of the tax collections mentioned, all costs of litigation, and interest at the rate of 8 per cent.

Utah Chapter of the American Mining Congress is interesting itself in the plan of Senator King, of this state, to obtain, if possible, national legislation whereby locators of mining claims will be permitted to obtain patents locally—the state district court in the district where the land is situated conducting examinations as to patent—without reference to Washington. At a meeting called by invitations sent out by the chapter, and held on the evening of Apr. 15, Senator King outlined his proposition, which met the approval of those attending. The plan is considered to be advantageous in that it offers a saving in formalities and in red tape. Also, those nearer at hand will naturally be better informed as to conditions obtaining on the ground in question.

Change in Leasing System of mineral lands belonging to the state has been effected whereby long-term leases will be given, royalties paid according to the value of the product extracted, and a minimum rental of 50c. an acre charged, in case royalties do not exceed this amount. The State Board of Equalization, which has the matter in charge, reserves the right of revision of the terms of leases every 20 years as well as of the amounts of royalty paid. Under the new system the size of the tracts offered for lease is fixed at not to exceed four sections, or 2650 acres, tracts of not less than this size being considered necessary to make coal lands attractive. At present lands in larger tracts are leased for short terms on a minimum rental—2, 5, or 10c. an acre. In what way leases now in force and coming under the new system will be treated has not yet been decided. Some lessees have already come before the board, it is stated, with requests for extensions, of course preferring to let their leases run out under the old system. Whether such an arrangement can be made is not known. It is possible that present lessees will be given the right to convert their leases into leases operated under the new system, if they are willing to surrender present leases as soon as the new law goes into force, which will be on May 12. It is a question of the advantage of long-term leases with higher rental as compared to short-term leases under lower rental, and the matter of improvements made and possibly surrendered later. The greater part of the area to which the new ruling applies is oil, gas, and phosphate land. There has been conflict with the Federal Government with respect to the ownership of the coal lands.

HOUGHTON, MICH.—Apr. 19

Plate-Glass Roofing for Stamp Mills of the Quincy Mining Co. has been used in extensive additions to the plant at Mason, Mich., and the cost is little beyond that of ordinary mill roofing. The glass roof provides a maximum of daylight. Quincy's mill additions will provide room for regrinding mills and new tables. Quincy's new hoisting plant, at No. 2 shaft at the mine, will house a hoist with a capacity of 14,000 ft. Building, complete, cost $75,000, including cost of concrete foundations for engine. Quincy's ore now comes from the greatest depth opened in the Michigan district, and the increase in copper content indicates that the Pewabic lode is an exception to the general rule of the district that contents diminish with depth.

Exceptionally Low-Phosphorus Ore of high grade has been cut at the Indiana mine, Iron River, in an exploration drift. The mine has been noted as a producer of low-phosphorus ore, averaging from .007 to .01% but the iron content of its ore has been about 36%, with about the same in silica. But now a drift has cut 30 ft. into a lens of high-grade ore assaying at the breast 50.50% iron and .003% phosphorus. This is perhaps the lowest phosphorus assay ever made in the Lake Superior region on untreated ore. It is said that the average of the drift is about the same as this assay. It is not believed that any considerable body of such ore exists; pockets of high-grade and low-phosphorus iron are not uncommon in that neighborhood. Pewabic's present shipments run .01% phosphorus, and the old Forest, which is on the same formation as Indiana, mined about 10,000 tons of very low phosphorus ore, after which the lessee gave up his lease, after having spent about $200,000 in developing the mine. The Indiana belongs to the Thomas Furnace Co., of Milwaukee, which is the only producer of low-phosphorus pig iron in the West.

Exodus of Workingmen from the Michigan copper district continues, 275 receiving settlements during the last week. Forty men were laid off at Allouez, 50 at Osceola and more at Centennial. Isle Royale continues to drop men, and rock shipments are now at the rate of only 60,000 tons per month, necessary to keep the mill at Houghton operating. The overflow last week totaled 300 tons. Superior rock now goes to Tamarack mill. The old Osceola mine has cut down from 80 to 60 cars. Centennial plans an elaborate scheme of development with further curtailment in copper output.

Calumet & Hecla is now building machinery for the additional flotation plant at mills. Dismantling of shaft rockhouse at No. 2 Hecla continues. Pillars have been taken out up to 7th level. Plenty of rich rock above cannot be moved, as surface plant valued at $500,000 is situated above. No. 12 Hecla now used exclusively for timber and supplies. It will be four months before the miners hole through for the lateral to permit transfer of Hecla rock to Red Jacket shaft. No 3 Tamarack, now part of Calumet & Hecla, is working only one shift

DULUTH, MINN.—Apr. 17

Low-grade Iron Ores of the Lake Superior district are receiving a constantly increasing amount of attention, and they are the subject of a special bulletin recently issued by the mines experiment station of the University of Minnesota. The bulletin calls attention to the fact that the present standard of merchantable ore can be maintained for only about 25 years more at the present rate of shipment, and all interested are urged to give the subject of beneficiation of low-grade ores their earnest attention and to coöperate with the experiment station in its effort to extend the life of the iron industry in Minnesota. Washing, screening, sintering, and drying are the concentration practices in most general use in the Lake Superior district at this time, and Minnesota has in reserve about 175,000,000 tons which can be profitably treated by one or the other of these methods. There are untold millions of tons of iron-bearing material in addition to these which are not susceptible to treatment under any of the processes mentioned as far as they have been developed, and it is to these that attention is directed.

Opening of Navigation for Iron-Ore Shipments from the head of the Lakes came at the earliest date in 41 years when on Apr. 12 the steamer "Pargny," of the Pittsburgh Steamship Co.'s fleet, entered Duluth harbor light for ore. On the same date the Hull pit of the Oliver Iron Mining Co. started shipments, and the other mines of the company are starting one by one. Although a number of mines are now shipping, there is not the enthusiasm to start that has characterized the last two seasons. With considerable ore on stock at lower Lake ports, and more or less uncertainty of the probable ultimate requirements for this year, it is generally considered that the first half of the season will be rather slow. In addition to a new ore dock, the Duluth, Missabe & Northern R.R. will facilitate shipments with 13 new locomotives of the Sante Fé type, capable of handling a train of 100 ore cars and replacing the present super-heated type, which have handled only 75 at best. Operators have been worried over a rumor to the effect that demurrage will be charged on loaded ore cars during the coming season, and it is hardly possible to estimate the inconvenience and added cost which would result under such an arrangement. Heretofore shippers have been allotted a proportion of the storage capacity of the railroads based on their total shipments and have been expected to keep within that allotment. With few exceptions this arrangement has worked out satisfactorily and to the general advantage of all shippers. The reduction of rates from $1 a ton down to a more reasonable figure has been unofficially denied, and it is not expected that any relief will be had in this quarter during the present season. The fight for a reduced rate will be continued.

PHOENIX, ARIZ.—Apr. 18

Suit of Copper Queen Gold Mining Co. against Arizona Binghamton Copper Co. has been brought alleging failure of the latter company to handle 100 tons of Copper Queen ore per day in the Arizona Binghamton mill. Damages are claimed to the amount of $118,000. The defence holds that there was no breach of contract, and that the company was ready and willing to mill the ore, but that the Copper Queen refused to make delivery. The plaintiff is represented by Attorneys Norris, Spaulding, Favour, and Westervelt, of Prescott, the defendant by Attorneys Bullard and Lewis, of Phoenix. The case is being tried in the Superior Court of Yavapai County before Judge Sweeney.

JEROME, ARIZ.—Apr. 18

The Haulage Tunnel, 12,384 ft. long, recently broken through into the 1300 level of the United Verde Extension mine after several years of driving, will prove to be an important factor in the mining work in this district. A drift was started from the mine end, and a shaft, the Texas, was started midway, 50 ft. from the tunnel line. From the shaft crosscut, at the depth of 595 ft., tunnel headings were started in both directions, much impeded by an excessive flow of water, that was drained when the portal and Texas east headings met. Work on the mine end then had to be suspended on account of water, and the tunnel heading was rushed ahead, merely drift size, to secure drainage at the earliest possible date. Now the last 300 ft. will be enlarged to the tunnel dimensions, 11 ft. wide and 10 ft. 6 in. in maximum height. There will be clearance above the broad-gage track of 9 ft. 6 in. Much of the tunnel is to be concreted, through the bad ground, and a concrete ditch 18 in. wide and 12 in. deep will be provided at one side for drainage. There is no expectation that the tunnel will be ready for operation within six months. Ore pockets have been constructed within the mine from which 30-ton hopper cars will be loaded. Electricity will be the motive power. The shafts will be used hereafter for lowering men and for hoisting material. The long surface tramway will not be needed again. It happens that the recent strike and the condition of the copper market have left the two larger mines of this camp unimpeded in the working out of great development plans that hardly could be carried out simultaneously with normal ore production

SPOKANE, WASH.—Apr. 17

The Inter-Mountain Copper Mining Co., in the Saltese district of Idaho, is planning to establish a line of trucks to transport its ore from the mine to the railroad at Iron Mountain. It is reported that county officials will coöperate with the mining company to build a good road on the grade of the private railroad which formerly operated from Iron Mountain.

Waste Dumps left many years ago in the vicinity of Nespelem by miners searching for gold are yielding returns to the Great Metals Mining and Milling Co. A 100-ton mill was constructed last year at the falls of the Nespelem River, about three miles from the townsite of that name. Water concentration and flotation was installed and recovery of 80% to date has been made. Newly mined ore has in many cases shown a recovery of 90%.

DEADWOOD, S. D.—Apr. 19

Labor Conditions have become somewhat relieved, and there is a daily return of miners from the copper districts of Montana. With a continuation of this influx it is safe to assume that the labor situation will return to normal before the end of this year. During 1918 the gold production of South Dakota showed a decrease in value amounting to $800,000 in comparison with the average annual output. This was caused by the scarcity of labor and should be overcome this present year. The outlook is encouraging, and several new enterprises are completing arrangements to develop some of the better idle properties in the district, and considerable new activity is looked for.

BIRMINGHAM, ALA.—Apr. 19

Iron and Steel Industry shows little change for the first half of April, the general opinion being that, once the uncertainty now existing is passed, the prospect will be bright for a resumption of all operations on a full schedule. Official figures just published for pig-iron production show the Alabama furnaces produced during 1918 a total of 2,587,852 tons, as against 1917 production of 2,953,705 tons and 1916 output of 2,762,885 tons. This record for 1918 is considered good in comparison with the two preceding years on account of the extreme labor shortage of 1918. This is owing to the fact that about 80% of the labor of this district is composed of negroes, and as a large number of labor battalions as well as combat units were formed of negroes in the making of the Army, this district was seriously affected by the draft.

GREENWOOD, B. C.—Apr. 18

Greenwood Smeltery, now idle, may be operated upon a coöperative basis if plans mature which were discussed at a meeting of A. H. Rogers, consulting engineer for the Canada Copper Corporation, Ltd.; Oscar Lachmund, metallurgical engineer, and a committee of the citizens of Greenwood. Mr. Lachmund, who is acting in an advisory capacity to the citizens, hopes that some arrangement may be reached whereby the residents of Greenwood may realize their ambition that the plant should be reopened and mining operations in the district resumed. Mr. Rogers, it is understood, was asked to place a price on the plant and complementary equipment, and in the event terms are satisfactory, the citizens, who are a unit in the matter, may arrange to take over the property, with a view to opening it on a coöperative basis. Mr. Lachmund in an interview said that there was much to encourage the prospector in the country about Greenwood and in the Slocan division. These fields were likely to become attractive to returned soldiers, and their attractiveness would be increased with the carrying out of the government's policy of the establishment of sampling works in various mining sections of the province.

VANCOUVER, B. C.—Apr. 21

Hyatt Steel Products, Ltd., of Granville Island, has taken over the Canadian Metals, Ltd., Tudhope Electric Metals, Ltd., and the steel-rolling mills at Port Moody, B. C. The new concern thus becomes one of the largest iron and steel industries in western Canada, and, with the greater facilities obtained through the fusion of interests, the company's operations will be considerably extended. The important branch of the industry is steel manufacture, it being asserted that tests conducted at the Tudhope plant, False Creek, have established its practicability. Operating a three-phase electric arc six-ton furnace, of 1500-kw. capacity, steel has been poured and declared to be of the highest quality. The company's intention is to make the ingots at this plant and roll them at the Port Moody Mills. For some time low-phosphorous pig iron has been manufactured at the Tudhope plant. The company has its own power substation

The Mining News

ALABAMA

Jefferson County

INGALLS IRON (Birmingham)—Announced during second week of April that contract was secured for construction of 20 steel containers, capacity 10 tons each, to be completed by May 10, for use for Warrior River transportation service.

REPUBLIC STEEL AND IRON CO. (Birmingham)—Has under construction at Crown ore mines at Houston, Ala., a washer of about 700 tons' daily capacity, to be completed probably during the first part of May. Spaulding mine, owned by this company, had an increased production for last month comparing with the previous month. Installation of new compressor completed. Production at Raimund group of mines shows increase for March over February, but not equal to furnace consumption for same period.

WOODWARD IRON COMPANY (Birmingham)—Has sold considerable iron ahead, but consumers are holding up delivery. Not until market improves will there be general resumption of operations at furnaces. At first proposed to extend curtailment of output at mines and furnaces only until Apr. 1, but decided not to start up until improvement is shown in demand for iron.

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—Production for March was: 2452 lb. copper, 27,067 lb. lead. 200 oz. silver, 47 oz. gold. For quarter ended Mar. 31, as follows: 1,000,844 lb. copper, 678,914 lb. lead, 44,129 oz. silver, 160.06 oz. gold.

Mohave County

DOROTHY (Chloride) — Shipping from 5-ft. vein.

MIDDLE GOLCONDA (Chloride)—Sold to L. R. Myers and others, of Minneapolis, already owners of Golconda and O'Dea property side-lining Middle Golconda. Deep tunnel to be driven under consolidated property, draining it and cutting veins. Golconda is developed 800 ft. deep by 1400-ft. incline. About $500,000 involved in purchases and development fund.

GROVE (Hackberry)—Shipping to El Paso.

CYCLOPIC (Kingman)—Sold by S. C. Bagg to Thomas Bell, who will enlarge cyanide plant and operate three shifts.

ADAMS (Oatman) — Unwatered and drifting started.

LAZY BOY (Oatman) — Contracted for 500 ft. of lateral development.

LEXINGTON (Oatman)—Crosscut nearing vein on 250 level.

Pima County

CLARK (Ajo)—Sam Clark will build small leaching plant at Clarkston; will haul ore from property, five miles distant.

EL TIRO (Silver Bell)—Tucson and eastern capital enlisted; lately leased by former manager, Percy Williams.

MINERAL HILL (Tucson) — To have $100,000 concentrating mill 20 miles south of Tucson. On 340 level developed 5% copper ore, found again on drifting on 600 level. Mainly Pittsburgh capital. U. A. Fritschie, manager.

RED CLOUD (Tucson)—Shipping rich lead carbonate ore recently cut. Owned by Cerro Colorado company. In Pantano section, in Empire district.

Pinal County

RAY CONSOLIDATED (Ray)—New No. 4 shaft change house, heating plant, and elevator man-hoist ready for operation. No. 1 shaft hoist overhauled after eight years of continuous operation.

TROY-ARIZONA (Ray)—Old Pratt tunnel reopened to within 160 ft. of orebody, but thence found so badly caved that entirely new tunnel to be driven for rest of distance by J. C. Devine, manager. Leases developed new orebody on Rattler claim.

FORTUNA (Superior)—Preparing to resume work on large scale.

MAGMA (Superior)—Little shrinkage of output. Drifting on 1800 level; deeper exploration will be by drilling. Nothing done with parallel zinc vein cut several years ago.

SILVER KING (Superior)—Planned to sink new shaft to 1000 ft., for development outside of old workings; expected to furnish ample ore for much larger mill. Settlement announced of suit of Robert Bowen for a twelfth interest.

Santa Cruz County

CASTLE BUTTE (Patagonia)—Leased by James Keating and E. H. Evans to McCall & Ismond. Silver-gold-copper property.

CHIEF (Patagonia)—Deep shaft to be sunk by A. H. Glidewell. Adjoins World's Fair, mainly owned by E. E. Bethel and Bracy Curtis, latter a Nogales banker.

CONSOLIDATED ARIZONA COPPER (Patagonia)—W. J. Mitchell driving shaft to 500 ft. from present 200 level.

MOWRY (Patagonia)—Strike of silver-lead ore reported.

Yavapai County

UNITED VERDE EXTENSION (Clarkdale)—Completely shut down. Production was at rate of about 56,000,000 lb. copper annually. Labor strike in district.

UNITED EASTERN (Congress Junction)—Resumption of milling promised. Said to have large deposits of gold ore ready for stoping.

GRAND ISLAND (Jerome)—Crosscutting on 500 level, with occasional showings of copper sulphides.

UNITED VERDE (Jerome)—Completely shut down. Production was about 72,000,000 lb. copper annually. Labor strike prevails in district.

ARKANSAS

Boone County

GLORIA (Zinc)—Operating zinc mine; has just installed new air compressor.

HARVEY (Zinc)—Operating silicate mine in Coon Hollow; making good production of hand-cobbed silicate; selling just enough at present price to pay expenses.

TAR KILN (Zinc)—Operated by Magnolia Mining Co.; lately encountered rich body of zinc ore in lower ground.

CALIFORNIA

Amador County

HIGH GRADE QUARTZ on Doak Ridge, between Cook Station and Blakely, reported by Charles Stirnaman, of Jackson.

Calaveras County

MORGAN (Carson Hill)—Clean-up of mill and cyanide plant for 15 days in March amounted to $29,400. Recently purchased by Carson Hill Gold Mines Co.; W. J. Loring, general manager.

Modoc County

HESS (Adin)—Good ore in new territory developed during winter. Extraction and milling resumed since weather permitted. Peter Keegle operating under lease.

Riverside County

FELDSPAR DEPOSIT near Lakeview, recently purchased of Robert Kinser by H. E. Fouch, of Orange, and Mr. Bryant, of Los Angeles, to be operated. Mill to be installed immediately. Product to be used in manufacture of floor tiling.

Shasta County

NUGGET in Jake Bleshek's cleanup in Flat Creek district near Keswick was valued at $117.20. On the same day the smaller nuggets and colors brought the one-day cleanup to $200. Recently a schoolboy picked up a $6.45 nugget.

SHASTA-BELMONT (Copper City)—Lower tunnel intersected orebody. Gold and silver occurs, with copper. Believed to be continuation of the Bull Hill vein system.

AFTERTHOUGHT (Ingot)—Extraction, development, and treatment of copper-zinc ores resumed after three months' shutdown. Flotation plant again in operation, and reverberatory furnace will start Apr. 15. Employ 50 men.

BULLY HILL MINING CO. (Winthrop)—New office and assay building destroyed by fire Apr. 10. Flotation plant also caught fire, but extinguished without great damage. Postoffice, express, and railroad offices destroyed. Total damage about $8000. Origin of fire unknown.

San Diego County

NORTH HUBBARD (Julian)—Modern mill installed and development and extraction to be increased. J. W. Lyon, superintendent.

Sierra County

KIRKPATRICK (Downieville)—New mill crushing cemented gravel. Large deposit developed.

BROWN BEAR (Downieville)—Softer ground encountered as tunnel advances toward channel rim. Rich gravel worked on both sides.

Tulare County

PORTERVILLE MAGNESITE (Porterville)—Orders for 20 cars of calcined product caused resumption. Other large orders expected.

Tuolumne County

McCORMICK CHROME (Sonora)—Optioned by C. S. Maltby, of San Francisco. Unwatering started. Product shipped to Colorado by McCormick last year.

COLORADO

Boulder County

BOULDER ORE SAMPLING CO. (Boulder)—This community sampler in operation for three weeks. Four to five men have been required to handle the ores. Timothy O'Connor is secretary; H. A. Fry, manager.

SLIDE MINING AND MILLING CO. (Boulder) — Operations resumed. During April, 25 to 30 men will be engaged. Large quantity of low-grade milling ore is in mine and on dumps. Estimated that ore averaging about $3 a ton can be treated at a profit. Flotation equipment installed. George W. Teal, manager.

Clear Creek County

CHARTER OAK (Idaho Springs)—Shaft being unwatered and retimbered preparatory to resumption of development work.

San Juan County

ECHO SILVER-LEAD MINING (Silverton)—Producing four carloads silver-lead concentrates monthly. Reported to contain 65% lead and 125 oz. silver per ton. Zinc concentrates carry 40 to 45% zinc and 60 oz. silver per ton. Zinc concentrates being stored awaiting better market. Mine equipped with two-bucket tramway connected with standard tramway by which deliveries are made to mill.

RADIANT M. & R. CO. (Silverton)—Secured working lease on Rubey; plans for considerable development. H. M. Kingsley, manager.

Teller County

MARY McKINNEY (Anaconda) — Ten sets of lessees operating properties. Six at work adjacent to main shaft. Two operating through Anaconda tunnel. Victory Gold Mining Co. operating through Howard shaft. J. C. Stumpff is operating the Lone Star property. J. L. Wilson opened commercial ore north of Anaconda tunnel, and shipped five cars. Pocket was opened recently by John Farrell. Charles Castello is president and general manager of the Mary McKinney Mining Company.

CHESAPEAKE (Victor)—Lease secured by John L. McLean, of Victor; has been idle for 15 years. New shafthouse will be built, and hoisting plant installed.

JO DANDY (Victor)—Development resumed by Eclipse Leasing Co. under lease from Jo Dandy Gold Mining Co. T. A. Smith, superintendent.

IDAHO

Shoshone County

BEAR CREEK (Murray) — Announces that operations will begin at once. Has mill of 150 tons' capacity and large amount of ore available, including considerable of shipping grade. Motor trucks deliver ore 12 miles to railroad.

HYPOTHEEK (Wallace)—Unable to sell bonds owing to unsettled business conditions, and has levied assessment of 1c. to meet expenses while mine is closed down. Announces that diamond drill disclosed two parallel veins carrying commercial orebodies, which will be developed when conditions favor resumption.

MARYLAND

Washington County

MARYLAND GLASS SAND CO. (Hancock)—Will develop sand deposits and erect $40,000 mill. Has purchased machinery. Proposed output, six cars daily. Central office, Hagerstown, Md. R. J. Funkhouser, president, in charge.

MICHIGAN

Copper District

MAYFLOWER (Houghton)—Shaft down 1100 ft. Offering $4.50 per 8-hour day; men quitting to work on the farms near by.

NEW BALTIC (Houghton)—At annual meeting in Houghton, officers elected as follows: Robert H. Shields, president; Herman W. Fesing, vice-president; S. T. Everett, John C. Shields, James W. Shields, H. W. Fesing, and Robert H. Shields, directors; John Edwards, secretary and treasurer; Robert H. Shields, general manager. President's report says work was suspended last September as result of war conditions and will be resumed when conditions seem to warrant. On July 20 bid in 18,823 shares of capital stock sold for non-payment of assessments due. Treasurer's report shows cash on hand of $4985, with $18,224 due from assessment No. 3.

WOLVERINE (Kearsarge) — Produced 485,234 lb. refined copper in March at rate of 18.459 lb. per ton, being increase of three pounds over January. February showing was 17.141 pounds.

MOHAWK (Mohawk)—Produced 1,229,772 lb. copper in March at rate of 23.5 lb. per ton.

BALTIC (Painesdale) — Continues to maintain showing of 35 lb. copper net per ton stamped. Makes large discard at surface. Last year hoisted 128,484 tons of waste rock, 30% of total hoisted.

Gogebic Range

DAVIS (Ironwood)—Will probably be shut down for four months because of fire in the shaft a few weeks ago.

NEWPORT (Ironwood)—On Apr. 16 gradual reduction of working forces begun here and at Palms-Anvil mine, in Bessemer. Both have filled their stockpile grounds and not yet able to ship large outputs.

PABST (Ironwood)—Started shipping ore to docks at Ashland on Apr. 15.

MINNESOTA

Cuyuna Range

CUYUNA-MINNEAPOLIS IRON (Crosby)—Control, formerly held by Franklin Merritt, of Minneapolis, taken over by Pittsburgh interests. Operates Ida Mae mine.

HILLCREST (Ironton)—Ownership passes from Hill Mines Co. to Coates & Tweed. Wilbur Van Evera, manager. Hydraulic stripping to continue and shipping to start soon.

Mesabi Range

MILLER (AURORA)—Began shipping season for eastern Mesabi Apr 11. About 12 cars daily to Two Harbors.

HILL ANNEX (Calumet)—Shipping contract for this season awarded to Guthrie company. Stripping to continue during shipping season.

MAJORKA (Calumet)—Remodeling plant. Draper, a new mine in same district, to make first shipment.

CARSON LAKE (Hibbing)—Initial shipment made Apr 15. This property a state lease operated by Oliver Iron Mining Co. as an underground mine and occupies basin of old Carson Lake. Lake removed partly by drainage and partly by filling with overburden from adjacent open pits.

MONTANA

Broadwater County

CROCKETT TUNNEL (Winston)—Crosscut tunnel 600 ft. long cut into vein carrying gold, silver, and lead.

Jefferson County

FREE COINAGE (Clancy)—Net smeltery returns made on 10-ton car. Another carload sent out on Apr. 16. Under operation by Amalgamated Silver Mines Company.

LEGAL TENDER (Clancy)—Part of carload shipped to smeltery from level in 500-ft. shaft. Silver ore.

MONEY LODE (Clancy)—Drifting on high-grade silver ore at 150 level.

Lewis and Clark County

HELENA (Helena)—South 400 level in higher grade silver-lead ore than found higher up. Cruse Consolidated in control.

STEMWINDER (Helena)—Carload silver ore sent to smeltery and another about ready to ship. Shaft 150 ft. deep. Steam hoist.

Powell County

MONARCH (Elliston)—Sawing lumber on claims for mill and buildings. Big body silver-lead ore in sight and developed.

NEVADA

Lyon County

MASON VALLEY MINES (Thompson)—Operations completely suspended. Production averaged 15,000,000 lb. copper yearly.

Nye County

TONOPAH DISTRICT ore production for week ended Apr. 5 was 7072 tons of estimated milling value of $120,224, comparing with 7074 tons the previous week. Producers were: Tonopah Belmont, 2300 tons; Tonopah Mining, 1050; Tonopah Extension, 2047; West End, 953; Montana, 50; Tonopah Divide, 245; McNamara, 210; Cash Boy, 56; Halifax, 47; Rescue, 62, and North Star, 52 tons.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—Shut down completely. Annual production was 15,000,000 lb. copper.

NEW JERSEY

Morris County

WHARTON STEEL CO., Wharton was reported to have closed its Scrub Oaks mine, at Mine Hill, indefinitely, owing to strike of 200 members of Ironworkers' Union No. 267 at the Wharton furnaces; 250 miners thrown out of work.

SOUTH DAKOTA

Lawrence County

CUTTING (Deadwood)—Electric hoist and compressor installed and sinking 500-ft. shaft started. Adjoins Homestake on west.

DEADWOOD LEAD AND ZINC (Deadwood)—At annual election following officers were named: Aaron Dunn, president; Frank W. Noll, vice-president; T. A. Ptak, treasurer; Clara D. Coe, secretary. Plans completed for placing newly erected 10-stamp concentrator in operation.

HOMESTAKE (Lead)—Star shaft has been discontinued. Ellison shaft will be electrified and skips will replace cages. Stamps at Star Mill again dropping after several months' idleness, owing to labor shortage. Mineral Point mill of 100 stamps still hung up, but will start crushing soon. First fatal mine accident in 15 months occurred Apr. 4, when Steve Brown was hit by rock in open cut and thrown into raise.

TEXAS

TEXAS OIL PRODUCTION REPORTS for first quarter of year, though not all in, so far indicate a decrease of 30% over preceding quarter.

Brazoria County

HUMBLE OIL AND REFINING CO. (West Columbia)—Two new wells brought in Apr. 10. No. 2 well on Marmion lease making initial production of 5000 bbl. a day; depth, 3250 ft. No. 1 well of Conn lease pumping 100 bbl. from depth of 3200 feet.

THE TEXAS CO. (West Columbia)—Hogg well No. 17, after standing for seven days, developed sufficient gas pressure to cause flow of 1000 bbl. daily, oil comes in hourly heads.

Harris County

MAGNOLIA GAS AND PRODUCTS CO. (Houston)—Capital stock increased from $100,000 to $200,000 for developments planned for near future. Officers are B. D. Cash, president; P. S. Grogan, vice-president; V. F. North, Jr., secretary; L. I. Sinclair, second vice-president and general manager.

UTAH

Juab County

TINTIC SHIPMENTS week ended Apr. 11 were 153 cars.

GOSHEN VALLEY R.R. (Eureka)—One mile of grading completed, and steel work for same distance expected to be completed soon. Under contract to be finished in July; 9 miles, including switches.

INDEPENDENCE (Eureka)—Work to start soon east of Tintic Standard.

TINTIC STANDARD (Eureka)—Producing about 5000 tons of ore monthly. Operation of Goshen road expected to effect yearly saving of about $100,000.

GRAND CENTRAL (Mammoth)—March production, 38 cars; February, 32; and January, 47. Production first quarter, 1919, about 5500 tons.

Salt Lake County

LITTLE COTTONWOOD OPERATORS seeking coöperation—in sum amounting to $3000—of Salt Lake County in placing nine miles of road upon canyon in good condition.

ALBION (Alta)—Tunnel being extended to south to open old Wellington workings at depth.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Heavy snowfall delaying somewhat opening of narrow-gage line.

Utah County

IN AMERICAN FORK DISTRICT, Globe and Belerophôn opening for summer work. Pacific, South Park, American Consolidated expected soon to send in crews. Latter has leased Mineral Flat power plant to furnish air for opening at greater depth Bog section of its ground.

CANADA

Ontario

MINING CORPORATION (Cobalt)—Shaft on North Cobalt property did not reach contact at 300 ft. Crosscutting will be started and diamond-drill holes put down to determine contact.

OPHIR (Cobalt)—Under option to Nipissing. Second oreshoot of high grade only few feet long.

SILVER CLIFF (Cobalt)—Under option to Northern Customs concentrator.

KIRKLAND LAKE MINES are advocating a good motor road instead of railroad branch which the Government has authorized. Road would be about six miles long, and it is felt that as a certain haul is necessary anyway, a motor road would serve as well.

LAKE SHORE (Kirkland Lake)—During March milled 1855 tons, averaging $24.46 recovery; recovered $45,364, the mine's record month to date

ASSOCIATED GOLDFIELDS (Larder Lake) — First annual report issued for many years shows large amount of development and equipment, and cash on hand $160,000. Proposes to spend additional $200,000 on development and $600,000 on new mill. Money to be raised by retailing stock to the general public.

DOME (Porcupine) — Management, recognizing shareholders' dissatisfaction, appointed three new members to directorate: Colgate Hoyt, of New York; T. R. Finucane, manager of McKinley-Darragh mine, in Cobalt, and C. D. Kaeding, manager of the Dome. At annual meeting it is understood that number of directors will be increased to nine and that Howard Poillion, mining engineer of New York, will be added.

LUCKY CROSS (Swastika)—Has been reorganized as the Marigold Mining Company.

PERU

Junin

CERRO DE PASCO (Morococha)—March production was 2419 tons blister copper

BELGIAN CONGO

UNION MINIERE DE HAUT KATANGA (Elisabethville)—Production for March amounted to 3,262,808 lb. copper.

DISCOVERY OF COPPER has been reported from near Beaudoinville, a port at the southern end of Lake Tanganyika.

Chosen

ORIENTAL CONSOLIDATED (Unsan)—Returns for January, 1919, show 160 stamps running 29$\frac{1}{5}$ days, crushing 22,212 tons. Gross receipts, U. S. gold, $104,423; operating costs, $97,764, operating profit, $6658; put back into improvements and development work, $24,756, leaving net loss of $18,097. Cable advices give March clean-up as $103,000. Details of bullion production for February as follows: Tabowie mill, 9355 tons, yielding $27,777; Taracol, 8600 tons, yielding $17,772. Taracol cyanide plant bullion, $12,561. Cordwood delivered per day by contractors during February was 115 cords, exceeding consumption by 40 cords. Practically none was delivered in early part of March, owing to epidemic of foot-and-mouth disease among the bulls, and all traffic was prohibited. Quantity of native labor sufficient but of inferior quality. Rice and millet prices unreasonably high. Suribong tunnel holed through on Feb. 23, and expected to turn river through on Mar. 12.

The Market Report

SILVER AND STERLING EXCHANGE

		Silver				Silver	
Apr.	Sterling Exchange	New York, Cents	London, Pence	Apr.	Sterling Exchange	New York, Cents	London, Pence
17	4.6500	101⅛	48$\frac{11}{16}$	21	4.6500	101⅛	....
18	4.6500	101⅛	....	22	4.6500	101⅛	48½
19	4.6488	101⅛	....	23	4.6550	101⅛	48½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Apr.	Electrolytic	Spot.	N. Y.	St. L.	St. L.
17	15.10 @15.15	†72½	4.90 @5.00	4.65 @4.70	6.00
18	15.10 @15.15	†72½	4.90 @5.00	4.62½ @4.67½	6.02½
19	15.15 @15.20	†72½	4.90 @5.00	4.62½ @4.67½	6.02½
21	15.15 @15.20	†72½	4.85 @5.00	4.60 @4.65	6.02½
22	15.12½ @15.17½	†72½	4.85 @4.95	4.60 @4.65	6.02½ @6.05
23	15.15 @15.20	†72½	4.85 @4.95	4.60 @4.65	6.05

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
Apr.	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
17	76½	76½	81	224½	222½	24½	24	35
18		..	...		....	..		...
19		....	...		..	.	.	....
21	....	....	. .	..		....	....	..
22	76¼	76½	81	226¾	225	24½	24	35
23	75½	76	80½	225½	223¾	24½	24	35

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Apr. 23, 1919

We reported the metal markets dull last week, but they were duller this week. In copper the transactions were very light, and scarcely more than a trifling business was done in lead and zinc.

Transatlantic freight rates are quoted nominally at 1@1¼c., but the regular lines are booked up with freight until the middle of June, and consequently it is difficult to arrange for shipments. Small lots of metals are slipped into cargoes from time to time. Outsiders ask 2c. Freights from Pacific ports to Hongkong and Kobe continue at $15 per ton.

Copper — The amount of business that was done this week was very small. Some producers did not do anything at all. The business that was consummated was almost entirely with wire drawers. There has been considerable copper offered in the market from speculative hands, which has been obtainable at prices below the terms of producers. It looks as if such speculative copper had been more or less cleaned up, perhaps as a result of which the market has exhibited a rather firmer tone during the last few days. The large producers are firm in asking 15⅝c., regular terms.

Among producers generally there is rather an optimistic feeling respecting copper, which is based on the idea that 15c. is a low price, considering present conditions, and that any new buying movement is bound to put the market up. On the other hand, it is recognized that the curtailment in production has not yet been so much as was expected.

There was a fair business in casting copper during the last week at about ⅛c. below the price for electrolytic.

Brassmakers report their business in a bad way, with cut-throat competition among themselves. Consequently, brassmakers are buying relatively little copper; practically none during the last week.

Owing to a defective plate, the copper prices in the Apr. 19 issue of the "Journal" were partly illegible and they are given as follows: Apr. 10, 15.20@15.30; Apr. 11, 15.20@15.25; Apr. 12, 15.20@15.25; Apr. 14, 15.20@15.25; Apr. 15, 15.10@15.15; Apr. 16, 15.10@15.15.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17c. per lb. f.o.b. mill, car-load lots.

Tin—The situation remains unchanged. Some consumers complain of having large stocks of tin in their yards, which they are unable to offer for sale, owing to Government restrictions, and cannot sell in the form of tinplate owing to poor business; while they are compelled to take in the Government tin allocated to them.

Lead—Not very much business was done. The A. S. & R. Co. maintains its price at 5c. and effects some transactions. Outsiders, however, sold first at 4.90c. and then as low as 4.85c. At the close lead was offered at 4.85c. and the market was weakish.

The main trouble with the lead market is that too much lead is being produced, the curtailment of some producers having been negligible. With the policy of laissez faire, the inevitable is bound to happen. Stocks of refined lead in the hands of producers are estimated at 35,000 to 40,000 tons, which is an increase over what they were at the beginning of the year. A sharp curtailment of production in Mexico has already been made and is being extended.

Zinc—A moderate business, comprising some lots of fair size, was done. The buying seemed to be largely of speculative character, reflecting the idea that at 6c. spelter is low and if it moves at all can only move upward. The buying had the effect of advancing the price a trifle.

Galvanizers in Pittsburgh and vicinity and in the Ohio Valley report very poor business.

High-grade zinc was bought this week in carload lots on the basis of 6⅝c., St. Louis. However, it is doubtful if the present premium on this grade of metal in a large way is any more than ¼@½c. above the price for common spelter.

Zinc dust is in no demand. Business could probably be negotiated on the basis of 50% above the price for common spelter, or, say, 9c., f.o.b., works.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—This market is a shade firmer, there having been a little more inquiry and a little more business effected. We quote spot at 6⅝@6⅞c. Shipments from the Orient are quoted at 6¾@7c., but very little is offered.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The stiffening in this market reported last week continued. We quote $75. Mexican was offered at about $70, but the supplies of this grade are light. San Francisco telegraphs $72, steady.

Silver and Platinum

Silver—Market remains unchanged at New York at $1.01⅛ per oz. 999 fine. Fluctuations in London have been trifling. The variation has been only $\frac{1}{16}$d. Shipments to London for the week ended Apr. 18 were 123,000 oz., and to Paris 486,000 oz. China exchanges are firm.

Mexican dollars at New York: Apr. 17, 77½; Apr. 18, 77½; Apr. 19, 77½; Apr. 21, 77½; Apr. 22, 77½; Apr. 23, 77½.

Platinum—Refined ingot was unchanged at $100, with good demand.

Palladium—We quote $115@120.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 19—Blende, per ton, high, $42.70; basis 60% zinc, premium, $39; Prime Western, $38@37; sludge, $35; flotation, $33; calamine, basis 40% zinc, $25@22. Average selling prices: Blende, $37.95; calamine, $25.56; all zinc ores, $37.57.

Lead, high, $63.20; basis 80% lead, $58@55; average selling prices, all grades of lead, $57.48 per ton.

Shipments the week: Blende, 10,241; calamine, 327; lead, 1577 tons. Value, all ores the week, $487,730.

The smelteries at Fort Smith and Van Buren, Ark., are reported on dead fire. At Sand Springs the fires have been drawn. At Bartlesville and Blackwell, Okla., labor differences are said to have been settled. At Henryetta, a smelterman, using the language of the plains, said: "The men are 'milling' around, but, lacking a leader, have not yet gone out. We do not know what to expect." Such is the smelting situation, as reported at noon today.

Platteville, Wis., Apr. 19—Blende, basis 60% zinc, $40 base for premium grade; $38 base was offered for high-lead blende, but operators refused to accept the cut, and no sales are reported. Lead ore, basis 80% lead, $54 per ton. Shipments reported for the week are 1307 tons blende, 263 tons galena, and 359 tons sulphur ore. For the year to date the totals are 29,619 tons blende, 1675 tons galena, and 1061 tons sulphur ore. During the week 2025 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—A little business in high-grade ore was reported done at about 80c. per unit.

Manganese Ore—It is reported that foreign ore is coming in on consignment and is being offered without finding buyers so far.

Molybdenum Ore—This ore is quoted nominally at 80c., but offerings at concessions from that figure did not result in business.

Tungsten Ore—Business to the amount of several hundred tons was reported, high-grade spot material fetching $7 per unit, while ore of 65% grade, guaranteed, was sold at $6.50 per unit for April-May shipment. An improvement in the business of high-speed steel and tool steel is reported. Tungsten powder was quoted at $1.50 per pound.

Pyrites—Spanish pyrites is quoted nominally at 17c. on the basis of 10s ocean freight. Buyers of pyrites are holding back, as the price of brimstone is $22 per ton f.o.b. New York.

Iron Trade Review

PITTSBURGH—Apr. 22

Complete stagnation prevails throughout the iron and steel market. Producers are waiting for inquiries in order to negotiate prices; in other words, it is an "open market," and buyers are waiting for no one knows what. The pig-iron producers make no effort to conceal the former fact, but rather wish to advertise it. They are not afraid to cut prices, realizing that these would not decline much, as the prospect is for furnaces to go out of blast; whereupon costs will come down. Steel producers do not talk "open market," but middle interests are convinced that if they had actual inquiries they could secure cut prices, below the nominal or recognized prices named Mar. 21 as a result of the agreement with the Industrial Board.

As to the Industrial Board's plan to regulate prices, even Judge Gary, at yesterday's meeting of the stockholders of the Steel Corporation, admitted that he understood the plan to have been abandoned, although he "hoped he was mistaken." The steel producers are evidently on the verge of quoting competitive and lower prices, but whether this will come in two weeks or two months no one ventures to predict. Industrial Board interference in steel prices, without the approval of the Department of Justice to an accompanying agreement among producers that the prices are minimum, is entirely unwelcome to the producers. At one time this support of the Department of Justice was expected, but later it became certain the support would not be given.

The condition of the steel market today is that in all probability cut prices would be named on many products if there were inquiry worth consideration, but orders placed are so small that nothing is done, and steel prices may be said to be maintained on the old basis. Mill operations average between 65% and 70% of capacity, and are steadily decreasing, as new business entered does not average more than half the tonnage that is being shipped.

Reports multiply of construction projects that are being considered, but give no definite date on which the prospective investors intend to proceed, and it may be assumed that investors are waiting for lower construction costs. Whenever the volume of work held back impresses the steel producers, it will encourage them, not to maintain prices, but rather to cut them in order to start business going. Steel prices would have been cut before this if the producers had been sanguine as to the industrial outlook. A danger to the situation, with respect to steel, is that the extensive road building and dwelling-house erection now being initiated and involving, of course, relatively little steel consumption, will tie up labor to such an extent that it will be in short supply for construction projects that involve large-steel consumption.

Pig Iron—The condition remains that there is theoretically an open market in pig iron, with furnaces willing to cut prices against inquiries of reasonable size, though practically the market is on the old basis, because inquiry covers only small lots, resulting in orders at regular prices, chiefly from carloads to 100 tons. Additional merchant furnaces go out from week to week. Some of these furnaces assert that they will not blow in until Lake Superior ore is available at much lower prices. Coke takes care of itself, as it has been declining steadily; and, as to labor, men work better, fewer men being required to run a furnace, and, when furnaces resume, rates per hour are expected to be lower. We continue to quote: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $15.75; f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh.

Steel—Specifications are light on billet and sheet bar contracts, and cover only orders for finished product already booked. Inquiry is totally absent. Middlemen believe present recognized prices could be shaded $2 a ton or more if actual orders were offered, and doubtless this will occur eventually. Meanwhile we continue to quote Billets, $38.50; sheet bars and small billets, $42; slabs, $41, and rods, $52.

Ferromanganese—The market on resale material continues irregular, there being little demand and light offerings, decreased demand being due chiefly to heavier deliveries of English ferromanganese, purchased long ago, generally at $100 to $175, although one little delivery was made recently winding up an order at $37, the lowest price ever done, that having been in July, 1911. Makers continue to quote $150 for 80%, though resale is available at $115@125, all prices being delivered. Resale spiegeleisen is about $42, shipping point, with no demand.

Coke—The lowest quoted price on standard furnace coke thus far is $3.60, for prompt lots or delivery to end of month, but brokers believe that with a definite order they could do $3.50. Production in the Connellsville and lower Connellsville region continues to decline, the last report showing 150,000 tons produced in a week, against 32[illegible],000 to 350,000 tons a week during July, August, and September last. The byproduct ovens have decreased production only slightly. Foundry coke is now available at as low as $4.25, but some brands command higher prices, and asking prices run as high as $5.50 or $6 by a few producers who are merely protecting their contract deliveries.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	......	36.963	47.215	......
May	74.745	99.505	......	37.940	48.980	......
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125	......	50.920	49.500	......
Oct.	87.332	101.125	......	44.324	49.500	......
Nov.	85.891	101.125	......	43.584	48.969	......
Dec.	85.960	101.125	......	43.052	48.492	......
Year	81.417	96.772	......	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	....	110.000	......	125.000	......
May	23.500	....	110.000	......	125.000	......
June	23.500	....	110.000	......	125.000	......
July	25.904	....	119.913	......	134.913	......
Aug.	26.000	....	122.000	......	137.000	......
Sept.	26.000	....	122.000	......	137.000	......
Oct.	26.000	....	122.000	......	137.000	......
Nov.	26.000	....	122.000	......	137.000	......
Dec.	(a)	....	118.447	......	133.167	......
Year	24.628	.	115.530	...	130.507	......

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	......	329.905	......
May	(a)	......	364.217	......
June	(a)	......	331.925	......
July	(a)	......	360.347	......
August	(a)	......	380.900	......
September	(a)	......	343.905	......
October	(a)	......	335.543	......
November	(a)	......	323.550	......
December	(a)	......	267.736	......
Av. year	(a)	......	330.138	......

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	....	6.701		29.00	....
May	6.818	....	6.704		29.00	....
June	7.611	....	7.511	...	29.00	....
July	8.033	....	7.750	....	29.00	....
August	8.050	....	7.750	...	29.00	....
September	8.050	....	7.750	....	29.00	....
October	8.050	....	7.750	....	29.00	....
November	8.050	....	7.750	....	31.20	....
December	6.564	....	6.324	..	40.00	....
Year	7.413		7.222	......	30.10	....

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.830	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890		6.715		54.000	
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442	..	9.092		54.000	
October	8.801	.....	8.451		54.000	
November	8.491	..	8.141		54.100	
December	8.163	.	7.813	.	56.050	
Year	8.159		7.890	.	54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15		32.95		33.95	
May	36.20	.	33.00		34.00	..
June	36.36		33.16	..	34.16	. .
July	36.60	.	33.40	.	34.40	. ..
August	36.60	.	33.40	....	34.40	..
September	36.60	.	33.40	..	34.40	..
October	36.60	.	34.40		35.40	.
November	36.60	..	34.40	. .	35.40	..
December	36.60		34.40	.. ..	35.40	. ..
Year	$36.67	.. .	$33.70	.	$34.45	....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 22
Alaska Gold M.	3¼
Alaska Juneau	2
Am.Sm.&Ref.,com.	72⅛
Am.Sm. & Ref., pf.	104¼
Am.Sm.Sec., pf., A	92½
Am. Zinc	14
Am. Zinc, pf.	45
Anaconda	61⅞
Batopilas Min.	1½
Bethlehem Steel	75⅝
Butte & Superior	21⅞
Butte Cop. & Zinc	7
Cerro de Pasco	42
Chile Cop.	23½
Chino	36⅞
Colo. Fuel & Iron	43½
Crucible Steel	69¼
Crucible Steel, pf.	94¼
Dome Mines	14⅞
Federal M. & S.	11
Federal M. & S., pf.	38
Great Nor., ore ctf.	44⅞
Greene Cananea	41⅞
Gulf States Steel	52½
Homestake	98
Inspiration Con	49½
International Nickel	28⅛
Kennecott	32⅞
Lackawanna Steel	70¼
Mexican Petrol	185
Miami Copper	23⅞
Nat'l Lead, com.	71
National Lead, pf	108
Nev. Consol	16⅞
Ontario Min	7¼
Ray Con	20½
Republic I.&S., com.	81⅛
Republic I.&S., pf	102
Sloss-Sheffield	53
Tennessee C. & C.	16¼
U. S. Steel, com.	100¼
U. S. Steel, pf.	116⅛
Utah Copper	75
Va. Iron C. & C.	53½
Worthington Pump	69

BOSTON CURB*	Apr. 22
Alaska Mines Corp.	‡ 12
Boston Ely	1½
Boston & Mont.	.65
Butte & Lon'n Dev.	.11
Calaveras	50
Chief Con	3½
Contact	.05
Corbin	‡ 25
Cortez	12
Crown Reserve	.45
Crystal Cop.	.26
Eagle & Blue Bell	2⅛
First Nat. Cop.	1½
Houghton Copper	.20
Intermountain	‡ 05
Iron Blossom	‡ 40
Iron Cap	12½
Majestic	08
Mexican Metals	18
Mines of America	‡ 05
Mojave Tungsten	‡ 05
Nat. Zinc & Lead	13
Nevada-Douglas	10
New Baltic	1
Oneco	20
Pacific Mines	‡ 25
Rex Cons	.15
Yukon Gold	.76

SAN FRAN.*	Apr. 15
Alta	.02
Andes	25
Best & Belcher	14
Caledonia	10
Challenge Con	‡ 03
Confidence	‡ 03
Con Virginia	‡ 30
Gould & Curry	07
Hale & Norcross	17
Jacket-Cr. Pt	06
Mexican	49
Occidental	‡ 40
Ophir	‡ 15
Overman	04
Savage	25
Sierra Nevada	27
Union Con	55
Utah Con	03
Belmont	3 00
Jim Butler	38
MacNamara	70
Midway	58
Mont.-Tonopah	20
North Star	08
Rescue Eula	11
West End Con.	1 75
Atlanta	05
Booth	30
Comb. Frac	‡ 03
Florence	35
Jumbo Extension	13
Kewanas	05
Nevada Hills	03
Nevada Packard	20
Round Mountain	38
Silver Pick	09
White Caps	20

COLO SPRINGS*	Apr. 22
Cresson Con	5 00
Doctor Jack Pot	01½
Elkton Con	05½
El Paso	10
Gold Sovereign	‡ 02
Golden Cycle	‡ 81
Granite	15
Isabella	01½
Mary McKinney	07
Portland	04
United Gold M.	18
Vindicator	26

BOSTON EXCH.†	Apr. 22
Adventure	‡ .75
Ahmeek	‡73
Algomah	‡ .30
Allouez	35
Ariz. Com.	11½
Arnold	‡ 20
Bingham Mines	7½
Bonanza	‡ 10
Butte-Balaklava	‡ 30
Calumet & Ariz.	59½
Calumet & Hecla	490
Centennial	12
Copper Range	43½
Daly West	‡2½
Davis-Daly	‡5½
East Butte	9
Franklin	3
Granby	65
Hancock	‡6
Hedley	‡12
Helvetia	‡ 25
Indiana	‡ 50
Isle Royale	26
Keweenaw	1½
Lake	‡4½
La Salle	‡2½
Mason Valley	‡2½
Mass	4½
Mayflower	3½
Michigan	3½
Mohawk	57
New Arcadian	‡1½
New Cornelia	17½
New Idria	‡9½
North Butte	11
North Lake	25
Ojibway	‡1½
Old Dominion	33½
Osceola	49
Quincy	56
St. Mary's M. L.	‡40
Santa Fe	‡ 25
Seneca	13½
Shannon	2½
Shattuck-Ariz	11
So. Lake	*.75
So. Utah	‡ 12
Superior	5½
Superior & Bost.	2
Trinity	2½
Tuolumne	81
U. S. Smelting	50½
U. S. Smelting, pf	46½
Utah Apex	2½
Utah Con	8
Utah Metal	1½
Victoria	2½
Winona	80
Wolverine	15½

N. Y. CURB†	Apr. 22
Am. Tin & Tung.	½
Big Ledge	½
Butte & N. Y.	‡½
Butte Detroit	‡ .04
Caledonia	.34
Calumet & Jerome	½
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	‡ 11
Con. Ariz. Sm.	‡1⅛
Con. Coppermines	‡5
Goldfield Con	20
Goldfield Merger	05½
Hecla Min	5½
Howe Sound	‡3½
Jerome Verde	‡½
Louisiana	¼
Magma	‡31
Marsh	06
McKinley-Dar-Sa.	48
Milford	‡ 75
Mother Lode	42
Nixon Nevada	21
Ohio Cop.	‡ 50
Rawley	‡2½
Ray Hercules	2
Richmond	‡ 50
Rochester Mines	19
St. Joseph Lead	11
Standard S. L.	⅛
Stewart	24
Success	05
Tonopah	‡3⅛
Tonopah Divide	1½
Tonopah Ex.	2½
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	5
United Verde Ext.	‡32½
United Zinc	‡½
Utica Mines	‡ 08

TORONTO*	Apr. 22
Adanac	17
Bailey	04
Beaver Con	43
Chambers Ferland	‡ 10
Coniagas	2 00
Hargraves	02
Kerr Lake	5 00
La Rose	25
Lake Shore	93
Min. Corp. of Can.	2 00
Nipissing	‡8 75
Peterson Lake	07
Temiskaming	30
Wettlaufer-Lor.	04
Davidson	68
Dome Exten	27
Dome Lake	24
Hollinger	6 12½
McIntyre	1 02½
Newray	12½
Porcu. Crown	26
Teck-Hughes	26
Vipond	20
West Dome	13

* Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

May 3, 1919

Volume 107 *Number* 18

THE CONCENTRATOR AT MINE LA MOTTE, MISSOURI. WATER RESERVOIR IN FOREGROUND

Economics of Concentration

BY A. P. WATT*

In this paper the pertinent question as to the economic aspect of concentration is considered, and abundant evidence is presented to show that technical efficiency and metallurgical recovery of concentrate are not the sole subjects for consideration. It is to be regretted that the relative worth of extraction and recovery figures is not better understood, and that there are frequent instances as our contributor points out, where those in control will insist on a so-called improvement of a certain phase of the process without paying any attention whatever to the economic aspect of the proposed change. The suggestions as to the advisability of operating a separate re-treatment plant are worthy of consideration, and the contentions made in relation to this matter are supported by ample evidence in favor of such procedure where it is practicable and where the highest operating efficiency is desired.

THE increased cost of smelting, together with the high prices of labor and supplies, makes it imperative that more study be given to the economics of concentration. Within the last few years prices have increased enormously; and to make the maximum profit it is necessary that attention be given to the subject of the most economic grade of concentrate to be shipped to the smeltery.

The question of metallurgical extraction in various concentrating plants has received ample notice, but only a small amount of attention has been given to the study of the grade of concentrate produced. Although every mill superintendent places reliance on extraction results, few ever consider, and many do not realize, that the grade of the concentrate is also a vital factor.

Smeltery returns depend entirely upon the grade and tonnage of the concentrate produced. It is just as important to have efficiency considered in the treatment of the concentrate as in the milling of the ore. The latter phase is only half the story; and although, generally speaking, increased metallurgical extraction is desirable, it must not be overlooked that the grade of the concentrate and the costs of smelting deserve greater consideration than has commonly been accorded to these subjects.

---

*Consulting engineer, ore concentration, 52 Vanderbilt Ave., N. Y.

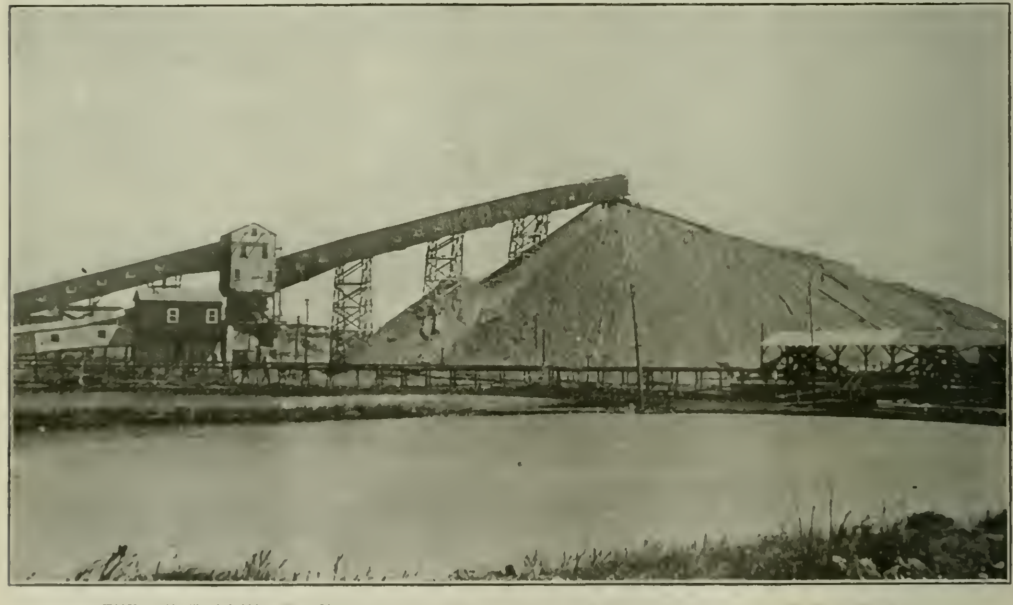
The economic conditions in the business world have changed so much within the last few years that a careful study should be made of how profits from an operating plant have been affected. With metal prices rapidly decreasing, and as a result of high labor costs, it is apparent that some change should be made both with regard to the grade of the concentrate and to the metallurgical extraction, if maximum profit is to be obtained.

METALLURGICAL AND ECONOMIC RECOVERY

It has previously been pointed out[1] that there are two types of percentage recovery to be considered in a metallurgical operation. One is *metallurgical recovery*, or the percentage of valuable mineral saved by the plant, and the other is the *economic recovery*, or the percentage of the gross value of the ore recovered as net profit. On first consideration it might appear that the primary object of concentration is to recover the highest amount of mineral in the ore. If this were true, the percentage of recovery of the valuable mineral would be the index of efficiency of the plant. This condition may or may not be true, but it does not necessarily follow that increased metallurgical recovery means increased profit. A plant making a low metallurgical recovery may be operating at a profit, whereas a higher recovery might mean an actual operating loss. This condition applies particularly to small mills treating low-grade ores carrying metal of low price. As the object of concentration is to make money, metallurgical recovery is of far less importance than economic recovery.

The metallurgical recovery in every plant is usually closely watched, both by the operating force and by the officials. Many operators do not realize that there is such a thing as economic recovery. On the other hand, many mill superintendents are so pressed by their executives that their one and only object is to ship the maximum amount of product each month, irrespective of the profits.

A case recently came to my attention in which the mill superintendent was forced to ship 15 cars of concentrate per month. It was impossible for him to do this with normal-grade concentrate, because of the low grade of the ore and the small tonnage being sent to the plant. However, as the officials of the company wrote him that they were looking for results and not excuses, he shipped, each month, the 15 cars of concentrate, as desired. This was achieved by cutting an excessive amount of middlings into the material shipped. I pointed out to him that the middlings which he was shipping would not even pay the freight, to say nothing of smelting charges. He said he realized this, but apparently the officials did not or would not. This is not an isolated instance, and one object of this article is to bring a fact to the attention of those who do not appreciate it, viz., that a large tonnage of concentrate does not necessarily mean increased profits.



THE "CHAT" DUMP OF THE ST. LOUIS SMELTING AND REFINING CO., ST. FRANCOIS, MISSOURI

In the consideration of economic recovery there are a great number of factors to be resolved, and the problem is much more complex than would be apparent unless a careful study had been made. It is not possible continuously to operate a plant in such a manner as to give maximum results, for the reason that conditions change so frequently that the most efficient economic recovery possible is never achieved.

This paper will deal more particularly with the economics of lead-ore treatment in those cases where concentrates have been produced by gravity methods. The principle involved is applicable in the case of all ores, but the greatest field for consideration is under market conditions in which the metal is selling at a low price and the smelting charges are high. The same principle applies to the treatment of flotation concentrate.

When copper was selling at 26c. per lb., and the smeltery was close to the point of production, the question of the most economical grade of concentrate was not a serious one. However, with lead selling at 5c. per lb., and with increased freight and smelting charges, a considerable field is open for investigation in the matter of increasing the profits accruing to the shipper.

---

[1] [illegible] *Mining Magazine*, Aug. 1913.

It should be realized that, in this paper, specific attention is given to lead ores, and all calculations are based on pre-war prices. The article will serve to point out a means of studying the re-treatment of concentrates, and will show the means of attacking each individual problem. Before proceeding with the question of the most economical grade of concentrate, it is expedient to consider a typical product. Any concentrate can be divided into three parts, which for convenience of reference may be termed, respectively, low grade, medium grade, and high grade.

The low-grade portion is the material that cannot be shipped to the smeltery at a profit. It is evident that a product must carry a certain amount of lead if it is to pay the cost of handling, of freight, and smelting. If a product is shipped containing this critical amount, no profit is made by the shipper, and no loss incurred, but if it contain less, the shipment is made at a loss to the shipper. Consequently the first item to be considered is the critical point in question.

This point will depend on a number of variables, such as the operating expense, the cost of freight, the terms of the smelting contract, and the selling price of lead. If all these items are considered as constants, with the exception of the selling price of lead, then the critical assay will vary inversely as the price of lead. This shows that as the price falls, the point of disappearing returns, as regards the assay of the product, will increase. With lead selling at 3c. per lb., the critical assay, under certain conditions, was 22% lead; whereas with 8-c. lead the critical assay was 9% lead.

Generally speaking it is impossible to beat the smelter. If a product will not pay its own way and return a profit, it cannot be mixed with high-grade material and shipped to a smeltery and a profit made on the previous non-profitable material. This statement applies, of course, only when the same smeltery contract is operative in both cases. Frequently, in a desire to obtain high metallurgical extraction, much low-grade material is mixed with the higher-grade concentrate in an attempt to smuggle it into the smeltery, thinking that the shipper is beating the smelter at his own game. To demonstrate that low-grade material cannot pay its own way, and will not do so even if mixed with high-grade material, the following example is given:

Assume that the freight rate is $1.50 a ton from the mill to the smeltery, and that the smelting charge is $6 a ton on a basis of 70% lead concentrate, and that 10c. a unit is added to the smelting charge for each unit of lead, in the product, less than 70%. Assume that the smelter pays for 90% of the lead, and that the selling price of lead is 4c. per lb. Assume, further, that 10 tons of 70% lead concentrate is mixed with 1 ton of middling containing 10% lead. That 10% lead middling cannot be shipped at a profit is shown by the preceding table.

SMELTING ONE TON OF MIDDLING CONTAINING 10% LEAD

Gross value 200 lb. of lead at 4c.		$8 00
Freight	$1 50	
Smelting charge, $6 plus 60 x 10c.	12 00	
Smeltery deduction, 10% of $8	.80	
Total charge	$14.30	
Gross value	$8.00	
Loss to shipper	$6.30	

It is thus seen that shipment of this low-grade material has resulted in a loss to the shipper. Had it been mixed with the higher-grade concentrate, the economic recovery of the plant would have been lowered in an attempt to increase the metallurgical extraction.

By considering the smelting of 10 tons of lead concentrate containing 70% lead, the following appears:

SMELTING 10 TONS OF LEAD CONCENTRATE CONTAINING 70% LEAD

Gross value 7 tons of metallic lead at $80		$560 00
Freight, 10 tons at $1.50	$15 00	
Smelting charge, 10 x $6	60.00	
Smeltery deduction, 10% of $560	56 00	
Total charge	$131 00	
Gross value	560 00	
Net return	$429 00	

If the one ton of middling were combined with the 10 tons of concentrate there would result 11 tons of product containing 64.555% lead. The profit resulting from the treatment of this 11 tons of composite material is shown in the following table:

SMELTING 11 TONS OF LEAD CONCENTRATE CONTAINING 64 555% LEAD

Gross value, 7.1 tons metallic lead at $80		$568 00
Freight, 11 tons at $1.50	$16 50	
Smelting charge, 11 tons at $6.55	72.00	
Smeltery deduction, 10% of $568	56.80	
Total charge	$145.30	
Gross value	568.00	
Net return	$422 70	

The net return from smelting 11 tons of 64.555% lead concentrate is $422.70, whereas the return from smelting 10 tons of 70% concentrate is $429, thus showing a loss of $6.30, which is the amount incurred by the addition of the 10% middling. This proves that if a product cannot be shipped by itself at a profit, a profit will not be made if it is combined with a high-grade material; assuming, of course, that both products are smelted on the same smeltery basis.

The above example shows that, in an attempt to increase the metallurgical recovery, the profit per ton of ore milled would actually be decreased; but the object of concentration is to make money, and not to lose it. From the smeltery contract given above the net profit per ton, which will be received from shipping different grades of products, can be calculated. The figures given have been made on the assumption that lead is selling at 4c. a pound.

NET SMELTER RETURNS OF DIFFERENT GRADES OF LEAD PRODUCTS WITH 4-c. LEAD

Lead in Product, Per Cent.	Net Smeltery Return to the Shipper per Ton
70	$42.90
60	34 70
50	26.50
40	18 30
30	13 90
20	1 90
18	.26
17	(a) 56
16	(a) 1 38
10	(a) 6 34

(a) Loss.

It is evident, then, that there is a definite grade of product which, if shipped, will return neither profit nor loss to the shipper. The percentage of lead in this product I have termed the *point of disappearing returns*. This point can be solved by the following formula:

Let X = percentage of lead in product which returns neither profit nor loss to the shipper. Then by solving

$$(A)\ 0.8x - 1.5 - [6 + (70 - x)\ (.1)] - \frac{0.8x}{10} = 0,$$

it is found that x equals 17.68% lead. Consequently, no profit is returned by shipping a concentrate product which contains less than 17.68% lead; but, instead of making a profit, a loss is incurred. This statement applies, of course, only under the assumption previously made. This point of disappearing returns will fluctuate with every variation in the price of lead, the cost of freight, and the detail of the smelting contract. A similar formula, however, can be derived for every contract, and, with this formula, plant managers will be in a position to determine the grade of material which will not return a profit. If the greatest profit is to be expected any concentrate containing less than the critical amount of lead should not be shipped.

That under the assumed smeltery contract noted above this point of disappearing returns is correct, is shown by the following calculations:

SMELTING ONE TON OF LEAD PRODUCT CONTAINING 17.68% LEAD

Gross value		$14.14
Freight	$1.50	
Smelting charge	11.25	
Smeltery deduction	1.41	
Total charge	$14.14	
Gross value	14.14	
Profit	$0.00	

The point of disappearing returns varies, of course, with the smelter contract as well as with all other cost variables; but, if a fixed contract be assumed, the point varies with the price of lead, decreasing with the increased price of lead, and *vice versa*.

It is possible to derive a general formula for determining the point of disappearing returns for any price of lead, thus:

General Formula for Determining the Point of Disappearing Returns

$$\text{(B)}\quad 20Px - 1.5 - [6 + (70 - x)(0.1)] - \frac{20Px}{10} = 0$$

Where

P = price per lb. of metallic lead expressed in dollars.

x = per cent. lead in product.

The above formula can be simplified to read as follows:

$$\text{(C)}\quad 18Px + 0.1x = 14.5$$

The points of disappearing returns for different prices of lead are as follows:

POINTS OF DISAPPEARING RETURNS FOR VARIOUS PRICES OF LEAD

Price of Lead, Cents per Lb.	Assay of Product, Per Cent. Lead
2	31.5
3	22.7
4	17.7
5	14.5
6	12.3
7	10.7
8	9.4

Assuming that the mill product is shipped to a custom smeltery, these points of disappearing returns show when profits disappear. If the mill product be shipped to a smeltery operated by the same company, these points no longer hold true, but the principle remains effective and correct.

Re-treatment of Concentrate

So far only one of the two points that affect the profits derived from shipping concentrate has been considered in the question of the elimination from the material shipped of that portion which will not return a profit. If this low-grade material is removed from the general mill concentrate by proper re-treatment methods, the material shipped would be of such a grade that every particle would show a profit to the shipper. However, there would be material in this re-treated concentrate that is only slightly richer than the standard shown in the critical assay. It would of course be profitable to ship this medium-grade material, but maximum profit is not obtained by so doing. Some portion of this concentrate should receive further treatment by being crushed and concentrated, and it would thus yield an increased profit. On the other hand, if a material of too high a grade be re-crushed, a loss would be incurred, as the increased grade of concentrate would be more than offset by the increased metallurgical loss. The function of the re-treating plant would be to separate from the concentrate that portion which will yield no profit if shipped, and also effect a like separation of all material which will yield an increased profit by further re-treatment. But the upper limits for this medium-grade product must be determined.

Critical Point for Re-crushing

Before the second critical point can be ascertained, it is, of course, necessary to know the details of the smeltery contract and the results of preliminary tests made to learn what recovery is possible by treating the medium-grade product, and also to determine what grade of concentrate would be produced. If tests show that an extraction of 80% of the lead in the form of a 70% concentrate would result from the treatment of this intermediate-grade product, then the second point, which I will call the *critical point of middlings for re-crushing*, can be determined. By this I mean the point above which no material should be further re-concentrated. Material lying within the lower limit of the point of disappearing returns and the upper limit of the critical point for re-crushing should be further re-concentrated if the maximum economic recovery is to be obtained. This critical point for re-crushing can be determined mathematically and, of course, will vary according to costs, grade of concentrate, and other operating conditions.

For the smeltery contract assumed above, the formula has been determined for showing the critical point of middling for re-crushing:

Formula for Determining Critical Point of Middling for Re-crushing

$$\text{(D)}\quad 6.0 + 10.0\ (0.7 - x) + 1.5(x)(\tfrac{1}{10})\ (P) - \frac{(0.8x)(1.5)}{0.7} - \frac{(0.8)(x)(6.0)}{0.7} - 0.8x(\tfrac{1}{10})(P) - 0.5 - 0.2xP = 0$$

Where

x = Critical point of middling for re-crushing.

P = Price of metallic lead per ton expressed in dollars.

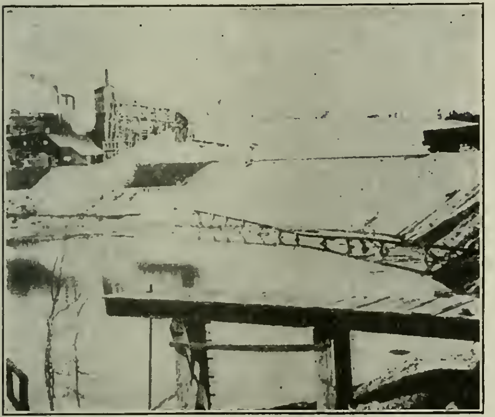
On the above basis it can be shown that with 4c. lead, the critical assay is 42.5%; with 5c. lead, 38.3%; with 6c. lead, 34.9%; with 7c. lead, 31.9%, and with 8c. lead, 29.8%.

With a fixed price of lead the assay of the middling can be calculated, and material containing less than this amount of lead should be re-crushed to insure the greatest possible profit. If the general mill concentrate is treated on the tables before shipment, it is possible to estimate the two critical points discussed above; and the three different products can then be sent to the proper destinations.

Having discussed in a general way the economics of the case, and indicated how the critical points may be determined mathematically, it is pertinent to consider how the theoretical information can be put into practical use. One manner of making the division of the general mill concentrate is by means of a central re-treating plant; and, where possible, it is advisable to use tables instead of jigs, thus avoiding the abrasion which would be caused by the latter, and permitting an easy observation of the material being re-treated.

One reason for re-treatment is to check up the work of the mill man. This need becomes more and more necessary every day. Poor operation should not be permitted in any plant, but if this condition does exist—and it is getting more common every day—the only means of counteracting such inefficiency is to place a central re-treating plant under the charge of one man who will be directly responsible for the grade of concentrate shipped.

Another reason for re-treatment is to provide a high-grade product for the smeltery, which is specially equipped for the handling of high-grade lead concentrate only. A re-treatment plant eliminates the possibility of shipping any product that will not return a profit to the company; it permits the separation and re-treatment of any product that will show an increased profit by so doing. The operation of a re-treatment unit should result in an increased metallurgical extraction of the entire plant. At first it might seem that if the general mill concentrate were re-treated a certain loss would result. Although this assumption is correct, it must be remembered, on the other hand, that a re-treatment plant will permit the elimination from the original mill system of a great deal of abrasion on the jigs, and will also remove a troublesome middling product.



THE DAM AT MINE LA MOTTE, MISSOURI

Re-treatment May Eliminate Excessive Jig Bed Abrasion

I have known cases where the re-treatment unit has increased the metallurgical extraction of the entire plant, for the above reasons. In many plants, in the attempt to obtain clean concentrates from the jigs, an enormous amount of abrasion is made on the jig bed. When one considers that the volume of a sphere is only 50% of the volume of a cube, both of unit measurement, it will be seen that the loss due to abrasion may be very serious. With a re-treating plant in operation, the concentrate can be discharged from the jig much sooner, and any free gangue removed on tables, thus eliminating this excess abrasion.

Furthermore, in many middling circuits there is frequently much free mineral, which is circulated for the simple reason that no provision exists for its elimination. By the use of a re-treatment plant, such middlings can be deprived of their free-metal content and a true middling then returned for re-grinding. A re-treatment plant makes the operation of the mill much more fool proof, and there is no occasion for expecting an increased metallurgical loss. If the concentrates being re-treated are, for any reason, so clean that no low-grade material can be removed from them, it is easy to ship all the different products from the re-treatment plant, which also serves as an excellent pilot mill and makes it possible to check the operation of any particular part of the main mill.

Re-treatment Not Always Applicable

In every case the economics of the problem must be worked out to determine if re-treatment is logical, because in some instances it is not advisable. No general rules may be laid down, any more than a general rule can be formulated for any part of ore concentration. The process to be followed in re-treatment of concentrate is simple; and in a properly designed installation the entire plant can be operated by one man. Wherever possible it is desirable to have a plant in the main mill, but the re-treatment plant should be installed as a complete separate unit, with its own individual power supply and accessory equipment.

It is not always advisable to send all the concentrate to the re-treatment plant, because in many cases it is possible to make a high-grade finished concentrate direct from some of the primary tables. The portion of concentrate to be re-treated is laundered to the main elevator of the re-treatment plant, elevated, and de-slimed. De-sliming can be effected either by the use of a cone or classifier. If the former is adopted, the spigot product is treated on Butchart concentrating tables, set to yield three products—a finished concentrate for shipping, an intermediate-grade product, and a low-grade product. The intermediate-grade product would be crushed in rolls and re-treated, yielding a concentrate for shipment, and a product to go back into the main mill circuit. The low-grade product from the tables would either go back into the main mill circuit or be ground in a ball or tube mill. The latter system may be advisable in some cases, as it definitely removes the middling which is so likely to build up in a mill circuit.

The overflow of the classifier is settled in tanks, the overflow of which can be sent to the flotation plant. The spigot product of the settling tanks is treated on Butchart tables, which yield (1) a high-grade concentrate for shipment, (2) a small amount of middling products which is circulated, and (3) a tailing, containing the fine free gangue, which is sent to the flotation plant. Such a plant can be operated by one man, who should be able to handle practically any tonnage of concentrate which may be made in the main mill.

According to a consular report, it was officially announced in Mexico that more than 400 mining properties would soon be returned to their owners in the State of Chihuahua. Properties belonging to the Creel, Terrazas, Pascual Orozco, and Victoriano Huerta interests, however, will continue to be retained by the government.

Nature and Uses of Capital in Mining

By J. R. Finlay*

A monograph on the nature and uses of capital as applied, more particularly, to the mining industry. The writer, an authority on the subject, discusses the length of life of a mine, the essentials of a mining investment, and the factors affecting the return of capital invested. Comparisons between the cost of erecting a new plant and remodeling an old one are made, and pertinent conclusions drawn as to the fallibility of a priori calculations in this respect. Concrete examples are given to illustrate that industrial success is now more dependent on capital and effort than on bonanzas. The Excess-Profits Tax, government and private ownership, and other topics are discussed, and differentiation is proffered to distinguish between profits and capital. The paper, which will subsequently form a chapter in a revised edition of the author's treatise, "Cost of Mining," concludes with a review of the principles of the valuation of mining properties.

THE price at which mine products are sold is not determined wholly by the cost of extracting them, but frequently by the difficulty of discovering them. Once found, an orebody is a prize—that is, if it is rich enough—and its value is established even if it lies in parts of the world remote from the centers of industry. It is obviously no test of the highest efficiency merely to make such a mine pay. The real test is to secure from it the greatest value possible. This problem involves not only the skill of the explorer and the miner, but also some consideration of the use and purposes of capital in ways not primarily entirely obvious.

One of the first considerations of this nature is the plain fact that the promise of a dollar at some distant date is not as valuable as its immediate possession. This is just as true of incomes as of single payments. It requires little argument to convince a man that if he is to receive a total income of $10,000 he would be better off if he got it in 10 years than in 20; better off if he obtain it in 5 years than in 10; still better if he receive it in hand at once. As a matter of fact, if interest on money is worth 5% a year, his $10,000, if paid in installments covering 20 years, would be worth barely $6000 at present; if he could get it in 10 years, it would be worth $7500; in five years, $8500; only if paid immediately would it be worth the full $10,000. If the same ultimate return should be spread over an indefinitely long period, say 100 years, his annual income would be only $100; and his capital, that is, the value of his possession, would be only such a sum as $100 would be fair interest on—a paltry $2000.

Application to the Mining Industry

These are surely not considerations merely for the banker or the financier, but apply with equal or greater force to anyone to whom the possession of goods, the acquisition of food, clothing, and comforts is a matter of importance. It is but a short step to the conclusion that an indefinitely long continuance of income which can never total more than a certain amount is not a desirable objective, but is distinctly an objectionable one; so much so that it would be excellent business to spend money to remedy it. Such considerations have a wide application in the mining business. An orebody the discovery of which is valuable is invariably limited in extent. If it were not limited, either its discovery would not be valuable, or a single discovery would serve all future purposes, which would be the same thing. Therefore, the miner attacks his deposit fully convinced that it contains only a certain quantity of valuable product; that it is worth while for him to secure and enjoy this product as soon as possible, instead of waiting indefinitely for a slow dribble of output; and that his problem is to explore the mine intelligently, so as to equip it, that its working may afford the maximum satisfaction to the owners. This problem may be reasonably stated as that of creating the greatest *present value* for the property.

Length of Life of Mine a Variable Factor

From this point of view, to my mind a just one, it will be found that the business enterprise based on a limited deposit will have a life of maximum desirability. Many writers on the economics of mining, such as Hoover, Ross E. Browne, and Smyth, have given examples which seem to show that discovered ore, or even the entire mine, should theoretically be worked out in a short time, say from three to nine years. This, of course, if there are no exterior obstacles, such as the danger of oversupplying markets, to prevent it. It appears, however, that the length of life which will create the maximum present value is inherently a variable, depending on the relative value of the capital required and the total value of the product, the rate of annual profit earned on the capital used in constructing and operating the plant, and the time required to put the plant in operation. Where the annual return on the invested capital is high, the life should be short; but when that return diminishes toward an amount such as will be only interest on money, the inducement to invest further capital for the purpose of hurrying output diminishes until it finally disappears altogether. When the return on capital is a mere interest rate, the life of the enterprise must be indefinitely long to justify the investment at all. At this point, indeed, the argument for the investment of further capital would be the same as would induce investment in government bonds —merely that one might have it to invest; and the effort and risk involved in initiating and managing an enterprise would remain uncompensated. At this point, of course, there will be no inducement for continuing the enterprise, and it will cease.

The Essentials of a Mining Investment

For several reasons that will be developed presently, these considerations promise to have greater weight in the mining business of the United States, perhaps in the world at large, than they have had in the past; and it seems worth while to ponder and resolve them. As a foundation for the discussion, the general conditions of a mining investment may be noted. It naturally includes, as essential elements, opportunity, time, effort, and cash, the value of all of which can, of course, be expressed in money.

---

*Mining engineer, 43 Cedar St., New York.

Omitting from the question of opportunity the matter of ownership, one may put down as a minimum the occurrence of ores in paying amounts. It is a point often overlooked that there is an essential difference between merely knowing that an orebody exists and having it so opened up that an output may be obtained from it.

The existence of many bodies of ore may be definitely established from mere geological observation or inference, or from drilling or some other form of exploration. This information is absolutely essential to the initiation of an industrial investment, and of course it must be paid for.

Delays and Extra Expense in Mine Planning Are Common

Once the decision to follow up these discoveries is made, considerable time is necessary for opening up and equipping the mine, the transportation system, mills and smelteries; in general terms, the required plant. In making and carrying out the plans for all this work there is abundant opportunity for mistakes, delays, and the deficiency of human comprehension and foresight. These are factors that are, generally, optimistically minimized. Why is it that a house planned to cost \$3000, and let on contract at that price, when it is finished has cost \$4500? Simply because neither the builder nor his contractor could think of everything that had to be done. When the contract is finished it is discovered that the house is not complete. This involves both parties in additional expense and in unexpected delay; for the builder will certainly not be satisfied with an unfinished house; it will be nothing short of a desolate disappointment. If the prospective house owner cannot afford to go on with it, he will have to confess it a failure. The next time he builds a house, of course, he will be on his guard against these contingencies that cannot possibly be foreseen. One does not know exactly what the "unforeseeable" will turn out to be, but he knows it is there.

Industrial Arts in State of Evolution

This homely comparison illustrates an element of every engineering project. It is particularly worth remembering that the industrial arts, including mining, have been for a long time, and still are, in a state of evolution. There is no standardized plan or pattern of plant, operation, or organization. Each new group of entrepreneurs may reasonably entertain hopes of improving upon their predecessors, in some respects at least; and in any event they invariably expect to make special adjustments for their own special conditions. Nothing is more common than to change plans after actual construction has begun, even on large-scale plants; indeed, sometimes the changes take the radical form of increasing the whole scale of operations, perhaps to take advantage of further developments of ore or to provide for working additional property. Thus though American engineering projects are generally carried out energetically and promptly, and on a large scale, it is entirely imaginary to consider them products of either invincible skill or of unerring judgment. They invariably cost more time and money than is foreseen, or for which plans have been made. The large group of Western mines known as the "porphyry coppers" is an excellent illustration of all these points. The time required to get a plant running from the moment of initiation was between three and seven years. The Inspiration Copper Co. is, of all, no doubt the greatest engineering success, but it is, at the same time, an example of all these causes of delay. Before it was finally launched as a going concern its properties were increased by various consolidations, its plants were designed for different outputs, and construction was interrupted to make a radical change in milling methods —from water concentration to oil flotation.

Modifications in Old Plants Involve Difficulties

Whatever may be said of starting a new plant may also be said of making radical additions to an old one; indeed, unless the original plant was especially designed in such manner as to facilitate additions, the difficulties are actually greater, for the operating plants are likely to get in the way of the additions and to compel the engineers of the enlarged plant to put up with a scheme that is sure to be, in some respects, antiquated and unsatisfactory.

It is, then, apparent that to change the scale of a mining operation is a matter requiring from three to seven years. It may be approximated at four years. Theoretically such a requirement seems unreasonable, but if one is to deal with the business as a practical matter of finance, it is far safer to count upon the actualities of experience than upon the calculations of theory. Of course all plants do not require the same amount of time. The small and often rude equipment needed for the shallow zinc mines of Southwest Missouri and Oklahoma may be built and started in a few months. But such plants are not only unrepresentative of the average conditions in the mining business, but are, after all, only incomplete installations.

The general tendency is toward elaboration of method and comprehensiveness of plan. If the operators in the Miami district consider their business in the aggregate, say as a matter of establishing an output of 100,000 tons of spelter a year, they will perceive that this is no problem of starting to dig ore from a 40-acre lease, but of exploring thousands of acres of land and of building smelteries and power plants. Such an operation would probably require the four years which, it appers, has been required to start the average Western copper mine. It may fairly be assumed that mines which may be quickly started, or quickly placed upon a new operating basis, are not really complete industrial units, but merely minor parts of a broader scheme already functioning. It might almost be said that they are not really mines, but *stopes*.

Estimates Based on Expenditures in Parallel Instances Preferable to a Priori Calculations

Here, then, an abrupt practical limitation to theoretical calculations of present values is encountered. If a mine could be worked out to advantage in three years after a plant is running, it is at least an embarrassment to have to wait four years before it can be started. Almost the same observations apply to the cost of plants as to the time required. *A priori* calculations are seldom adequate. The safest estimate will be the one based on the total expenditures that have been necessary for a similar plant.

It is easy to forget working capital altogether. The amount needed is usually equal to the cost of operating for between six months and a year. Thus, a company which expends $500,000 a month will need from $3,000,000 to $6,000,000 working capital. The Miami Copper Co. may be taken as an example. That company, in 1915, produced about 42,000,000 lb. of copper. Its capital accounts stood as follows:

CAPITAL ACCOUNT, MIAMI COPPER CO. 1915

Mine property	$1,535,000
Mine development	1,417,000
Construction	3,059,000
Working capital	3,000,000
Total	$9,011,000

If at that time it had been considered desirable to double this output from the same property, it might have been estimated that the scheme would not have been completed before 1919, and the capital account for an output of 84,000,000 lb. would have stood about as follows:

CAPITAL REQUIRED TO DOUBLE 1915 OUTPUT

Mine property	$1,535,000
Mine development	2,834,000
Construction	6,118,000
Working capital	6,000,000
Total capital required	$16,487,000

An increase of capital amounting to nearly $7,500,000 is indicated. In 1915 the normal earnings were about $2,250,000 a year, and, if the operations had been merely maintained on the same scale in the four years required for increasing the scale of operations, the company might have paid $9,000,000 to its stockholders; but if the enlargement were to be paid out of earnings, it could have paid only $1,500,000 to the stockholders. What length of life would be required to justify this course?

A Concrete Example

It is estimated that in 1915, with a life of thirteen years, the stock of the mine was worth $27 a share. It is plain that the increase would not benefit the stockholders unless it would increase the present value of the stock, that is, the value in 1915. Of course, such increase would have to be figured into it from the expectation of increased dividends to be obtained as the result of the project. It is easy to understand how this would work out from the standard calculations of the value of a series of installments of income.

The four installments of reduced income totaling $1,500,000 equal 50c. a share for four years. The expectation of these payments was worth, in 1915, $1.75 per share. In 1919, the company would go on a basis of $6 a share for four and a half years—at which time the mine would be exhausted. By doubling the output the life of the mine has not been shortened by one-half, but merely from thirteen years to eight and one-half years. This is the stumbling block to increasing value by increasing output: it must be paid for by delay in receiving earnings. In 1919 the value of $6 a share for four and one-half years would be about $23. But this was not the value of these installments in 1915. Nobody will pay $23 for $23 to be paid four years hence. One would lose money unless the sum was discounted by an amount which would constitute interest on payment for those four years. The actual value in 1915 would be about $19.16, to which would be added $1.75, the present value of the four minor installments; making a total value of $20.91. But the stock was worth on the former basis $27.

Many variations could be introduced into such computations. For instance, one might take into consideration the final liquidation of the working capital, which is an asset that would be worth less to the stock on the long-life basis than on the shortened-life basis. But to go into such niceties is a waste of time, in view of the already obvious fact that the increased scale of operations is not warranted, but would involve loss and wasted effort, and would be, in short, an engineering and financial blunder of the first magnitude. But there must be some volume of ore and some length of life that would justify doubling the output.

The conclusions set for this have been based on a total production of 18,000,000 tons, equivalent to thirteen years' life at 1,400,000 tons a year. The present value may be calculated on that basis, and on the doubled basis beginning in 1915, and assuming longer lives for both projects.

COMPARATIVE-PRODUCTION SCALE

Scale 1,400,000 Tons a Year			Scale 2,800,000 Tons a Year. With Four Years' Delay	
Tons	Life, Years	Value per Share	Life, Years	Value, 1915
21,000,000	15	$30.00	9½	$1.75 + $23.00 = $24.75
28,000,000	20	36.00	12	1.75 + 31.55 = 33.30
35,000,000	25	40.50	14½	1.75 + 38.75 = 40.50
42,000,000	30	44.20	17	1.75 + 45.00 = 46.75

Thus it will be perceived that not until the volume of ore is doubled will it pay to double the scale of operations. The inference is that the Miami mine was skillfully exploited in the first place.

These calculations must not be confused with other factors which might (and, as a matter of fact, do) enter into the situation. The output of the mine has actually been increased by one-half without a corresponding increase of plant cost, but merely through the instrumentality of minor alterations and adjustments. This fact does not enter into my argument, for the circumstance that such adjustments could be made means nothing more than that the capabilities of the plant had not been fully worked out and utilized.

Operating Plants at Part Capacity Not Economical

Any increase of output, without additional expense for construction, is pure gain. Anything short of running a plant at full capacity is uneconomical. The shortening of the life of a mine by such means (that is, without the use of additional capital) is so obviously advantageous that consideration of the arithmetical factors involved seems superfluous.

The real point of this discussion remains to be brought out. It will be noticed that the earning power of the capital invested in plant and working capital on the Miami ores is 30% per year. The minimum life required to return this capital with 5% interest is 3.8 years. It will not pay to double the scale of operations unless the life on this scale exceeds 25 years. At a smaller increase of capacity, say 25%, it is found that the present value will be increased slightly at a life of less than 25 years. It is plain that when the capital return is 30%, and the time required for initiating an enterprise is four years, the scale of operations to give the maximum value should be such as will give a life of between 20 and 25 years. A consideration of a variety of factors that might be introduced, such as the possibility of initiating plants in a shorter period than four years, would involve interminable arithmetic, and would probably be tiresome without adding materially to the clarity of the subject.

It is evident that the time required for plant installations is an important element in the problem of the intelligent use of capital, not only in mining but in industry in general; and that where the return on capital is high, and the warrantably assumed life of an enterprise is short, the possibility of loss through delay becomes proportionately greater. Thus, if the earnings upon capital are 100%, if it requires four years to start a plant, and if the capital required is in use an average of one-half the time required for its investment, it is plainly impossible to discover any promise of profit in an enterprise that will run less than two years after the plant is started. It is rare indeed that earnings will be so large, although there have been instances where they have been much greater.

Success of Industry Now Mainly Dependent on Capital and Effort

For example, the Goldfield Consolidated mining and milling plant probably cost about $2,000,000 in the aggregate and required two and one-half years for completion, but it immediately began to earn profits at the rate of $6,000,000 or $7,000,000 a year. A single year's operation would compensate for the investment, the time, and the effort. But such instances are merely spectacular accidents which are less and less likely to be repeated. The main tendency in the mining industry is toward less dependence upon the discovery of bonanzas and more dependence upon capital and sustained industrial effort.

The number of mining enterprises in this country that are rich enough to warrant an operating life of less than five years would probably constitute only a minute fraction of the industry, and one certainly not worth public attention. There are, of course, many mines in the country whose earnings on the capital invested are, say, from 25 to 50%, but the largest mining enterprises are already far below that figure. In the case of the United States Steel Corporation, the capital invested averaged before the war no less than $140 per ton of finished product sold each year, and the earnings only $8, or less than 6%. If money is worth 5% interest, the shortest justifiable life of such an investment is more than 40 years. If the earnings on capital are 10%, the shortest justifiable life will be 15 years.

High Returns Obtainable Only From Bonanza Deposits

It may be worth while to repeat, for the sake of emphasis, that the shortest justifiable life is that which will merely return the capital with such interest as might be obtained merely by lending the money on good security. When one comes to take account of the difficulty of guarding against chances of failure, such as lie in the overestimate of the ore supply, underestimate of cost, unfavorable changes in prices, or in absolute accidents, it seems venturesome to consider a return as low as 10% a safe margin for investment. To justify it, it is necessary to count on exterior factors, such as a probability that the business would continue to expand indefinitely instead of being limited to an exhaustible deposit. Perhaps I shall not be far astray if I assert that most mining enterprises are based upon a return of between 10 and 50% on the money required for development, plant, and working capital; that these returns vary according to the relative abundance of the materials handled, and that the higher returns are obtainable only upon bonanza deposits of which the mere discovery is a matter of capital importance.

These statements are likely to be misunderstood unless the basis for them is thoroughly explained. It is possible for one intent upon showing the extraordinary profits of a mine to take for an example some notable bonanza, and explain to the public that its great earnings come from practically nothing. This is often done for two diametrically opposite purposes. On the one hand, the stock promoter uses the figures to tempt speculation; on the other, theorists on social systems seize upon them as examples to illustrate the inequalities and injustice of the distribution of wealth which lie in "capitalism." Both representations may fairly be attributed to the fact that a little knowledge is often a dangerous thing.

The United Verde Extension Company

Take as an illustration the most remarkable mining bonanza of recent times, the United Verde Extension copper mine. This property was discovered by the present company at a cost of about $275,000. It immediately began shipping ore running more than 25% copper, and within three years under war prices it was earning at the rate of $12,000,000 a year. These facts sound exceedingly extravagant; but, when they are examined in terms of the normal conduct of business, modifications will be found at once.

In the first place, the expenditure of $275,000 was not really all the money put into this discovery. It was merely the amount required to put through the fortunate and decisive chapter of it, which was the reorganization and re-financing of an existing company. Exploration had previously been carried on for many years without success, and a large sum of money, I do not know how much, but certainly many hundred thousand dollars, was spent. This was not lost, because the work done pointed the way to ultimate success. Thus the actual cost of the discovery must have been nearly $1,000,000, instead of $275,000, as usually stated. Furthermore, the money spent by this company on this property was only a small part of the outlay on account of this particular bonanza; for, as soon as the discovery was made, other explorations were undertaken, right and left, in part by the very people interested in the Verde Extension; and millions were put in without resulting in the discovery of even a dollar's worth of ore. The real cost of the discovery, therefore, was not $275,000, but several millions. If it were a matter of importance, the exact amount could be determined with fair accuracy.

The next modification is that the apparent profits were for a time doubled by war prices. A further modification is that the sums stated as earnings have not been paid to the stockholders. Only a quarter of the amounts have been disbursed as dividends, and the stated earnings never will be so paid, for they have been expended in the construction of a plant, the development of the mine, for working capital, and for war taxes. If there had been no war prices, the earnings would have been, in 1916, 1917, and 1918, so much smaller that the dividends would have been certainly less than half of the $6,667,500 actually paid.

But the consideration that is really obscure to those who do not take the trouble to reason it out is the fact that the earnings that went to stockholders really came from borrowed capital. The new bonanza mine had no equipment of its own to enable it to put copper on the market. Railroads had been built for other mines, by which smelteries, also built for other mines, could be reached. The owners of the United Verde Extension had to pay a toll out of the richest of its ores for the use of that capital; and it paid in the form of profit on freight and treatment. To ship those richest ores was only a fortunate and temporary expedient. The enterprise needed a plant of its own, in spite of all the assistance of this kind for which it could negotiate. The construction of a smeltery, a tunnel, and a railroad to connect it with the mine; of shafts, machinery, and living accommodations for employees (these being nothing short of two townsites, one at the mine, the other at the smeltery); the purchase of land, and the creation of a working capital have actually absorbed from $12,000,000 to $15,000,000. If the work had been done under pre-war conditions, these requirements would have been smaller by perhaps a third. But the mine cannot continue to ship the extraordinary ores that were obtained in these first years; and its earnings certainly will not average as much as 50% on the capital required to establish and operate it.

Industrial Success Often Achieved by Using Part of Prize as Capital

The individuals who accomplished the reorganization of this company reaped extraordinary profits. They drew a capital prize in the lottery of nature by paying for only one of the tickets. It is equally true that they used this prize with skill and acumen, and out of it built up an extensive industry by using a part of their prize as capital. The property is a first-rate example of adventure and success—the kind of enterprise that has been the spirit of the mining industry, keeping alive the desire for fresh efforts, and lending zest and even romance to the development of the country. There are elements in our national situation which make it worth while to inquire whether this sort of enterprise is to continue freely, or whether it is to be curtailed and discouraged. The importance of this question has been accentuated by the war, through the increase of taxation that is the invariable concomitant of wars.

There is no question that the mining industry should pay its full share to support the Government and every national enterprise in proportion to its income and profits. But it is exposed to the danger of confiscation of capital under the guise of "income" and "excess profits." The manner in which this may be done is evident from preceding discussion and examples. The revenue law of 1918 was passed when the wave of enhanced profits due to high war prices was rapidly receding. Costs were rising by leaps and bounds, and prices were either fixed or falling; profits were not much above normal and promised soon to become subnormal. The law carried a provision for taxing "excess profits" up to as much as 80%, and the question of the amount of profit was to be determined, not by the relation of the war earnings on an ounce of gold or a pound of copper to the normal earnings on an ounce of gold or a pound of copper, but by the nominal capital of the enterprise. For instance, there was acute danger that, according to this law, the capital of the United Verde Extension would be put down at 50c. a share, 10% allowed on this value for normal profits and the remainder taxed 80% as "excess profits." In the meantime, many persons had bought this stock at over $40 a share on an expectation of normal profits—that is, not counting upon war prices at all—and the actual profits were little, if any, above what might have been earned in ordinary times. According to the plan of the law, 80% of the earnings would be swept away. On these terms four-fifths of the capital of actual investors would be confiscated. Two questions may logically be considered: (1) What was the normal profit of the product of this industry, and (2) what was the capital in this industry.

Excess-Profits Tax

Before proceeding with the second point, it is reasonable to interject the conclusion that an excess-profits tax on real excess profits, as a war measure, is hardly open to objection. The United Verde Extension might, under average pre-war conditions, expect to make 10c. profit per pound of copper. Now, if it were making 20c. during the war, it would be not unreasonable to say that it was making 10c. "excess profits." A tax of 80% of that amount, even in addition to other ordinary income taxes, would not be confiscation. But the question would not necessarily be disposed of even at that point, for it would still be necessary to scrutinize the receipts and expenditures of all mines according to a uniform principle, in order to fix the amount of profit fairly. There would, however, be no objection to the theory if it could be applied properly.

It is hardly to be expected that the American nation will be influenced permanently by the psychology of a war period. There is no immediate prospect of more wars in the future than there have been in the past. This country has been engaged since the Revolution in wars of greater or less importance about 7% of the time, and its ordinary disposition is to dismiss the question of war as an abnormal and improbable contingency. Nevertheless, steps are taken during these occasional wars that have unexpected results in times of peace. A tariff to provide war revenue may be converted into "protection," a policy which may or may not favor some industries at the expense of other industries.

Government Administration of Public Utilities May Be Chrysalis of Government Ownership

A temporary stopping of brewing and distilling has been converted by war psychology into permanent and constitutional prohibition much sooner than would have been the case normally. Similarly, the marked increase of taxation on incomes, as a war measure, may develop, or degenerate, into a deliberate and sustained attack on capital. Government administration of railroads, as a temporary expedient, may be the chrysalis of government ownership. The net result may be to multiply the number of government employees, multiply the weight of the machinery of government, and to substitute for the independence of individual initiative a general dependence upon governmental employment. There are many who regard all these tendencies as desirable, who, indeed, look upon anything that can secure a majority of votes as not only desirable but sacred. It is hardly worth while to hold fixed opinions as to the merits of such tendencies. It is more to the point to discern, if possible, how powerful they are and what forces lie behind them. To make such an analysis is entirely beyond the scope of this discussion, but it seems as if I cannot be far wrong in drawing a general conclusion that the mainspring of most of the tendencies of social, political, and economic legislation is faith in coöperative effort as against individual effort, and doubt as to whether this coöperative effort may properly be left to individual owners. The efficiency of great corporations has been demonstrated in many industries. Would not still greater corporations, even one all-embracing corporation, the government itself, be still more efficient? Would not such an institution automatically make all the people comfortable and relieve all of the terrors of making a living?

Private Ownership Still a Fundamental Law

But this conception is still only a theory, and will undoubtedly remain so. It is easy to comprehend how the coöperative or integrating movement will reach absolute limits, in the form of intricacies of detail which would be beyond the power of any corporation to master. When the tendency to integration is forced by its momentum beyond its proper boundary it is sure to be overcome by the reaction of disintegration.

The right of private ownership of property is still recognized by the fundamental law of the land. It is a natural desire of every man to have something of his own which he can alter, dispose of, or lend to suit his own whim. Whenever the theory of government interference goes far enough to deny the whims of a large enough number of people, it will meet effective resistance. Thus far it has been easy to draw some distinction between great aggregates of "capital," generally typified in the name of some individual whom magazine writers have made as mythical as Hercules or Theseus, and private property. No person with a spark of ambition or initiative wishes to deny himself the right of owning property and increasing it. The world is not ruled by the passive and timid, no matter how greatly they may preponderate in numbers. It is ruled by the aspiring and energetic.

Now, the mines of the country are not owned by a few rich and decadent beneficiaries of privilege, but by a huge army of stockholders, investors great and small, whose capital is, by overwhelming preponderance, the fruit of their own efforts and their own virtues—of frugality, industry, enterprise, and ability. These people have a decided interest in holding their capital intact, and not having it reduced or dissipated by ignorant—perhaps malicious—taxation of "income." This scheme of taxation is, apparently, in the minds of theorists, whose number is apparently increasing, a convenient way of meeting the increased expenses of the Government. These expenses are to be permanently increased not only by the interest on war debts, but by the growth of Government bureaus, which has been greatly stimulated by the war, and by a general expansion of the policy of the Government which it will be difficult, no doubt, to nullify.

Difficult To Differentiate Between Capital and Profits of Mines

What, then, is the capital of mines? There appears to be no sure way of fixing capital, or of distinguishing it sharply from profits. Some may be disposed to argue that capital is the actual amount of money invested in a given project. This conclusion does not seem to fit the case except momentarily. When an enterprise is launched the amount of money put into it is, of course, the amount upon which a return is expected; but it is always a mere accident if the return is just equal to the amount required. It is far more likely to be either below or above that amount. If below, a part of the investment is lost, because the enterprise does not yield an amount sufficient to return it to the owners. If above, a gain is made, because the yield is greater than the amount required to return the investment. In one case the capital diminishes; in the other it increases. In neither case does it remain stationary.

If an investment is disappointing, no amount of explanation will restore the capital; therefore everyone must admit that it involves a loss of capital. If it be argued that the capital in a successful enterprise does not increase, then one is forced to look forward to the extinction of all capital, for it is self-evident that, if some enterprises lose capital and none gain it, the process of investment must be one of destruction.

Again, what is the amount invested? Must it be money drawn from a bank, or can it be some other form of value? Take, for instance, a mine. One party contributes $1,000,000 in actual money for equipment; another contributes a tract of land, on which, say, $10,000 has actually been spent, but which nevertheless is accepted by the first party at a valuation of $3,000,000. That the transaction is made in good faith is proved by the fact that the party which contributes all the money is satisfied with only one-third of the property. In this case, a frequent one, the question may be asked: Is the amount invested the $1,010,000 which may be traced to actual money transfers, or is it the $3,000,000 agreed upon as the basis of the property transfer? My assumption is that the investment is the latter sum. I would assume, further, that this sum is the capital put into the enterprise at the time the bargain is made, but that it is not necessarily a permanent measure of the capital, any more than the $10,000 in money, put into the land, was a final estimate of the value of the land.

Capital Must Have Value

This train of argument leads to the conclusion that if one is to admit the existence of capital at all, he can describe it only as so much "value." The origin of that value must be ignored, and attention devoted to the practical matter of how to measure it. I believe this conclusion is one which has been upheld, and will continue to be upheld, by the courts as well as by financiers. It seems utterly absurd to argue that capital can be limited by the mere process of setting down certain figures. It is equally out of the question to attach commercial significance to how much capital could be credited to an enterprise or to an individual at any past date. The fact that a rich man of today was a penniless boy 50 years ago has no bearing whatever on the amount of capital he may own. Similarly, a mine yielding $1,000,000 a year is surely an asset, and that asset is capital, without any regard to the fact that it may have been started by prospectors without a bank account, and by dint of manual labor.

Valuation of Mining Properties on Proper Basis

As to the process of establishing value, I have always argued that it must be traced to commercial transactions. It is not reasonable to attribute theoretical value, for instance, to the metal lead. Theoretical figures might perhaps be worked out for it, based, say, on its relative abundance compared with other metals, or on some such consideration; but nobody would pay any attention to them. The value of lead is always established by its price in the open market. The value of a lead mine must rest on that price, and be figured from the amount that can be marketed, the cost of production, and the time required to complete the operation. If these additional factors (quantity, cost, and time) are uncertain, as they usually are, it is obvious that the valuation of the mine is a much more intricate and less reliable matter than that of the metal which it contains. As a matter of fact, grave mistakes are frequently made. Properties which are accepted by the public at high valuations finally turn out to be worthless.

The facts stated present a forceful argument for not accepting stock-market quotations as indicative of the value of mining companies, although it must be admitted that, in the majority of cases, those quotations do give a reasonable approximation of the values. But mines are not staples, as are the metals that they produce, and market quotations upon them are of a different order from quotations on staples. Thus, lead in a warehouse is always marketable. Its price varies between certain limits, of course, but the market value, whatever it is, is always there. But no such certitude or permanence is apparent about the stock of the mine. Today it may be in high favor; five years from now it may be worth twice as much, or nothing at all; and the quotations bear no definite relation to the price of the metal, but are influenced strongly, often decisively, by other factors.

Again, one can never be certain that the valuation of stocks by market quotation reflects in all cases their actual worth. Many properties are not on the market at all. Of those actually before the public, some may be in high esteem, skillfully advertised, and distributed among a large number of holders; others may be scarcely noticed, with few holders and few transfers; and the market may be merely nominal. It is conceivable that the highly advertised stock might bring twice the price of the obscure one, even though both have the same actual merit.

Question of Valuation of Mines Should Receive Frequent Review

I think these considerations are generally conceded to be convincing reasons for subjecting the valuation of mines to a searching and independent review every time such property becomes the object of an important transaction. I think the Government should recognize this fact in its dealings with mines. In former times those dealings were, from a financial point of view, of slight importance, but under present conditions the settlement of taxes is for prosperous concerns a transaction of the first order. It follows that it is highly desirable for the Government not only to permit but to encourage a rational method of valuation, which can be applied at any time at the instance of either party.

If the purpose of a government is not to promote fair play among its citizens, then it must be prepared to exercise its forces regardless of fair play. This does not sound well, for the consequent inference is that if the organized powers of a government are not necessarily to be used to secure justice, they may be used for oppression. An attitude of this kind, therefore, is tenable only as an excuse for temporary confusion, and not as a real policy. It follows as a practical conclusion that a government must adopt a logical and equitable theory of distinguishing capital from profit.

My conception of such a theory may be summarized as follows:

1. The capital is the present value that could be realized from the liquidation of an enterprise, through normal commercial transactions.

2. Profit is a fair interest upon the capital.

3. In the case of a property like a mine, in which a profit can be made only by using up its physical resources, income is never wholly profit. In the case of an unprofitable enterprise, the income is merely a partial return of money actually invested. In the case of a profitable enterprise, it is partly capital and partly a return on that capital.

When such a property is short lived, the proportion of capital required each year is large. As the length of life increases, the annual installment of capital diminishes. Thus a property which is to be liquidated in three annual installments requires an annual return of capital equal to more than 31% of the total value; whereas one that is to be liquidated in thirty annual installment requires only a return of 2%. Let it be supposed that, in each case, the income is $1000 and the interest rate 5%. In the three-year property, the present value is approximately $2790; the annual income is $930 principal and $70 interest or profit. In the case of the thirty-year property, the present value is $15,000, and the income is $250 principal and $750 profit. In the first instance the capital return required is 93% of the total income; in the second, only 25%. These figures are only approximate, but they illustrate the point.

From this it is clear that, as a matter of calculating income tax, the question of the proportion of profit is more a determination of expected life than of anything else. When the life is unlimited, the capital installment is zero, and all income is profit.

Rio Tinto Co., Ltd.

The annual report and statement of accounts of the Rio Tinto Co. for the year ending Dec. 31, 1918, shows that, during the year, the company, at the request of the British government, created peseta mortgage bonds in Spain for fifty million pesetas. The proceeds were placed at the disposal of the British government. The company's exchange operations benefited by this transaction, and its liability toward the Spanish bondholders is kept fully secured by a Treasury guarantee, together with the deposit at the company's bankers of sufficient British government securities.

The total distribution of dividends for the year amounted to £1,018,750. The interim and final payments on the ordinary shares are equal to a total dividend of 50% for the year. The total amounts paid in all the dividends, if spread over both classes of shares, would represent 29% on the whole share capital of the company.

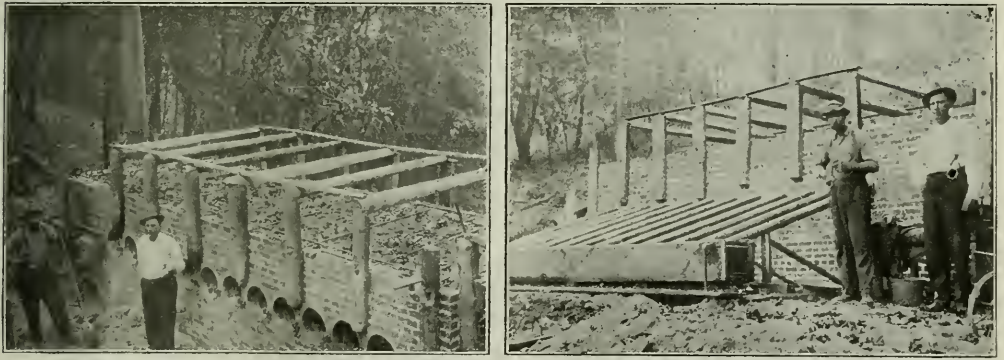
During 1918, great difficulty was experienced in connection with company undertakings. For want of fuel, all the steam shovels and many of the locomotives were unable to work, the mining and other operations necessary for producing and shipping the pyrites needed by the British and foreign explosives factories being largely carried on by hand labor. Smelting operations were also affected, and could be carried out only on a reduced scale. Iron used in the precipitation of copper was so high in price that the cost of copper produced by the wet process was double that of normal times.

Cinnabar Ore in Jackson County, Oregon

By A. E. KELLOGG*

AN OFFICIAL examination of the cinnabar ore deposits in the Gold Hill district was made in 1913 by A. N. Winchell, in charge of the field work of the Oregon Bureau of Mines. H. M. Parks and A. M. Swartley, of the same bureau, made mention of these deposits in their 1916 "Hand Book of Oregon Mines," and are jointly responsible for the estimates and conclusions herein given.

Geologically, the Gold Hill district is an area chiefly occupied by old Paleozoic sediments interbedded with sills or flows of andesite and greenstone, the sedimentary rock striking northerly, usually about N. 15° E., and dipping eastward at angles ranging from 65° W. upward. Diller[1] has shown that Jurassic beds west of this district have been overturned so that the oldest strata now overlies the younger formations. It seems possible that the Paleozoic sediments are also overturned, and that the limestone found on Kanes Creek is probably of early Paleozoic age, and fossils found in limestone lenses on this creek indicate that they are not Devonian. Diller suggests that they are Silurian rather than Carboniferous in age. Accordingly, the Paleozoic sediments in this district are referred to as the Devonian or Carboniferous or to both periods.



A FRONT AND REAR VIEW OF A TYPICAL 12-PIPE MERCURY FURNACE OPERATED IN THE OPEN IN THE CINNABAR-ORE DISTRICTS OF GOLD HILL, OREGON

Long after the formation of the sedimentary rocks, the region was intruded from below by a mass of molten igneous mass is now exposed to view in the mountains, by the same agency, the bedded rock solidified beneath a considerable thickness of sediments or other rocks, which have since been removed in some places. The igneous mass is now exposed to view in the mountains, and it seems probable that it underlies, at considerable depth, the major part of the Gold Hill district. This igneous intrusion and intense folding appear to have elevated the region sufficiently to cause a new cycle of erosion and the formation of coarse sediment which could not be transported far by ordinary agencies. Therefore conglomerates were produced, and these were succeeded by feldspathic sandstone during part of the Cretaceous period.

The history of quicksilver in this district dates from 1878, when an early settler discovered cinnabar ore in the meadows on Evans Creek 12 miles north of Gold Hill, on what is now known as the Chisholm group of mercury mines. Since that time and until recently the settlers distilled mercury from the ore taken from this deposit by roasting it in crude open furnaces, and supplied quicksilver to the gold-placer miners, who used it to save the fine gold in the sluice boxes.

The Chisholm mine is situated at an elevation of 2500 ft. on the south slope of the Umpaqua Mountains, in a heavily timbered district. The vein, which occurs along a graphite-sandstone contact where the granite is in part pegmatitic, and strikes N. 53° W., has been exposed by adits for 2000 ft., the greatest depth attained being 75 ft. The mineralized zone is from 100 to 200 ft. wide, and follows an irregular contact. The ore contains cinnabar, native quicksilver, pyrite, gold, zinc sulphide, silver, and a heavy black mineral resembling meta-cinnabarite. Samples taken from all of the adits assay from \$5 to \$6 per ton in gold, 5 oz. in silver, 2.5% zinc and 1% mercury. The cinnabar appears all through the ore and also in the hanging and foot walls in the form of seams and kidneys. These seams are from 6 to 20 in. thick and contain an average of from 17 to 70% mercury.

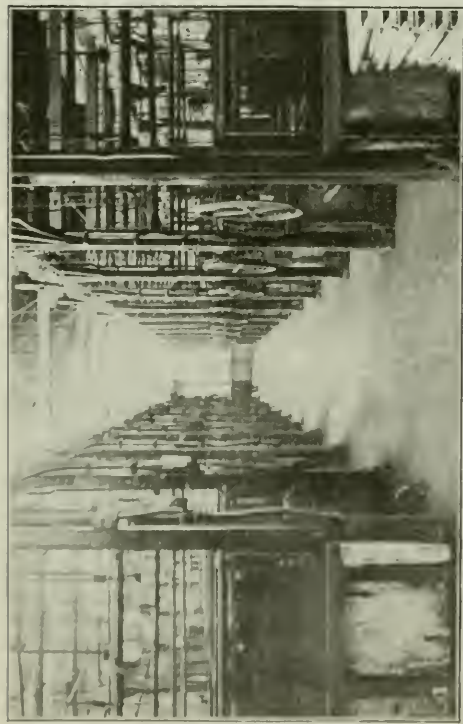
This description, as to formation and contents, is equally applicable to the dike which extends northward from California into and through Jackson, Josephine, and Douglas counties, Oregon. This dike makes its first appearance in Oregon in the bedrock of the famous "49" placer diggings four miles northwest of Ashland. Other dikes, which have been considerably faulted, appear as laterals from the main dike through the country; on the west in the Applegate district extending into Josephine County and on the east into the Butte Creek district. The main vein or dike makes its next appearance north in the meadows, where the Chisholm mine is situated, and thence extends over the Umpaqua Mountains into Douglas County, where the rich cinnabar deposits are still in evidence.

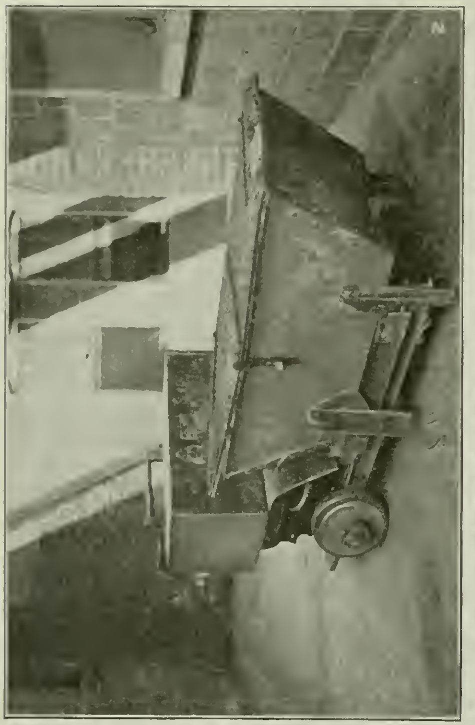
Every Victory Note is a Monument to the heroes who sleep in France. Buy to the limit.

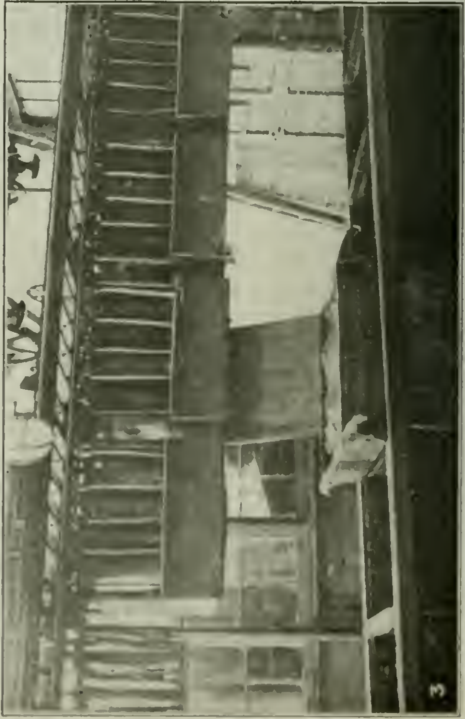
---

*Box 173, Gold Hill, Oregon.

[1] U. S. Geological Survey *Bull.* 546, pp. 18 and 22.







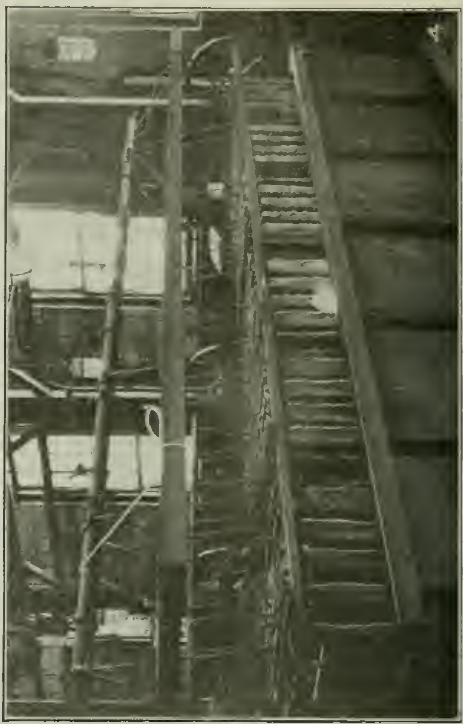


FIG. 1. TANK ROOM. FIG. 2. TRUCK FOR TRANSFERRING THE ANODES. FIG. 3. METHOD OF REMOVING DEPOSITED SILVER. FIG. 4. SUSPENSION OF CATHODES

The Electrolytic Refining of Silver and Gold*

By GEORGE G. GRISWOLD†

An account of refining silver bullion electrolytically, by the Moebius process, at the works of the American Smelting and Refining Co., at Perth Amboy, N. J., The Wohlwill plant for electrolytically refining the gold bullion, and recovering from it platinum and palladium, is also described. The explanatory illustrations that accompany this article are on the opposite and succeeding pages.

THE first electrolytic plant for the treatment of doré bullion was put in by the Kansas City Smelting and Refining Co., Argentine, Kan., in 1884 or 1885, by Dr. Moebius. This worked satisfactorily, and was followed by other installations. The second plant was at the Perth Amboy works of the American Smelting and Refining Co., and was of the Moebius vertical type. Dr. Moebius afterward patented a horizontal system with traveling silver belts for cathodes, a small installation of which was made at Perth Amboy, but it did not prove as satisfactory as the vertical type. When the parting plant was destroyed by fire, in 1897, it was decided to install the vertical system in the new plant. The decision to adopt this system was due to its greater capacity for a given floor space, smaller tie-up, and the fact that, being run in connection with a lead refinery, the anodes could be cheaply made 990 fine or better.

The new tank room contains 24 sections of 6 tanks each, the sections being in series and the tanks in multiple. In the original installation the tanks were made of wood, which was never satisfactory, and, consequently, stoneware tanks were used in the new plant. The anodes, weighing about 100 oz., are cast by hand in the lead refinery, and transferred in locked steel boxes, by a storage-battery truck, to the parting plant. They are weighed, counted, and punched, and are then used as required. The punching gives a slight depression on each side of the ear of the anode, thus furnishing a secure hold and better contact for the spring clips which support them.

THE CATHODES

The cathodes are made from cold-rolled silver sheets $\frac{1}{32}$ in. thick. There are four bags and five cathodes in each tank, and each bag holds four new anodes. Seventy-five percent of the silver is deposited in 24 hours. It is constantly brushed from the cathodes by wooden sticks, rigidly attached to a wooden frame having a reciprocating motion, which serve to prevent short circuiting, and also to give circulation. The deposited silver falls into wooden silver boxes, and is removed daily by dropping the hinged bottom of the silver boxes, which dumps the silver into a tray, from which it is emptied into a wooden silver car, provided with a false bottom and filter. The car is transferred to vacuum boxes, and the silver is washed and then transferred to the melting room, where it is dried, melted, and cast into bars.

The electrolyte is a neutral nitrate solution containing 15 to 20 gm. silver and 30 to 40 gm. copper per liter. Silver nitrate is added as required, and enough electrolyte withdrawn daily to keep the purity up to standard. The waste electrolyte is put in a wooden tank and the silver precipitated on copper, after which the copper is cemented out on iron, and the resultant solution, after passing over lime, thrown away.

Current was supplied by an engine-driven generator in the same building, and a current density of 19½ amperes per sq.ft. carefully maintained; but later it was found more advantageous to install a motor-generator set in the central power plant, and to increase the current density to 40 amperes per sq.ft., which increased the capacity accordingly. The current is carried from the switchboard by copper cables which distribute it through mercury-filled copper cups over ⅞-in. cold-rolled copper busbars, the end ones being bent to fit into the mercury cup when lowered into position.

BAGS FOR CATCHING GOLD SLIME

The bags which contain the gold slime are removed at regular intervals, and the contents sluiced into the gold box, thoroughly washed, transferred to iron boiling kettles, and treated with H_2SO_4, 66° Bé. to remove the copper and silver. The gold slime is washed, dried and cast into anodes for electrolytic refining by the Wohlwill process. The liquor from boiling the slimes is run into lead-lined tanks, and the silver precipitated out on copper. The copper-bearing solution then goes to the copper refinery.

The Wohlwill installation has five cells, and is in series with the silver sections. At the time it was put in, owing to the war, it was not possible to obtain porcelain, and stoneware cells were used. With the high current density of 150 amperes per sq.ft. osmosis develops in the stoneware; also, as it cracks with any unequal strain, it was necessary to place the cells in a lead-lined box filled with water heated by steam coils. The boxes are supported in a lead-covered table with cupped top.

MERCURY CUPS ON BUSBARS MAKE QUICK CHANGES EASILY EFFECTED

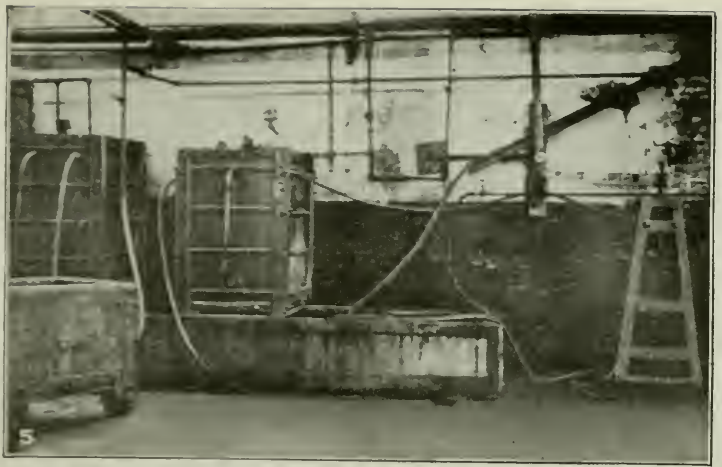
An interesting feature is the use of mercury cups on the ends of the copper busbars, whereby any unit or units can be cut in or out quickly by using cross bars, also of copper, with ends bent to fit into the cups. The cathodes are thin gold sheets, rolled from electrolytic gold, and are connected to the contact bars by bending one end of the sheet around them and clipping them fast.

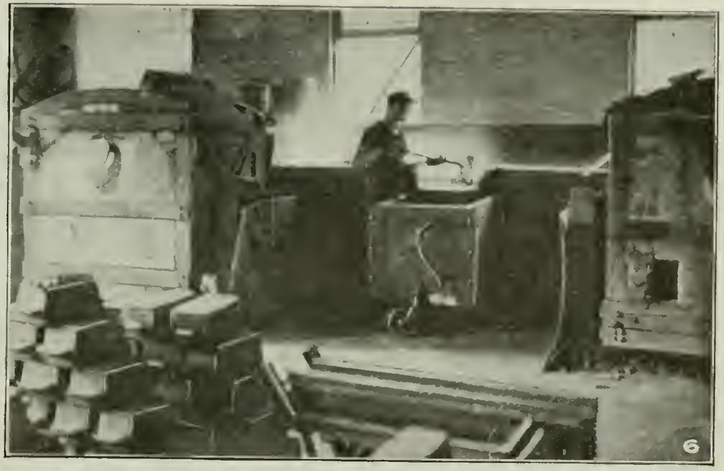
The electrolyte contains 30% free HCl, 80 to 85 gm. gold per liter, and varying amounts of platinum and palladium. When a sufficient percentage of these latter metals accumulates in the solution, a portion is withdrawn, and they are separated, refined, and sold as pure metals.

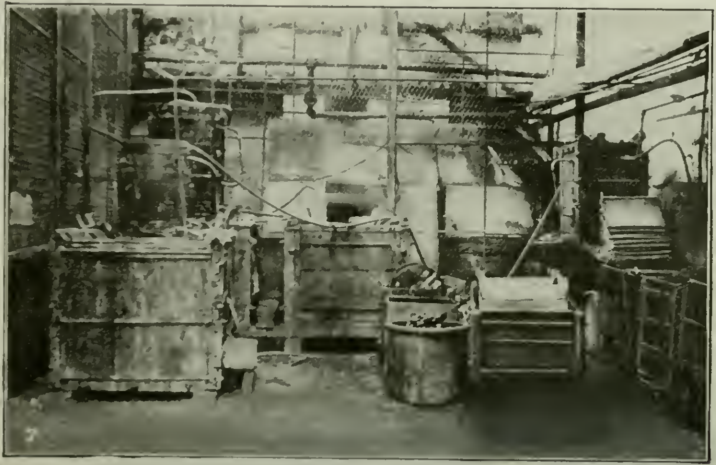
---

*A paper which was presented at the New York meeting of the American Electrochemical Society, Apr. 3-5, 1919.

†Superintendent, smelting and lead refinery, American Smelting and Refining Co., Maurer, New Jersey.







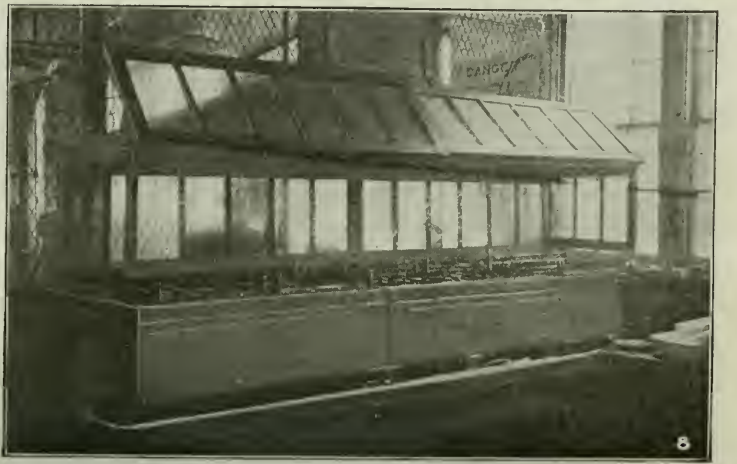


FIG. 5. VACUUM BOXES, SUMP TANK, AND SOLUTION PUMP. FIG. 6. MELTING FURNACES. FIG. 7. GOLD BOX AND BOILING KETTLES
FIG. 8. WOHLWILL GOLD-REFINING INSTALLATION

Iron-Ore Super-Taxation in Minnesota[*]

BY DWIGHT E. WOODBRIDGE[†]

The tax situation in the northern Minnesota iron districts has for several years been a precarious one, and subject to much bitter controversy in the State Legislature. It has been shown during each argument of the matter that increasing operating costs have reduced the miner's margin of profit, and that to increase his tax burden, already greater than that levied in other states where iron mining is carried on, will result in the suspension of that industry. In the following article it is shown that Minnesota, although producing 62% of the iron ore mined in North America, is in a keen competitive position with regard to other iron-mining districts of the world.

WE READ of the Mesabi Range and its share of the iron production of the United States. We know, for instance, that 62% of the iron ore mined in North America last year was mined in Minnesota; we know what enormous sums the iron mines pay in tolls to the state and in wages to labor, and what further vast sums the mines contribute in the form of Federal taxes, and incidentally in gross earnings taxes, and in almost every other form of tax imposition. Quite naturally we get the idea that there is nothing like the Mesabi Range; that there are no other districts to compete with it. But in this we are wrong. France alone has recovered from Germany in the last few months as much ore as there is in Minnesota.

PROMINENCE OF MINNESOTA IRON DEPOSITS DUE TO ECONOMIC CONDITIONS

Minnesota owes its preëminence in iron ore not only to the size and comparative ease of mining of its merchantable deposits, but also to the highway of the Great Lakes, to the development of automatic machinery, to the marvelous improvement in costs brought about by big railways, big ships and big operations generally, and, perhaps most of all, to the fact that many years ago, before the state was known to contain ore at all, a conjunction of markets, waterways, coal fields and iron ore made western Pennsylvania and eastern Ohio the great producers of articles made from iron. It was this conjunction of waterways, markets, and coal fields that led to the beginning of the Pittsburgh district as a producer of finished iron articles years before pig iron was made there.

The construction of the first blast furnace in Pittsburgh, in 1869, marked the drift of the markets from the Atlantic Coast to the interior, and it is to this incident that we owe the preëminence of Minnesota in iron ore. If the blast furnaces of this country were still situated east of the Alleghanies, in New York State, in Pennsylvania, in Maryland, as they once were, there would be no question of an iron-ore tonnage tax in Minnesota, for there would not be enough iron ore mined here to make it worth while, and our mines would supply the ore for only a few local and scattered furnaces. So long as 65 years ago there were in Maryland alone no fewer than 31 blast furnaces, and the Atlantic Coast states from Massachusetts to Georgia were dotted with them. But the Pittsburgh district was a better distributing center for the great new markets of what was then the West. Iron articles were fabricated there, and finally it became the world's greatest steel-making center.

Under present conditions it is cheaper to bring ore to Pittsburgh from the Great Lakes than from the Atlantic, and this is the secret of the development of Minnesota. I use the word Pittsburgh as typifying all that tremendous manufacturing region from Lake Erie to the Alleghanies; for railway rates are so fixed that all this region, the Lake Erie shore, the Mahoning and Shenango valleys, Youngstown, Wheeling and Pittsburgh, is on a parity.

A project is now under way for the construction of great steel mills on New York Bay. As I understand it, this project simply waits action by the Federal Government permitting of the filling of the Jersey flats near Newark. Ores for such a plant as it is designed to erect there will come from Cuba, from Brazil, from Newfoundland, from the states of New York and New Jersey themselves; from Spain, perhaps from Sweden and Norway. They are unlikely to come from the interior of the United States, and cannot, unless we are on a strictly competitive basis. This plant and others like it will be direct competitors of steel mills which secure their ore from Minnesota. With the building of such a fleet of American merchant ships as is planned, ocean freights will eventually be so low that bulk freight like iron ore will be carried at a small cost.

NINE WELL-KNOWN DISTRICTS CONTAIN WORLD'S LARGEST IRON-ORE DEPOSITS

There are eight or nine well-known iron-ore districts in the world. These are, in their order of size: Brazil; Newfoundland; Eastern France, Lorraine, and Luxembourg; Lake Superior; northern Sweden; eastern Cuba; Alabama and Georgia; eastern New York and New Jersey, and perhaps a ninth in Norwegian Lapland, north from the Arctic Circle around to the White Sea. All of these are competitive, one with another, in so far as the world's trade is concerned as to anything more than mere local and provincial business.

ECONOMIC EQUALIZATION OF VARIOUS DISTRICTS

It is a curious but none the less indisputable fact that Nature seems to have equalized the advantages and disadvantages of most of these great districts, so that almost every one of them, whether it contain high-grade ore or low, whether it is separated from markets by long distances or by short, or whether it is on all-water transportation or on rail, can compete on fairly even terms with each of the others, at naturally competitive points. This equality is so close that any added burden, however slight, put on one field, may be too much for it to overcome. For example, the ores of the Lake Superior field, more especially that portion of it represented by the Mesabi Range, are easily mined, have cheap transportation, but are at long distances from the ocean, and are of medium quality, whereas the ores of Brazil, 300 miles from the sea and 5000 miles by ocean to coal fields, are of exceptionally high grade, and mining there is mere quarrying.

---

[*] Abstract of a statement made to the Tax Committee of the House of Representatives, Minnesota Legislature, on Feb. 24, 1919, in connection with bills then before the Legislature providing for super-taxes on the profits of mining companies in the state.

[†] Consulting mining engineer, Sellwood Bldg., Duluth, Minnesota.

Cuban ores lie on the very beaches of the Atlantic and are on the surface, but they are lean and wet and require concentration to make them available The Norwegian deposits, situated long distances away and so low in grade that they too must be concentrated, are beside great water-powers which can be developed at low cost and will supply the necessary power for beneficiation treatment. The one striking exception to this general similarity of assemblage costs are the iron ores in Newfoundland. This deposit, twice as large as all those of Lake Superior combined and of as high a grade so far as blast-furnace results are concerned, lies partly under the Atlantic Ocean, and its ores can be mined and delivered at such ports as Philadelphia, New York, Liverpool, or Hamburg at from $2.25 to $2.50 a ton, or, say, 5c. per unit of iron. I am using in all of these figures not war-time costs, but those of a normal period, both as to mining and transportation. This Newfoundland deposit outcrops on the edge of the sea and covers an area of 25 to 30 square miles under the Atlantic. It is estimated by engineers that it contains about 3½ billion tons of ore now merchantable. It is cheaply mined, because no timbering is required and because the deposit is without any mixture of rock and is homogeneous.

The ores of Cuba are distant from New York only by 1100 miles of cheap water transportation. They lie on the sea and are adjacent to harbors, and they are the soil itself, so that no expensive stripping, no high preliminary costs, no long railways, are necessary to enable them to enter the market. Cuban ores can be delivered at American Atlantic ports at not far from 7c. per unit.

BRAZIL DEPOSITS LACK DEVELOPMENT

In Brazil are the greatest high-grade deposits known to the world, and estimates indicate not less than five billion tons. Before the war, plans were far advanced for the development of these ores and their delivery to England and the United States, and we learn that now these plans are being revived and that in a short time mines will be opening and these ores will enter the market. Because of their exceedingly high and other desirable attributes, and their lack of phosphorus, they must be counted on to attain and hold their deservedly important place.

The ores of Spain come to this country in comparatively small quantities, but it is a fact that during 1918, even with the high charge for ocean freights and with the great demand for shipping for war purposes, more than 100,000 tons of Spanish ore was sold for delivery at Philadelphia.

Sweden has one deposit of one billion tons, and there is as much ore in northern Sweden as there is in northern Minnesota, and the grade averages better. These ores, though they do not reach this country now, have done so in the past and will do so in the future if our costs here are higher than their own.

The coast of Norway from the Arctic Circle to the Russian frontier near the White Sea, a distance of about 700 miles, is one continuous belt of iron-bearing country. Two vast deposits of ore are known to exist in the district, although undoubtedly there are many more. They are situated close to the sea and near water-powers. They can be mined and concentrated cheaply, and normal ocean freights are low. I have known the time when, for from $2.50 to $5 a ton, depending on the bulkiness of the materials, ships would carry cargoes half around the world. Such low rates, or lower, will undoubtedly return. The Norwegians have sold their high-grade concentrate, delivered in this country, at about 10c. a unit, or $6.50 a ton, in which presumably there was a profit.

HIGH-GRADE MAGNETIC DEPOSITS IN NEW YORK

New York and New Jersey contain in their magnetic ore deposits about two billion tons, and New York in its hematite deposits has about five hundred million tons more. The magnetic iron deposits in New York have already produced about forty million tons of high-grade ore, part of it the richest ever mined anywhere. There was completed last year a barge canal connecting these deposits with New York City, and boats have been built for the ore traffic. It is expected that by the use of these boats ore will be delivered in New York Harbor at about 5c. a unit. Steel barges are to be built to carry New York ore through Buffalo and the Great Lakes into territory served by Lake Superior ores, and it is stated that these ores will compete successfully there.

ALABAMA DEPOSITS IDEALLY SITUATED FOR FURNACE CONDITIONS

There are more than one billion tons of red iron ores alone in Alabama which were being mined a few years ago at about 90c. a ton, and there are no heavy costs for freight to furnaces. The furnaces are immediately adjacent. I know of one company which controls a strip of land one mile wide and four miles long. At one end of this strip are its iron mines; at the other end its coal fields; in the center its furnaces and steel mills rising out of limestone beds of a sort available for furnace use; and connecting the three is a double-track standard-gage railway which crosses in its four miles of length ten trunk roads. Nowhere in the world are conditions so favorable for the assemblage of materials required in the manufacture of pig iron. Nowhere in the world, unless it be in India and China with labor at a few cents a day, can pig iron be made so cheaply as by this company. This and other concerns in the same district are so situated with regard to ocean transportation that they can deliver and have delivered to Europe at the lowest costs. The influence of the Panama Canal must eventually raise at some point on the Gulf of Mexico, say at Mobile or Pensacola, one of the great centers of iron manufacture and export.

Michigan is having a tremendous expansion, and the ore beds of that state, though not exposed to the surface, as are some of those of Minnesota, may be as extensive and productive. As nearly as I can learn, taxes upon mines in Michigan are much less than they are in Minnesota at the present time. Figures given me by the county auditors of the three iron counties of Michigan show that taxes paid by mining companies there in 1918 varied from 1.5c. per ton on their output to as high as 15c., averaging about 8c. In 1918 the Steel Corporation paid about 28c. a ton on its production in Minnesota, and this year it must pay even more.

I do not think the Steel Corporation will be so seriously affected by additional tax burdens as will be the individual operator, the local Minnesota man who is developing small properties and who has put his own money into the mining game. These operators will be handicapped by additional taxation to such an extent that some of them must go out of business. If you wish to aid the collection into a few hands of the iron ores of Minnesota and if you wish to further the possibility of monopolistic ownership, you can do it more easily and quickly by passing tonnage-tax bills than in any other way, for you will force the small operator to abandon his properties, and no one can afford to work them who has not the advantage of being linked up with blast furnaces or steel mills.

I know of half a dozen drilling campaigns under way now in Wisconsin and Michigan, in a search for ore, in which an aggregate of more than a million dollars is being spent. I know of one large company in New York that is arranging to drill six miles of holes in its ore beds preparatory to extension of its mining operation. I do not know of one drill working in Minnesota in a search for orebodies.

COMPARATIVE COSTS OF MINING AND TRANSPORTATION OF IRON ORE

Situation of District	Tonnage	Average Per Cent. Iron Content	Assumed Cost of Mining (*a*)	Freights To Atlantic Coast	Freights To Valley Points (*b*)	Cost to Furnace per Unit of Iron Atlantic Coast	Cost to Furnace per Unit of Iron Valley Points
Brazil	5,000,000,000	68	$1.00	$4 00	$5.60	7.3c.	9.7c.
Newfoundland	3,500,000,000	50	1.25	1.25	2.85	5 0	8.2
Lake Superior	2,750,000,000	52	3.15	2.85	1.70	11.5	9.3
Sweden	2,200,000,000	57	2.00	2.00	3.60	7.1	9.5
Northern Cuba	3,000,000,000(*c*)	36	2.00	.90	2.50	5.8	9.0
New York and New Jersey	2,500,000,000(*c*)	35	2.50	1.00	2.60	6.1	8.9
Alabama	1,750,000,000(*d*)	36	1.00	.25	2.75	3.5	10.5
Norway	500,000,000(*c*)	35	2.50	2.00	3.60	7.5	10.2

(*a*) Figures are in part necessarily assumed, as in Brazil. For Newfoundland they are based on results. For Lake Superior the $3.15 average is because 50% of Lake ore has averaged $2.90 in cost at Lake Erie for the last six years, and knowing that this 50% has lesser royalties and greater steam-shovel proportion than on the remainder, it is assumed that the remainder costs 50c. more per ton, giving the $3.15 average.

(*b*) Freights and dock charges to Valley points from seaboard are assumed at $1.60. There is no rate, but the assumption is based on a set of about 25 rail rates covering iron-ore movement in the United States.

(*c*) The cost of ore to furnace is figured not against crude analyses but against an average iron content in concentrate produced.

(*d*) Alabama ores are smelted at the furnaces, and the figure of 25c. in column of "Freights to Atlantic Coast" is merely the switching and delivery charge from mine to furnace. To this should be added freight on product to the sea, to complete this comparison.

All the figures in the comparative-cost table are based on fairly normal conditions, both as to freights and mining costs, and are not to be considered as representing present conditions, except for tonnages and grades. It is exceedingly difficult to give a figure on freights from Brazil, as no iron ore has yet been shipped from that country. The figures given for other points represent perhaps sub-normal conditions in the ocean-tonnage markets, but they are based on conditions that are likely to return in the course of a few years.

The figures of tonnage and unit costs are based on the following, as well as other data: Brazil—British Department of Industrial Research; reports of the U. S. Geological Survey's officials; paper in the Transactions of the American Institute of Mining Engineers. Newfoundland—"Memoir 78," Canadian Department of Mines, page 7; the writer's personal estimates; E. C. Eckel, "Iron Ores of the World," p. 304; C. K. Leith, of U. S. Geological Survey. Lake Superior—U. S. Geological Survey, "Monograph No. 52," C. W. Hayes, Chief Geologist. Sweden—"Iron Ore Resources of the World," published by the International Geological Congress. Northern Cuba—Proceedings of American Institute of Mining Engineers, Vol. 42, pp. 73 to 169. New York and New Jersey—Proceedings of American Iron and Steel Institute for October, 1916; G. C. Foote, manager for Witherbee, Sherman & Co. in Transactions of American Institute of Mining Engineers, Vol. 56, p. 912; "Report of State Geologist of New Jersey for 1910," F. C. Nason, late State Geologist; various papers. Alabama—"Mineral Resources of the United States for 1906," Proceedings American Institute of Mining Engineers, Vol. 43, p. 291; U. S. Geological Survey, "Bulletin 400." Norway—"Iron Ore Resources of the World," issued by the International Geological Congress; the writer's own investigations; also reports of the Actieskelskabet Sydvaranger. The sources noted include but a few of the possible references confirmatory to what have been given above as the tonnages and other detail of competitive iron ores of the world, and touch on only the main groups of deposits.

The iron-ore people remember steadily that they are struggling against the imposition of a principle of taxation false in theory and vicious in practice, and they know that any tonnage-tax bill, however gentle and mild it may seem, is but the entering wedge for a constantly growing series of tax bills, each one worse than that before, which they can see following each other down the vista of the coming years.

There has been a good deal of loose talk with regard to the Steel Corporation, but that corporation is as truly an evolution and as logical as that of a national state growing from a community of farms and villages and cities. And for this reason: For all the period of our national growth until long after the Civil War, blast furnaces and rolling mills and iron mines and transportation interests were separated, and though their owners saw the advantage of combination, they were unable to consolidate, because of a lack of liquid capital. Their own demands, caused by their rapid growth, changed their liquid capital into fixed form so rapidly and to such an extent that to carry on their businesses they were obliged to borrow in large amounts, and they could borrow only on paper passed from one to another and indorsed. They could not have borrowed the money they needed had the different interests been combined into one company, for there could have been no indorsements by separate entities. But later their profits permitted the growth of fluid capital again, and their borrowing requirements were less, and they began to combine, and mines and mills and railways and ships formed the great aggregation of today. This is in brief the history of the growth of the Carnegie Steel Co. and of the United States Steel Corporation.

PREDICTIONS FOR IRON DEVELOPMENT IN MINNESOTA

Two years ago I appeared before you to urge that the Legislature do not pass a tonnage-tax bill, for I was helping to carry out a great experiment—an experiment that meant adding hundreds of millions of tons of iron ore to the resources of Minnesota; an experiment that, if successful, would virtually create iron ore out of waste rock. I said to you then that if the experiment succeeded it would make iron mining in the state perpetual, so far as anything in this transitory world can be said to be perpetual, and that we should do away with Mr. Bendixon's argument of a "vanishing heritage" in ore. I said that the margin of profit in the business would doubtless be close and I urged that you place no handicap upon us. Since that time a large sum of money—several hundred thousand dollars in fact—has been spent in the attempt to demonstrate our theory, and we are confident of success; so much so that we are now making plans for the construction of works that will cost several million dollars, to prove finally that all these billions of tons of waste rock are of value and will be the basis of an industry that ultimately will pay billions to labor in Minnesota from our own operations and from those of others who may follow us in time. The tonnage that this experiment adds to the resources of our state is far greater than I dared think two years ago, large as that was.

In the following table the gross returns on non-bessemer ore are rated on an analysis of 51.5% iron and 10% moisture. Rates apply after paying rail and Lake freight and selling charges, to get the ore to Lake Erie, where the base price applies. Actual shipments of Mesabi non-bessemer ore run about 1.5% under the base grade, and the price received will therefore be from 15c. to 20c. under the figure given in the price column.

Out of the "gross return to mine" come all mine costs, the amortization, all taxes, overload, development, unsuccessful exploration, insurance, shrinkage in transit, and the loss resulting from contract sales made at prices less than the standard, as well as the penalty resulting from the failure to ship ore meeting the base price, which, as stated, is a direct charge in itself of from 15 to 20% a ton.

GROSS RETURN TO THE MINE ON MESABI NON-BESSEMER BASE STANDARD ORE

Year	Mesabi Non-Bessemer Price	Rail Freight to Lake Superior	Lake Freight and Selling	Total Charges	Gross Return to Mine
1901	$2 75	$0 80	$0 95	$1 75	$1 00
1902	2 75	80	85	1 65	1 10
1903	3 20	80	95	1 75	1 45
1904	2 50	80	80	1 60	90
1905	3 00	80	85	1 65	1 35
1906	3 50	80	85	1 65	1 85
1907	4 00	80	85	1 65	2 35
1908	3 50	80	75	1 55	1 95
1909	3.50	80	75	1 55	1 95
1910	4 00	80	80	1 60	2 40
1911	3 50	80	70	1 50	2 00
1912	2 85	.60	60	1 20	1 65
1913	3 40	60	65	1 25	2 15
1914	2 85	60	60	1 20	1 65
1915	2 85	55 (b)	60	1 15	1 70
1916	3 55	.55	70	1 25	2 30
1917	5 05	55	1 20	1 75	3 30
1918	5 25(a)	1 00	1 20	2 20	3 05
Average					$1.89

(a) An average of the various prices set by the government during the year. (b) From June 1, 1915

Figures presented to the Federal Trade Commission under oath early in 1918 showed the cost of delivering Mesabi non-bessemer ore to Lake Erie to be $5.01. Deducting from this the cost of getting the material to Lake Erie, shown in the table to be $2.20, leaves $2.81 as cost at the mine. As shown, the gross return to the mine for that year on the standard-base ore of 51.50% iron is $3.05. As average Mesabi non-bessemer shipments averaged 50%, and as the unit price of non-bessemer ores was 11.36c., 17c. must be deducted from this $3.05, making the actual gross return to the mine $2.87, showing a theoretic net profit of 6c. a ton.

Mining in Australia

Melbourne Correspondence

The Chillagoe Co., of North Queensland, after many reconstructions, will soon cease to exist. The company was formed originally in 1898 to work the leases at Chillagoe and to construct a railway from Mareeba, in the Cairns district, to Chillagoe, a distance of 102 miles. The line was subsequently extended to Ethridge via Einasleigh, a distance of 147 miles. The railway has always been a good revenue producer, but the company's mines were unable to provide the necessary ore to keep the smelting works operating profitably. Finally the debenture holders took possession of the property, and as a result of an agreement the Queensland government has acquired all the company's holdings, with the exception of the Mount Mulligan coal mine, which will probably be sold to a new company. The railways will be placed under the control of the state-owned system; the smelting works will be reopened by the government for the benefit of the district, representations having been made that the small producers can find no outlet for their ore; and the government itself intends to operate the Einasleigh copper mine, which was the company's principal producer in recent years.

The failure on the part of the commonwealtn government to arrange for any extension of the copper contract, the embargo on the export of ores, and the low prices now ruling, are effecting the Australian mining industry detrimentally. The Electrolytic Refining the Smelting Co., Port Kembla, which refines copper from Mount Morgan and Mount Lyell and also purchases ore and matte from many of the other mines, has found it necessary to restrict its operations considerably; and, although the larger copper mines are still working, many of the medium-sized and smaller producers are closed down. The general feeling is that the position is only a temporary one and that conditions abroad, which are governing prices ruling here, will soon improve.

The position with regard to the silver-lead mines is not so acute as with copper, because of the fact that, until recently, the British government has been purchasing the lead output at a price equivalent to about £32, delivered in London. But now that this agreement has expired, the ruling low market prices for lead will seriously affect producers.

A deputation recently waited on the Commonwealth Prime Minister, to present a series of resolutions carried at the gold producers' conference. E. C. Dyason, president of the Victorian Chamber of Mines and managing director of the Bendigo Amalgamated Gold Mines, said that the proposals of the members of the delegation could be reduced to three main headings. The first was the abolition of the embargo on the export of gold, or, as an alternative, the paying of the "export parity" on the gold required in Australia. They desired this to apply only to new production. The second request was the removal of state and federal taxation on the gold-mining industry, and the relaxing or removal of the restrictions on the formation of gold-mining companies. At present the taxation was imposed largely on the basis of the few prosperous companies, and fell heavily on an industry which, as a whole, was not profitable under present conditions. In the third place, they desired the encouragement of prospecting by the federal and state governments. The conference decided that the best method of stimulating prospecting was to offer substantial rewards, as high, perhaps, as £10,000 or more, for good discoveries. The commonwealth would not lose if no discoveries were made, whereas, if they were made, the community would benefit immensely.

The only concession given to the deputation was a promise by Mr. Watt. For three months at least the free export of gold would be permitted, subject to a proper measure of control to prevent the gold getting into the hands of those whose possession of it might prove to be detrimental. This concession will apply only to new gold; and the banks are precluded from taking any part in it. To carry out the proposal the Australian Gold Producers' Association has formed a limited company, and all bona fide gold producers are being invited to join. The subscription, division of profits, and voting will be upon the basis of production. A shipment of sovereigns has already been made on behalf of the new association; and, although the full price quoted was not realized, it is understood that a satisfactory profit has been made.

Manganese Ore Mines of Ecuador from which a number of shipments have been made to the United States are situated near San Antonio, Ecuador, according to *Iron Age*. The claims cover about 1¼ square miles. The principal deposit so far discovered consists of a vein 3 to 9 ft. thick, and an extension of about 21,000 sq.ft. An analysis made by a New York chemist shows the following composition: Manganese, 46.36%; iron, 1.55%; copper, 0.02%; phosphorus, 0.140%, and silica, 6.44%.

Will It Come to This?

A plain consulting engineer
Is writing for advice.
I've sent the bill for a report
And had it sent back twice.
My client says, "The bill's too big,"
For a "thing so damned prosaical."
So I've changed the style to suit him, but
To me it's lackadaisical.

"Prosaical" means what it says.
Do you think that this way
Of writing in Walt Mason style
Would make my client pay?
And, with the "izes" running loose,
It hardly seems amiss
To ask if we will have to write
Our field reports, like this:

LOCATION

The claims that make the "Bull Con" Group
Are fourteen, to a fraction,
And situate along a line
Of great volcanic action.
They're two miles south of Hope Deferred,
A mile east of the river,
Where water for a mill is found,
And can be reached by "flivver."

TOPOGRAPHY

A line of cliffs, due east and west,
Rises to an elevation
Of more or less a thousand feet
Above the railroad station
At Hope Deferred. Out to the north,
A terminal moraine
Gives evidence conclusive that
The whole was once a plain.

GEOLOGY

The country rock in general
Is granite, pegmatitic,
With faults and dikes and sills and flows
In manner quite erratic.
The territory showing ores,
(By quite the larger fraction)
Shows many evidences of
A metamorphic action.

For half a mile. due east and west,
There runs a major fault,
Which proved a zone of weakness
To intrusions of basalt.
From north to south are other faults,
With filling porphyritic,
Of bostonite and biotite,
And others, andesitic.

Surcharged waters, from great depths,
With metamorphic action
Deposited the metals which
They held by least attraction.
Along the zone of major fault
Are many indications
That at a depth there may be found
Magmatic segregations.

DEVELOPMENT

But little work was ever done,
Aside from the shaft sinking,
And from its very nature shows
The prospectors were thinking
That they would cut "Bonanza" ores
To pay them for their labors,
Or they could sell the property
To one of their near neighbors.

The "Bull Con" shaft, two hundred feet,
Was sunk as an incline
Along the main fault, and with depth
Might make a paying mine.
The lowest level (Number Two),
Is just above a sump,
Where water from the workings is
Raised with a sinking pump.

The surface shows a lot of cuts
Put down to hold locations,
Or, put down on the cross faults, which
Showed plainest indications
That metamorphic action had
Effected depositions,
Or segregations had occurred
In shallower positions.

ORES

Along the pegmatitic fault
The ores have all been leached,
But in the main, and deepest shaft,
The sulphides have been reached.
The outcrop, now a gossan,
Is too poor to pay for mining,
Since the recent rise in charges
For both smelting and refining.

Where the sulphides were encountered
A condition has been noted;
The copper, lead, and zinc, and iron
Can probably be "floated."
Gold goes with the iron and copper,
Silver, with the zinc and lead.
This is demonstrated constant
When the assay sheet is read.

SAMPLES

Sample 1, from the first level
Shows the lead 19 p. c.
Traces each, of zinc and copper,
With 9 ounces of Ag.
Three feet of this ore was sampled,
While, out toward the hanging wall,
There is two feet of fault breccia
Showing values—none at all.

Ten feet further in the level
We cut Sample Number 2,
Which gave nine point five in copper,
And point seven three Au.
One point four was all the silver,
Two point seven of Pb.
Six point nine per cent. of sulphur,
Twenty-one per cent. Fe.

There was five feet of this sample
(Which was cut from wall to wall)
But, advancing in the level,
Values take a sudden fall.
Fourteen feet beyond the second
Sample, and right in the face
We find pyrite, very massive,
Gold and silver, but a trace.

Dropping to the second level,
Both the walls are well defined.
There has been a little stoping,
And some copper ore was mined.
From the smelter liquidations
On ores shipped in nineteen-eight,
Fourteen carloads, shipped to Denver
Barely paid the railway freight.

Sample 4 was from a prospect
On a cross fault farther west.
Shows a vein, though somewhat narrow,
High in silver, and the best
Of the samples that were taken.
(Nine hundred ounces to the ton)
And these ores resemble greatly
Those as shown by Sample 1.

The grade of ores from samples taken,
If averaged, would be
Five four Cu; point six Au,
And six point six Ag.
The leady ores show low Cu,
And are higher in Zn;
Pb nineteen, Fe fourteen,
Au but nought point ten.

The silver, one nine eight point four,
Was higher than expected
And, fearing it was "salted,"
Was properly rejected.
The ores are of a character
Requiring separation,
And this could be accomplished by
The process of "flotation."

RECOMMENDATIONS

The river level offers
A location for attack
That will provide for drainage, and
Can be reached by a track
Extended from the main line, from
The town of Hope Deferred,
The only serious drawback
Being costs to be incurred.

While the ores may not continue
To the level of this drive,
Every foot of tunnel driven
Gains a depth of four or five.
From the showing made in sinking,
Values, gaining depth, enhance.
Therefore, it is recommended,
Drive the tunnel. Take the chance.

CONCLUSIONS

Just like any mining venture,
Cash invested may be lost,
But the general conditions
Justify the tunnel's cost.
Values shown by careful sampling,
Show a profit can be made
Even if the ores extracted
Fall below the average grade.

Terms, as stated in the option,
Might be slightly modified
To extend the final payment
Till the tunnel scheme is tried.
The price demanded for the claims
Would really seem to be
Approximately what they're worth.

I. TISAGUESS, C. E.

Copper Mining in Venezuela

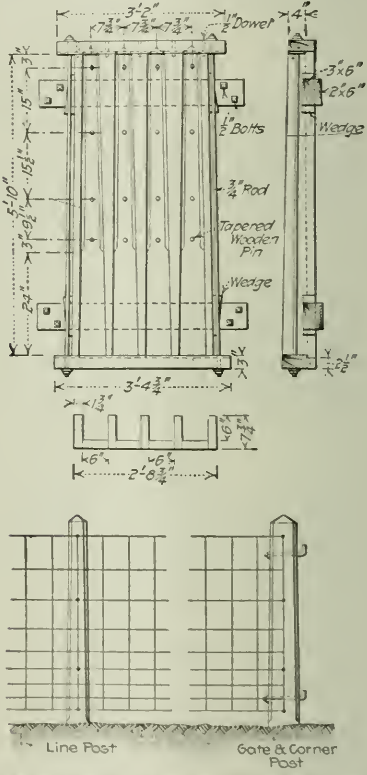
The only important mining operations in the Puerto Cabello district of Venezuela are carried out at the copper mines of Aroa, State of Yaracuy, by the South American Copper Syndicate, Ltd., a British corporation, states a consular report. These mines were first worked in the days of the Spaniards. From 1862 to 1880 they were under control of a British company, and a large output was reached. They were then closed for a period of about 15 years, after which they were reopened by the company now operating them. They have experienced unusual prosperity since the war. In 1917 the output was 11,289 tons of ore, containing about 7% copper, the largest production since the mines have been under control of the present company. The total output of copper ore in all Venezuela was 42,271 tons in 1917.

Form for Concrete Fence Posts

BY A. H. SAWYER*

A collapsible form for making four concrete line fence posts at a time is illustrated herewith. A form for gate and corner posts would be similar but larger, as these are 8 in. at the butt, 6 in. at the top and 1 ft. longer. The posts are designed to carry 40-in. field-fence wire, but the design can easily be altered to suit other sizes of fencing.

The holes in the posts correspond to the longitudinal fence wires, and are made by inserting tapered wooden pins in the form and removing them while the concrete is still green. Hook bolts ⅜ in. in diameter and of different lengths to suit the thickness of the posts hold the wire in place.



CONCRETE FENCE POSTS AND FORMS FOR MAKING

In the gate posts, two ¾-in. pipes are inserted to provide holes for the gate hinges, as shown in the sketch. The chamfering of the corners and pointing of the tops of the posts are easily done and considerably improve the appearance.

Lincoln Said: "Don't fail to keep that pledge and it will be the best act of your life." This advice applies today. If you couldn't assume your full share of Liberty Bonds in 1918, buy Victory Notes to the limit now.

---

*With Gulf States Steel Co., Brown-Marx Bldg., Shannon, Alabama.

Company Reports

Phelps Dodge Corporation

The annual report of the Phelps Dodge Corporation for 1918 covers the operations of the Copper Queen branch, Morenci branch, Burro Mountain branch, Copper Basin branch, and Stag Canyon branch of Phelps Dodge Corporation, together with those of the Moctezuma Copper Co., Bunker Hill Mines Co., and Phelps Dodge Mercantile Company.

The copper ore extracted in 1918 from the various properties amounted to 2,684,701 tons, of which 106,037 was mined and shipped by lessees. Of the total ores mined, 1,797,161 tons was given preliminary concentration and 887,184 tons smelted direct. The total amount of copper-bearing material smelted at the plants, including ore, concentrates, old slag, scrap, and cement copper, was 1,400,911 tons. The copper bullion contained 32,709 oz. gold and 2,307,307 oz. silver.

There was also mined and sold 5942 tons of manganese ores and concentrates from the Copper Queen and Bunker Hill mines and 704 lb. of molybdenum sulphide from the Moctezuma Copper Co.'s La Fortuna and Bella Union mines.

Of the ores and concentrates smelted at the reduction works, 1,168,882 tons was developed from the company's properties, 188,074 tons was general custom ores, and 43,955 tons was treated for the United Verde Extension Mining Company.

Unit costs in almost all operations show an increase, in sympathy with the increased cost of labor and supplies, although, as a whole, they have not risen to the same degree. Three adjustments of wages in the form of advances were made during the year, so that the wages during the last quarter were paid on a basis of 32-c. copper when the market price was only 26c. per pound.

Up to the time of the signing of the armistice maximum output was being well maintained, but since then the lack of demand for copper and the lower price have called for a drastic curtailment and reduction in costs.

The total output of the Copper Queen reduction works was in 1918 the largest in the history of the plant. Much valuable investigation work in connection with metallurgical problems was accomplished during the year, which will now be followed by large-scale tests to prove results definitely.

At the Copper Queen branch, credit is due to the mining department for maintaining production with, at times, less than 70% of the normal crew, as well as for keeping the major operating costs down, in the face of increasing labor and supply costs. The ore reserves at the end of the year showed a slight increase.

The metal produced from the ores of the branches and subsidiaries of the Phelps Dodge Corporation during the year was 169,035,687 lb. copper, 1,683,113 lb. lead, 1,772,119 oz. silver and 30,434 oz. gold; and, in addition, ores were purchased or smelted on toll at the reduction works, which yielded 43,348,592 lb. of copper, 973,040 oz. silver and 6778 oz. gold.

Dividends, regular and extra, to the amount of 24% were declared during the year. In addition, distributions of 6% were made from the reserve for depletion, of which 4% was declared in the form of U. S. 4¼% Liberty bonds. The dividend and the distribution declared in December were made payable in January, 1919.

Utah Copper Co.

The 1918 annual report of the Utah Copper Co. shows that the gross production of copper in concentrates and leaching plant precipitates for the year was 196,600,165 lb. The shipments of crude ore contained an additional 1,378,392 lb. After making smeltery deductions, the net production was 188,092,405 lb. The production of gold amounted to 50,928.217 oz. and of silver to 489,483.74 oz. The net cost of production of all copper during the year, after deducting miscellaneous income, including revenue as dividends from the Bingham & Garfield RR. Co. and deducting the value of the gold and silver contents, but not including the dividends received from holdings in the Nevada Consolidated Copper Co., was 14.533c. per lb., as compared with 10.995c. per lb. for the previous year. The increase in cost was caused by the large increase in the cost of labor, supplies, freights, smelting, and refining.

The net operating income was $13,807,302.65. The income from interest, rentals and dividends on investments amounted to $5,138,477.31. A direct charge was made against income for the amount contributed to the Red Cross and the United War Work funds in Liberty Bonds at their par value, $500,000. The total income applicable to dividends or for other capital purposes therefore aggregated $18,445,779.96, or $11.35 per share, as compared with $17.66 per share for the previous year. Total disbursements to the stockholders for the year were $10 per share, or $16,244,900, of which $12,589,797.50 was dividends and $3,655,102.50 in capital distribution.

The total amount distributed to stockholders down to and including Dec. 31, 1918, has been $92,015,782.50 in cash.

Chino Copper Co.

The annual report for 1918 of the Chino Copper Co. shows that the gross copper production for the year in concentrates and direct shipments was 79,340,372 lb. Smeltery deductions reduced the net production to 75,655,641 lb. In addition, gold and silver valued at $39,731.91 was produced. The net cost of producing copper for the year was 17.178c. per lb., as compared with 11.39c. per lb. for the year 1917. The increase in the cost of production was caused by the great increase in the cost of labor, supplies, freights, smelting and refining.

The net income was $4,010,272.15; miscellaneous income, rentals, and like charges were $43,051.75; total from all sources, $4,053,323.90. There was directly charged to income the amount contributed to the Red Cross and the United War Work funds in Liberty Loan bonds owned by the company, $145,101.65, being the cost price of $150,000 par value of these bonds. The total net income, therefore, amounted to $3,908,222.25, or at the rate of $4.49 per share, as compared with $10.93 per share for the year 1917.

Disbursements were made to stockholders during the year as follows: First quarter, dividend of $1.50 per share; second quarter, dividend of $1 per share; third quarter, $1 per share (being 75c. dividend and 25c. capital distribution); fourth quarter, capital distribution of $1 per share. Dividends and capital distributions for the year amounted to $4.50 per share, or $3,914,910, of which $2,827,435 was dividends and $1,087,475 was capital distributions. The total disbursements to stockholders up to and including Dec. 31, 1918, have amounted to $26,403,042.

Nevada Consolidated Copper Co.

The Nevada Consolidated Copper Co. has recently issued a report for the fourth quarter of the fiscal year ended Dec. 31, 1918. Production of copper for the quarter was 19,020,773 lb., as compared with 18,643,216 lb. for the preceding quarterly period. The total production of copper for the calendar year 1918 amounted to 76,607,062 lb. During the quarter, 985,665 tons of Nevada Consolidated ore, averaging 1.51% copper, was milled, as compared with 1,003,898 tons, averaging 1.50% copper, for the previous quarter. Of the tonnage milled, 68% was supplied from the pit and 32% from the underground workings of the Ruth mine. In addition to the treatment of company ores as above, 21,765 tons of customs ore was concentrated, and the resulting concentrate, together with 17,864 tons of customs ore and concentrates, was smelted at the Steptoe plant.

The cost of production per lb. of copper for the quarter, including Steptoe plant depreciation and all fixed and general charges, was 19.01c., as compared with 20.70c. for the third quarter, and as compared with 17.88c., the average cost per lb. for the first six months of the year. These costs do not include credit for gold and silver or miscellaneous earnings, which for the current quarter amounted to 1.82c., for the previous quarter 2.05c., and for the first six months of the year 2.53c. per lb. of copper. The comparatively high costs for the current quarter, as well as those of the preceding quarter, are occasioned by the higher freight rates imposed by Federal tariffs, additional refinery tolls, and continued high wage schedules.

The financial results of operations for the calendar year are as follows:

FINANCIAL STATEMENT OF NEVADA CONSOLIDATED COPPER CO., FOR FISCAL YEAR ENDED DEC. 31, 1918

Surplus balance Dec. 31, 1917		$13,180,525 97
Earnings from mine, investments and miscellaneous		3,459,879 73
Total		$16,640,405 70
Subscription to American Red Cross	$50,000 00	
Subscription to United War Fund	100,000 00	
Charged costs for plant abandonments	57,809 20	
Dividends paid at 3.25 per share	6,498,235 25	6,706,044 45
Surplus balance Dec. 31, 1918		$9,934,361 25

This statement is subject to such revision and correction as may be necessary, to include tax accrual adjustments, and other entries in the final closing of the accounts for the year. The reduced earnings for the quarter are based upon an average copper price of 17.23c. for the quarter. This low average price is due to the accumulation of an unusually large stock of unsold copper, which is held in company metal inventory at the established carrying price of 13½c. per pound.

Tennessee Copper and Chemical Corporation

The annual report for 1918 of the Tennessee Copper and Chemical Corporation shows that the production of sulphuric acid during the year amounted to 283,092 tons of 60° acid, as compared with a production for the previous year of 262,858 tons. The production of copper was 9,819,838 lb. from company ore, as compared with 10,547,708 lb. in the previous year. An arrangement was made with the International Agricultural Corporation under which an increased price was paid for all acid delivered in excess of 175,000 tons during the year 1918. Under this arrangement the average price received for acid was $6.49 per ton, but would have been considerably higher had not production during the last quarter of the year been curtailed by reason of the influenza epidemic.

Four increases in wages were granted during the year, and this, together with the high prices prevailing for coal and coke, largely increased the costs over those of the previous year and decreased the net profits. Dividends paid during 1918 amounted to $392,817.

American Zinc, Lead and Smelting Co.

The 1918 annual report of the American Zinc, Lead and Smelting Co. and its subsidiary companies shows that the total profits amounted to $911,415.98. Dividends on preferred stock amounted to $482,637. During the year the natural-gas zinc smeltery at Neodesha, Kan., was dismantled, as in large part also was the natural-gas zinc smeltery at Dearing, Kan., the gas supply for these smelteries being exhausted. Substantial amounts were realized for the material sold.

Improvements to properties during the year consist principally of additions to the zinc-oxide plant at Hillsboro, Ill.; additions to the sulphuric-acid plant at East St. Louis; installation of pumps and further development of No. 4 shaft at Mascot, Tenn.; additions and improvements to housing facilities at various properties, and installation of mechanical hearths at the lead smeltery.

U. S. Smelting, Refining and Mining Co.

The annual report of the U. S. Smelting, Refining and Mining Co. for 1918 states that, with the exception of the high costs pertaining to supplies, the operations in Mexico during 1918 may be considered to have run on a normal basis. The two mills treated 690,000 tons of ore during the year, approximately 58,000 tons a month. Extraction of ore from the new vein was increased from month to month, and will, before long, reach the anticipated steady tonnage. This ore being of much higher grade than the average formerly supplied to the Guerrero mill has had the effect of materially raising the mill heads, resulting in a substantial increase in profits. No difficulty is expected in maintaining these results. A moderate tonnage of the highest grade ore obtained from this vein is being shipped directly to the smeltery.

The output from this vein and from other localities, both in the Real Del Monte and Pachuca districts, is capable of an increase beyond the present capacity of the company's two mills. This situation will be met by the additions to the mills which were started last year and are now approaching completion. It is expected that by the middle of 1919 the capacity will reach 80,000 tons a month. The erection of a third mill of 15,000 tons' monthly capacity is still under consideration. Tests are not completed to determine the best process to be adopted in its construction, neither do costs and deliveries of materials favor construction at this time. In view of the more stable general conditions in Mexico, and the favorable results in opening up ore reserves, the prospects for earnings in these properties are favorable.

The metals produced in 1918, including those from custom ores and the production in Mexico, were as follows: Copper, 20,359,378 lb.; lead, 96,567,485 lb.; zinc, 18,771,684 lb.; silver, 15,337,465 oz.; gold, 137,315 oz. The profit for the year was $4,775,090.21, from which dividends amounting to $3,457,800 were paid.

Jim Butler Tonopah Mining Co.

A recently issued report, covering the operations of the properties of the Jim Butler Tonopah Mining Co., at Tonopah, Nev., for the period of 15 months from Oct. 1, 1917, to Dec. 31, 1918, shows that shipments aggregated 27,352 tons. The average metal content was 0.249 oz. gold and 21.97 oz. silver per ton.

The gross value of the metals in the ore produced by company operation was $724,009.13, or an average per ton of $26.15, as compared with the gross value of the previous year of $1,052,600.67 and the average per ton value of $26.12. The total operating costs were $13.61 per ton, or an increase of $1.67 per ton over the similar costs of the preceding year.

Development costs per ton were $1.75, as compared with $1.06 for the previous year. Transportation costs were reduced, by reason of the shipments to the Belmont mill at Tonopah rather than to the mill at Millers, from the 71c. for the previous period, to 53c. per ton. Treatment charges were reduced, on account of more favorable milling contracts, from $5.33 per ton during the previous year, to $3.98 per ton. Mill deductions (losses in tailings and shipping and marketing of products) were increased from $1.79 in the previous year to $2.14 per ton, a greater part of the increase being due to the higher value of the silver lost in tailings. Combined treatment charges and mill deductions were, however, less by $1 per ton than during the previous year. The percentage of profit during the period was 40.92%, as compared with 45.52% during the previous year. Dividends paid during the period aggregated $292,063.57.

Tonopah Belmont Development Co.

A report descriptive of the operations of the Tonopah Belmont Development Co. for the fiscal period of 10 months ended Dec. 31, 1918, shows that the Belmont mine and mill at Tonopah continued operations, with but minor interruptions, throughout the period. The Tonopah mill treated, in addition to 87,089 tons of Belmont mine ores, about 60,361 tons of custom ores, most of which was purchased from the Tonopah Mining Co. and the Jim Butler Tonopah Mining Co. The milling plant at Millers, Nev., which had been partly dismantled during the previous year, remained idle. The re-treatment plant for the milling of sweepings from the slime tailings ponds was operated for six weeks. From 87,089 dry tons of Belmont mine ores, earnings were $567,980.54. A profit of $14,373.76 was made from the treatment of 60,361 tons of custom ores; and from tailings-lease royalties, slimes re-treatment plant operations and miscellaneous earnings profits of $9,134.45 accrued.

Consolidated Interstate-Callahan Mining Co.

The annual report for 1918 of the Consolidated Interstate-Callahan Co., shows that the amount of ore delivered to the mill was 84,720 dry tons. From the tonnage taken from the mine to the mill there was 2757 tons of crude zinc ore, assaying 48.3% zinc and 3.46% lead; 1634 tons of crude lead ore, assaying 54.7% lead and 19.91 oz. silver, and 11,462 tons of waste sorted from the belt. The remainder, 68,867 tons, went through the mill. An average of 525 tons a day is now being mined, and the management expects to increase this output, so that an average of 6000 tons per month of zinc and lead-silver ores will be shipped.

The flotation section was completed in the early part of the year, and on June 1 the old part of the mill was closed for repairs, during which time the flotation unit was used to treat tailings. During June, July, August, September, and October, a total tonnage of 46,802 tons of slime tailing, assaying 13.96% zinc and 2.16% lead, and 37,245 tons of tailing, assaying 7½% zinc and 2.4% lead, was treated from the stockpile. This tailing was recovered by a Sauerman slack line cable excavator at low cost. The flotation concentrates made were passed over ten Deister-Overstrom slime tables and four Wilfley tables, and in this way it was possible to separate a lead from a zinc product.

Dividends paid during the period amounted to $456,222.25.

Butte & Superior Mining Co.

The Butte & Superior Mining Co.'s seventh annual report, that for the year ended Dec. 31, 1918, shows that 468,814 tons of ore was milled during the period, of an average content of 15.928% zinc and 6.335 oz. silver per ton. The extraction of zinc in the form of concentrate amounted to 92.965%. The total production of zinc concentrate amounted to 135,543 tons, with an average content of 51.217% zinc and 20.029 oz. silver per ton. Lead concentrate amounted to 2790 tons.

During the year an improvement in milling and concentrating methods was effected whereby the zinc concentrate production averaged 3.74% higher in zinc content and 2.23 oz. per ton higher in silver content than during the previous year, with an increase in extraction of 1.84 per cent.

Estimate of ore reserves, as of Dec. 31, shows 830,000 tons, averaging 17% zinc and 5.7 oz. silver per ton. The net operating revenue amounted to $12.617 per ton. Mining cost $7.591 per ton, and milling $2.951. The balance to surplus account amounted to $628,348.28.

Pending litigation and other conditions have caused the management to decide to defer declaration of dividend for the present.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief

The Anaconda Copper Mining Co. is expected to file the largest single claim which has yet been submitted to the War-Minerals Relief Commission. It is understood unofficially that the claim will be slightly in excess of $1,000,000. The smallest claim which has been filed to date is for $39.90.

The commission is not willing at this time to make public a full list of the claimants, with the amounts of each claim, but it is possible that this information will be given out later. It may be stated, however, that the following are among those who have filed the largest claims: Bethlehem Mines Corporation, Bethlehem, Penn.; Grasselli Chemical Co., Cleveland; Southern Pyrites Ore Co., Atlanta; Parke, Shepherd & Wilson, Batesville, Ark.; Sulphur Gulch Manganese Mines, Oakland, Calif.; United States-Canada Mining Co., Trenton, N. J.; W. A. Sanger, Big Pine, Calif.; John F. Barneberg, San Luis Obispo, Calif.; Wells Chrome Lease, San Francisco; Liberty Manganese Mining Co., Salt Lake City; Tristate Chrome Co., Spokane, Wash.; John Peterson, Helena, Mont.; National Mining Co., Wilmington, Del.; Karl Olsen, Wilmington, Del.; G. L. Finster, Patterson, Calif.; L. H. Van Horn, Jacksonville, Ore.; Hanna Minerals Co., Cleveland; Suffren Co., Inc., New York; St. Anthony Mines Leasing Co., Fanning, Nev.; Independence Mining Co., Batesville, Ark.; John Bouse, Berkeley, Calif.; Chestatee Pyrites and Chemical Co., Atlanta; K. G. McLaughlin, San Francisco; Paga Mining Co., Cartersville, Ga.; Collier Mines Co., Santa Fe, N. M.; A. H. Stow, Bluefield, W. Va.; Eureka Manganese and Mining Co., Cushman, Ark.; Chrome Mining Co., Philadelphia; Oklahoma-Kansas Mining Co., Miami, Okla.; Victor Rakowsky Co., Joplin, Mo.; Boulder River Chrome Co., Great Falls, Mont.; Oneida Mines Co., Duluth; Maryland Chrome Corporation, Baltimore; National Pyrites and Copper Co., Birmingham.

Sale of Sulphur and Nitrate Stocks

The Director of Sales, War Department, announces that contracts have been made to dispose of War Department surplus stock of sodium nitrate, sulphur, and copper. This material will be sold, by the firms contracting with the War Department, at current market prices. Anyone desiring to purchase part of this material should communicate direct with the companies concerned.

Sodium nitrate will be sold for the War Department by the W. R. Grace Co., Wessel, Duval & Co., and H. B. Baker Co., of New York City, and the du Pont Nitrate Co., of Wilmington, Del. The surplus stock of sulphur will be sold by the Union Sulphur Co., of New York City. The surplus stock of copper will be sold by the United Metals Selling Co., of New York City.

The sale of these materials will be extended over a period of time, and they will not be dumped on the market in a way that would change, in the slightest degree, the market price or market conditions.

The Rehabilitation of Europe

The obstacles in the way of an immediate great overseas trade to Europe are of two general kinds, positive and negative, the one tangible, as in the nature of an artificial barrier, and the other a void where there was formerly an active facility, writes Burwell S. Cutler in *Commerce Reports*. Embargoes answer to the first definition, and lack of ships and credits to the second.

Quick and heavy buying presupposes a fat and ready pocketbook, but the pocketbook is almost, if not quite, empty. Europe is in the position of a man who has overdrawn his credit at the bank and must come again to terms with his bankers—very severe terms—before his check is good for the next month's rent. A temporary policy of home economy against foreign goods is not only allowable—it is wisdom itself. Great Britain must turn out goods with which to pay its debts to us, for we already have plenty of gold to stabilize our currency, and further shipments to us would make remittance by British dealers for our merchandise impossibly expensive.

That some day trade on a vast scale to and from Europe is inevitable no one can deny. Exactly when it will have reached its maximum proportions, what seer can foretell? We cannot expect a sudden flowering of the golden bud. Many a frost may delay its growth. A misplaced geographical boundary as a cause of new war; an internal revolution with characteristic economic demoralization; the sudden ascendancy of a rabid protectionist or free-trade statesman; an inimical political alliance; a Germany too extensive or a Germany in fragments—such deterrents may possibly operate at one time or another. But gradually, through struggle and muddling and true inspiration, the European mélange will shake itself like a kaleidoscope into orderly arrangement.

The instinct of self-preservation will bring stability, as the indispensable condition of contented human existence. Here and there a factory will start and will need new machinery and raw materials; a home will be rebuilt, and will need furnishing; a railroad will be revamped, and will need rails—all of them simple supplies, but comprehensive and running into billions of dollars.

Claims Against Mexican Government

The State Department at Washington, recognizing the lack of standardization in the manner in which claims against the Mexican government are being filed, is now preparing a standard form for that purpose. It is expected that the final form will be prepared for approval by the middle of May.

As soon as it is available, copies will be sent to members of the National Association for the Protection of American Rights in Mexico, that they may re-submit their claims. The new form will supersede all previous ones in which claims against Mexico by American citizens have been filed. Those who intend filing claims are advised to await this new standard form.

April Mining Dividends

The decrease in dividends paid by copper companies continued in the month of April, 1919, reductions being made by Inspiration (from $2 to $1.50 per share), Phelps Dodge (from $8 to $2.50) Shattuck Arizona, (from 50c to 25c.), and Wolverine ($1 to 50c). Magma, New Idria and Ontario passed the quarterly dividends which would have been due at this time.

Dividends paid in April, 1919, by 19 United States mining and metallurgical companies making public returns, amounted to $5,025,926, as compared with $7,294,751 paid by 30 companies in April, 1918.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Smelters, pfd. A	U. S.-Mex.	$1.50	$146,071
Am. Smelters, pfd. B	U. S.-Mex.	1.25	42,962
Caledonia, l. s	Ida.	.01	26,050
Cresson Cons., g	Colo.	.10	122,000
Daly, l.s	Utah	.10	15,000
Electric Point	Wash.	.03	23,813
Golden Cycle, g	Colo.	.03	45,000
Grand Central	Utah	.04	20,000
Homestake, g	S. D.	.50	125,580
Inspiration, c	Ariz.	1.50	1,772,951
Judge, l.s.z.	Utah	.12½	60,000
Phelps Dodge	U. S.-Mex.	2.50	1,125,000
Portland, g	Colo.	.02	60,000
Shattuck Arizona, c	Ariz.	.25	87,500
Tonopah Belmont, g.s	Nev.	.10	150,000
Tonopah Ex., g	Nev.	.05	64,140
Tonopah Min., g.s	Nev.	.15	150,000
United Eastern, g	Ariz.	.07	95,410
U. S. Smelting, com	U. S.-Mex.	1.25	438,894
U. S. Smelting, pfd	U. S.-Mex.	.87½	425,555
Wolverine, c	Mich.	.50	30,000
Canadian and Central American Companies			
Asbestos Corpn., com	Que.	$1.25	$37,500
Asbestos Corpn., pfd	Que.	1.50	60,000
Belmont Surf Inlet, g	B. C.	.05	125,000
Cons. Min. and Sm., c.z.l	B. C.	.62½	261,936
Florence Silver, s.l	B. C.	.01½	17,650
Howe Sound, c	B. C.	.05	99,208
McIntyre Porcupine, s.g	Ont.	.05	180,514
McKinley-Darragh-Savage, a	Ont.	.03	67,431
N. Y. & Honduras Rosario, g.s	C. A.	.50	100,000
Nipissing, g.s	Ont.	.25	300,000

Canadian and Central American mining companies paid $1,249,239 in April, 1919, and $903,506 in April, 1918.

The totals for the first four months of 1919 are as follows, the 1918 figures being given in parentheses: United States mining and metallurgical companies, $34,459,932 ($54,556,275); holding companies $696,572 ($743,433); Canadian, Mexican, Central and South American companies, $5,863,751 ($5,531,281).

California Mineral Production

The California State Mining Bureau has issued a bulletin giving the following details regarding production of certain minerals in 1918:

Asbestos production in 1918 amounted to 229 tons, compared with 136 tons in 1917. The material was mostly of the chrysotile variety and came mainly from Nevada County.

The output of borax in 1918 amounted to 88,772 tons, against 109,944 tons in 1917. The product came entirely from the colemanite deposits of Inyo and Los Angeles counties.

Cement produced in 1918 amounted to 4,772,921 bbl. compared with 5,790,734 bbl. in the preceding year. The value of the cement showed an increase of $425,627 in 1918, owing to the higher selling price, although there was a decrease in the amount of cement used, on account of the war.

The output of pyrite amounted to 131,029 tons in 1918, as against 111,325 tons in 1917. The material came from two properties in Alameda County, and one property in El Dorado and Shasta counties respectively, and was utilized for the manufacture of sulphuric acid.

There was a small output of barytes in Monterey County; cadmium in Shasta County; fluorspar in Riverside County; lithia mica in San Diego County; onyx marble in Solano County; and serpentine "marble" in Los Angeles County, of a total value of $97,732. As there was but a single operator on each of these substances, the individual figures are not disclosed.

A small tonnage of sulphur was produced in 1918 at each of the two plants in Colusa and Inyo counties toward the end of the year, but none of the product had been shipped up to Dec. 31.

Army Gas Masks in Sulphur-Dioxide Atmospheres

Owing to a transposition of cuts, the captions used under Fig. 1 and Fig. 3, on p. 693 of the *Journal*, Apr. 19, 1919, are in error. Fig. 1 is the Tissot-type of gas mask and Fig. 3 is the U. S. Army gas mask, mouthpiece type.

Mining Accountants Wanted

The U. S. Civil Service Commission announces an open competitive examination for mining accountants, for men only. Vacancies in the Bureau of Mines, Department of the Interior, with headquarters in Washington, D. C., or in the field, at $2400 to $4200 a year for Grade 1, and $4200 to $6000 a year for Grade 2, and in positions requiring similar qualifications, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion.

Certification to fill the higher-salaried positions in either grade will be made from those attaining the highest average percentages in such grade. Appointments as a result of this examination will be made on a monthly basis, but the work may continue for a year or more. The duties of appointees to Grade 1 positions will be to examine the accounts of producers of minerals in connection with claims made for losses growing out of the war with Germany. The duties of appointees to Grade 2 positions will be to supervise the work of a number of accountants of Grade 1.

Competitors will not be required to report for examination at any place, but will be rated according to education, training, and experience. A report or discussion must be filed with the application.

Lead Prices Affect Monterey Smelters

The smelters in Monterey are being seriously affected by the price of lead in the British markets, as they pay the mines for the lead contents of their ores at the price of lead in London at the date the ore is purchased in Monterey, says a consular report.

A short time ago the British government stopped the control of the prices of metals, and the value of lead jumped from £29 to £40. As the Monterey smelters consider this only a temporary flurry in the market, they are refusing to buy lead ores until the market settles down again. As a result, numbers of the mines in the northern part of Mexico have been forced to close down, the local smelters have been obliged to reduce their staffs, and many changes are being made among both the Mexican and foreign employees.

Save and Have—Buy Victory Notes.

Editorials

Prosperity—Let's Go

A CAREFUL review of the present status of the Peace Conference might cause some to feel pessimistic, but is it not true that in all such conferences there frequently occur wide differences of opinion among the interests seeking an agreement, that for a time seem to be almost insurmountable? We are confident that there will be agreement soon. We feel that peace, together with a league of nations, will be accomplished. There are few indeed who deep down in their hearts do not desire a harmonious working agreement among the nations of the world. We entered the war to make the world better. Let us continue this spirit. The Peace Conference is in strong hands. It is in wise hands. Let us accept as a foregone conclusion that when we have the actual terms of peace and the Charter of the League of Nations we will find them to our liking. That there will be some sacrifices goes without saying. That other nations will also have to make sacrifices is apparent. We have already made a tremendous sacrifice in the men who will never return from France. Let us not forget that the power to accept sacrifices is the hallmark of character.

If we grant that the outcome is to be justice in large measure to all, then what can we do now to prepare for the immediate future? The answer to this is clear. Let every individual, company, and corporation *resume work*. Accelerate the wheels of industry. It is not a time to mope and question and say "Let the other fellow do it." Do not wait for your neighbor to act. Begin at once.

Waiting for the fall in prices has slackened the efforts of many. Why wait longer? Prices have fallen and some may fall still further, but there are markets just ahead of us. It is up to us to perfect our organization if we are to reap the full benefit of the trade that awaits us.

There is a certain succession in the order of business. A basic commodity passes through a number of hands and through different manufactories before the salesmen can confidently go forth to sell the finished product. The success of the salesmen means the vitalizing of all the industries, from mine to consumer.

The signing of the armistice started a commercial revolution. It was, however, only a revolution in kind of product manufactured and sold. In place of war products we must substitute the products used in normal times. The transition has indeed been a period of uncertainty. But is there any reason for continuing the transition indefinitely?

Is there not the same power of organization existent now as when we sent more than two million men across the Atlantic? That was not many months ago. A fraction of that energy will start the salesman out on his course again and cause the succession of industrial establishments, from retailer down to the mine, to resume.

A fraction of the courage that broke the Hindenburg line, applied to our industrial and commercial problems, will speedily win for us a prosperity that will absorb every pound of metal produced and find a job for every soldier returned from the war.

Nature and Uses of Capital in Mining

WE ARE indeed fortunate in being able to present to our readers such an excellent paper on the nature and uses of capital in mining as appears in this issue of the *Journal*. J. R. Finlay is a clear thinker and an illuminating writer. There is much in mining finance that is not generally understood, and those who are able to write in an informative way on this subject seldom attempt to do so.

The equitable taxation of mines, both by the states and by the Federal Government, is an intricate subject, and, though there has been a great deal of discussion on mine taxation, and many articles on the subject have been printed in the last decade, there is still much that can be done in formulating taxation laws which will make it possible for mining enterprises to pay their fair share toward the common weal, and at the same time enable the industry to prosper.

That mining enterprises are uniformly remunerative is a mistaken idea. This is true of a relatively small proportion only. A high degree of technical skill is required both in the operation of and in financing a mining project. Before development can be started there must be accurate information of the existence and extent of orebodies of sufficient size and metallic content to warrant attention. As Mr. Finlay says, the bonanza ore deposits are the spectacular accidents of mining, and receive far more weight and influence public opinion to a greater extent than they should. The mining industry depends largely upon mines that bring only a moderate return upon the capital invested. Nevertheless, it is the possibility of discovering a rich deposit or of developing a mine which will bring in more than the ordinary returns capital might be expected to earn that furnishes the incentive for men to go down into mines and to pioneer new country.

Mr. Finlay, though recognizing, as does every mining man, that the mining industry should bear its proper share of the expense of government in proportion to its income and profits, points out that the industry is exposed to the confiscation of its capital under the guise of "income" and "excess profits." This can come about only through misunderstanding of the significance of capital, income, and present value as applied to mining enterprises. Mr. Finlay's conclusions that the capital in question is the present value which could be realized from the liquidation of an enterprise, through normal commercial transactions; that profit is a fair interest upon the capital, and that, in the case of a property like a mine—in which a profit can be made only by using up its physical resources—income is never wholly profit, are essentially sound, and will receive substantial recognition.

Doing It Now

THE greatest deterrent to success—what is it? The neglect of those little details that take up time, attention, and thought, not because they amount to anything but because they are allowed to accumulate. Too often we keep putting them off. We are inclined to deride the Spanish word *mañana* when it is translated into "Never do today what you can put off till tomorrow," but we are, all of us, guilty of neglecting to finish the little jobs when they arise. Trying to avoid "doing it now" has led to many a failure—for tomorrow never comes.

The Fifth Liberty Loan is one of the little details that we must get off our minds without wasting time. No good is to be achieved by discussing it or even talking about it. We should take immediate and final action. The matter is absurdly small, and simple, and unimportant, this request from our Government for a mere loan, when we compare it with the glorious achievements of our men on land and sea and with their heroic sacrifices.

The Loan must be subscribed, and the nation's debts and obligations paid. For those who mourn, and for the maimed in mind and body, our sympathy, however deep and sincere, is impotent, for we can do nothing adequate. But we can see to it that the Loan goes "over the top." So let's finish the job. It *must* be finished. It *will* be finished; and it might as well be finished early. While we remain hesitant we waste time and energy that we should be using for the real work of reconstruction.

The war wasn't won by wobblers in thought or action. Let's all "do it now!"

Prosperity Impending, Not Depression

AT THE annual meeting of the United States Steel Corporation Judge Gary said in his usual illuminating way:

> "I have been accused of being more or less optimistic, but I am never so optimistic as to shut my eyes to possible danger and facts. All I can say is that any man who believes that this country is going into bankruptcy or has embarked upon a period of depression which will end in disaster, or that in the near future we will enter into such a period of demoralization, is a man who does not possess himself with the facts and figures."

It is one of the signs of the times that doubts should be expressed as to the financial stability of our country. There is a curious pessimism that attends any great transition such as is now taking place. We have our mines. We have our ores. We have our smelteries. We have our factories. We have an excellent force of skilled workers. We can see our markets ahead of us. Why should there be any doubt as to the present or the future? It is not Judge Gary's optimism that enables him to see so clearly ahead of him. It is common-sense.

Judge Gary goes on to say:

> "The war is over. We want peace between capital and labor, between competitors, between industries and the Government and with all the world. Whether we succeed in this laudable ambition will depend upon everybody doing his part and working together, from the ordinary citizen and laborer up to the more important Government officials. If we will do this, who can question the claim that the United States is bound to be the most prosperous and progressive nation on the globe?"

This is sound advice. Let everyone do his part, from lowest to highest. The final result is the outcome of the successful accomplishment of each individual task. What we want most of all is agreement between all factions, and the speeding up of the wheels of industry. Prosperity is almost within our grasp. Discussion and argument may well be postponed. Let action take their places.

Iron-Ore Taxation in Minnesota

TAXATION of the mineral wealth of Minnesota was initiated in 1881 with the enactment of a law providing a tax of 1c. per ton on all iron ore, coal, and copper ore found in the state. This remained in force and was the only tax on iron ore until 1896, when an assessment, based upon a valuation of $60,000,000, was made against the mining properties, after a careful investigation by the board of equalization and control. During the ten years following, this assessment was increased, until in 1906 the valuation had reached $80,000,000. The state tax commission, established in 1907, raised the assessable valuation of ore lands to $180,000,000, and during 1918 the valuation in St. Louis County, which contains the great mines of the Mesabi, was $275,195,453. The proposal to exact an additional impost, a super-tax, to be levied on the iron ore produced, which was introduced during the last session of the State Legislature, after previous unsuccessful attempts on the part of its supporters, has again been defeated, and it is hoped that it may not be revived in subsequent sessions.

Mining men are in no way different from other business men as to their manner of conducting commercial enterprises. The mining industry is operated along broad lines, and, as in any successful business, allowances must be made for a fair return on capital invested. However, mining in all of its branches has appealed to many, unfamiliar with its processes, as a "get-rich-quick" proposition, and the judgment of legislators too often has been biased because of this too prevalent fallacy.

Minnesota, in addition to its mineral wealth, derives immense capital from agriculture, which flourishes according to the productivity of the soil and the activity of the farmer. In contradistinction to mining, which leads to depletion, farming begets an increase in the productivity of the locality. But the depletion, argues the farmer, is a "vanishing heritage"; hence the desire to grasp the golden opportunity and make the most of the natural resources while they last. Possibly some strength might have been added to the argument for the increased tax had the creation of a sinking fund been considered, but the proposal to place the increased income, derived from such a tax, in the general fund undeniably reflects on the sagacity of the advocates of the super-tax.

Primarily, little thought is given by the projectors of tonnage taxes to the pioneer work done in mining. Ore extraction by steam shovel may be regarded as highly profitable when viewed from the bank of an open pit; the flowing sweep of the steam-shovel dipper into the closely packed bank, the dropping of the load into the ore car, and the repetition of these operations, may be conducive to thoughts along socialistic or communistic lines, but it is but just to consider, at the same time, the preliminary labor and expense which have made all this possible. The stripping of overburden is no easy task, nor inexpensive one, and following the removal of "steam-shovel ore" is the painstaking work of "cleaning up" the pit and removing the orebody, both of which operations involve consideration of a mass of detail and often a complication of mining methods.

Underground mining on the Minnesota ranges is by no means a cheap or simple operation, and the increasing costs of labor and supplies have done much to decrease the narrow margin of profit made by the operator during the last few years. By the introduction of improved methods and machinery, open-pit and underground miners in Minnesota have been able to hold their own, but this they cannot continue to do if they are hampered by the imposition of an unfair tax.

In the article "Iron-Ore Super-Taxation in Minnesota," which appears in this issue, D. E. Woodbridge advances a masterful argument to the controversy on super-taxation. Minnesota is placed in competition with several of the other great iron-ore districts of the world, and, although occupying a strong economic position at present, the confiscation of fairly earned profit, in the form of an unjust tax, would mean the surrendering of that position.

BY THE WAY

Some of the men one meets in Virginia City are not only fellows of infinite jest, but also of such an agreeable disposition that it is pleasant to have them around, said Dan De Quille in "The Big Bonanza."

"Do you know Mr. Popper?" asked a barroom proprietor of one of his customers.

"I have heard of him," said the customer, "but I don't know that I ever met him."

"No?" said the other. "Well, you ought to make his acquaintance. He's a nice agreeable gentleman. I never saw him before last night, when he came in here about 12 o'clock and took a drink. He is a man who makes himself at home with you at once. Why, he had hardly been in here five minutes before he drew out his six shooters and began shooting holes through the pictures, the lamp and other little notions about the place, just as familiarly as though he and I had been boys together. Nothing cold and distant about him! He's a charming fellow!—charming!"

The State Historical Society is now the possessor of the gold nugget that caused the stampede to Alder gulch back in the early '60s, and resulted in the settlement and development of the State of Montana, says the *Wallace* (Idaho) *Miner*. The nugget was presented to the society by Mrs. Granville Stuart. It still reposes in the old buckskin purse in which it was placed by Mrs. Stuart's brother-in-law, James Stuart, when he picked it up on Gold Creek, just west of the main ridge of the Rockies, on May 21, 1862. Following that discovery, gold seekers poured into the state, found the rich placers in Alder gulch, founded Virginia City, and the state was born. Relating to the discovery, Mr. Stuart's diary says: "May 21, 1862. Clear and cool, west wind. Cleaned up sluice of about $22, half of this amount in one nugget. This is the first nugget found here, all the gold being rather fine. This piece is half quartz and worn smooth by glacial action. There may be quartz ledges here."

"I 'ave 'ere, m'son, w'ot's nawn in financial circles as a prospectus, an', dam-me, it do my 'eart good to see tha charitableness o' these 'ere promoters," said Cap'n Dick. "This 'ere letter, firs' of h'all, states a chap is loosin' tha h'opportunity of a lifetime if 'e does'nt read un. So 'ere we are: The Rooter H'oil an' Gas Company, Bo'okus, Texas, 'as 'oldin's coverin' 'alf tha state, an', dam-me, on she gaws like one o' these 'ere fairy stories. Trouble is, m'son, tha letter speaks o' these 'ere famous gushers, an' man never naws w'ether un means tha promoters or the h'oil wells. Then 'ere's w'ot come with tha letter—a gert yellow sheet with a 'andsome map coverin' 'alf o' one side. W'ot's think on un? These 'ere 'aystack-lookin' things scattered raound h'art tha h'oil wells, a-gushin' forth. 'Ere's tha h'expert's h'opinion, an' 'e calls your special attention to tha fac' that 'e 'as made a personal study o' tha development h'all araoun' tha 'oldin's. Wonnerful, m'son, wonnerful. But, min' you, tha h'only guarantee that thee 'as is that tha company's h'affairs will be 'andled in a fair manner, an' dam-me, I 'as no doubt o' that. Las' of h'all is tha 'sign 'ere' square, tucked away so thee can't see un 'till thee 'as read tho 'ol wondrus story. An', dam-me, son, isn't un some beauty? 'Ave I bought some? No, m'son; thee's forgetin' baout these 'ere Victory Notes."

The pessimist is not needed in the mining game, nor, for that matter, is the optimist, unless he has the brains and the push to make his optimism good. Push will carry a man over all obstructions, it will level mountains, it will bridge canyons, it will make the impossible possible, it will convert the can't-be-done to the can-be-done. Berton Braley[1] says of this minority of the human race:

There's a thousand "Can't-be-done-ers"
  For one who says "It can!"
But the whole amount of deeds that count
  Is done by the latter clan.
For the "Can't-be-done-ers" grumble,
  And hamper, oppose and doubt,
While the daring man who says, "It can!"
  Proceeds to work it out.

There isn't a new invention
  Beneath the shining sun,
That was ever wrought by the deed or thought
  Of the tribe of "Can't-be-done."
For the "Can't-be-done-ers" mutter
  While the "Can-be's," cool, sublime,
Make their "notions" work till the others smirk.
  "Oh, we knew it, all the time!"

Oh, the "Can-be's" clan is meager,
  Its membership is small.
And it's mighty few see their dream come true
  Or hear fame's trumpet call;
But it's better to be a "Can be,"
  And labor and dream and—die,
Than one who runs with the "Can't-be-done's"
  Who haven't the pluck to try!

---

[1] *Bessemer Monthly*, January, 1919

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

10781—LEACHING—Copper Leaching Methods Applicable to Australian Ores. Percy R. Middleton. (Chem., Eng. and Min. Rev., Feb. 5, 1919; 2 pp., illus.) 40c.

10782—MANITOBA—Northern Copper Country Development. J. A. Campbell. (From a pamphlet entitled Manitoba's Northland, published Nov., 1918; 3¼ pp., illus.)

10783—ONTARIO—Mineral Developments in N. W. Ontario. Arthur L. Parsons. (Ann. Report, Ont. Bureau of Mines, 1918; 15½ pp., illus.)

GOLD AND SILVER—GEOLOGY

10784—MANITOBA—The Northern Manitoba Mineral Belt. J. A. Campbell. (From a pamphlet entitled Manitoba's Northland, published Nov., 1918; 6 pp., illus.)

10785—MANITOBA—The Rice Lake Gold Area. C. A. Bramble. (From a pamphlet entitled Manitoba's Northland, published Nov., 1918; 7 pp., illus.)

10786—NEW ZEALAND—Notes on the Geology of the Murchison District. J. Henderson. (New Zealand Journ. of Sci. and Tech., Mar., 1918; 4½ pp.)

10787—QUEENSLAND—Mount Peter Goldfield. H. I. Jensen. (Queensland Govt. Min. Journ., Feb. 15, 1919; 2¾ pp.) 60c.

GOLD AND SILVER—GENERAL

10789—BRITISH COLUMBIA—Revelstoke Mining Division. E. A. Haggen. (Min. and Eng. Rec., Dec. 31, 1918; 13 pp., illus.) 20c.

10790—COLOMBIA—The Guamoco District of the Republic of Colombia—II. S. Ford Eaton. (Eng. and Min. Journ., Apr. 5, 1919; 4¾ pp., illus.) 20c.

10791—MANITOBA—Mining Development in Northern Manitoba. R. C. Wallace. (Bull., Can. Min. Inst., Mar., 1919; 10 pp.)

10792—NEVADA—Divide District Promises Another Tonopah. Judson Wright. (Salt Lake Min. Rev., Mar. 15, 1919; 3 pp., illus.) 20c.

10793—RAND MINING in 1918. A. Cooper Key. (Eng. and Min. Journ., Apr. 19, 1919; 2 pp.) 20c.

10794—SAMPLING PRACTICE at Independent Mill. Claude T. Rice. (Eng. and Min. Journ., Apr. 12, 1918; 3¼ pp., illus.) 20c.

10795—SOUTH AFRICA—The Mineral Industry of South Africa and Its Future. P. A. Wagner. (So. Afr. Min. Journ., Jan. 11, 18, 25 Feb. 15 and 22, 1919; 6½ pp.)

IRON ORE DEPOSITS, MINING, ETC.

10796—AUSTRALIAN IRON ORE RESOURCES. (Min. Mag., Mar., 1919; 6½ pp.) Information from official sources. 40c.

10797—CANADA—Iron Deposits on the Belcher Islands, Hudson Bay. E. S. Moore. (Bull. Can. Min. Inst., Feb., 1919; 9½ pp., illus.)

10798—CONCENTRATION — Iron-Ore Concentration on the Mesabi Range. F. A. Kennedy. (Eng. and Min. Journ., Apr. 19, 1919; 6 pp., illus.) 20c.

10799—IRELAND—Iron Ore in Ireland. (Statist, Feb. 15, 1919; 1¼ pp.) 40c.

10800—ONTARIO—Mineral Developments in N. W. Ontario. Arthur L. Parsons. (Ann. Report, Ont. Bureau of Mines, 1918; 15½ pp., illus.)

IRON AND STEEL METALLURGY

10801—ALLOY STEELS—Microstructural Features of Flaky Steel. Henry S. Rawdon. (Bull. A.I.M.E., Feb., 1919; 18¼ pp., illus.) 40c.

10802—ELECTRIC FURNACE DEVELOPMENTS. J. Bibby, (Iron and Coal Tr. Rev., Dec. 27, 1918; 4 pp., illus.) Abstract of paper before Cleveland Instn. of Engrs. 40c.

10803—ELECTRIC STEEL PLANT—World's Largest Electric Steel Plant in Toronto. (British Forgings, Ltd.) George T. Clark and Frederick Phillips. (Can. Engr., Mar. 27, 1919; 5¾ pp., illus.) 20c.

10804—FERROMANGANESE—Production of Ferromanganese in Blast Furnaces. P. H. Royster. (U. S. Bureau of Mines, War Minerals Investigations, Series No. 5, 1918; 31 pp.)

10805—FOUNDRY—The Practical Analysis of Molding Sand. F. Albert Hayes. (Iron Age, Mar. 20, 1919; 3 pp., illus.) 20c.

10806—FURNACE GASES—Cleaning Furnace Gases Without the Use of Water. J. C. Barrett. (Chem. and Met. Eng., Apr. 1, 1919; 2 pp., illus.)

10807—HIGH SPEED STEELS, Specifications for. R. Poliakoff. (Iron Age, Mar. 27, 1919; 2½ pp.) 20c.

10808—MANGANESE ALLOYS—The Use of Manganese Alloys in Open-Hearth Steel Practice. Samuel L. Hoyt. (U. S. Bureau of Mines, War Minerals Investigations Series, No. 11. 1918; 17 pp.)

10809—SMELTING—A New Method for the Smelting of Iron Ores. Jas. W. Moffatt. (Can. Min. Journ., Apr. 2, 1919; 4 pp.) 20c.

10810—SPIEGELEISEN—Production of Spiegeleisen in Blast Furnaces. P. H. Royster. (U. S. Bureau of Mines, War Mineral Investigations Series, No. 6, 1918; 18½ pp.)

10811—UNITED STATES STEEL CORPORATION. (Eng. and Min. Journ., Apr. 19. 1919; 1¾ pp.) Abstract of annual report. 20c.

LEAD AND ZINC

10812—ARKANSAS—Operations at the Zinc Camp, Arkansas. Tom Shiras. (Eng. and Min. Journ., Apr. 5, 1919; 1¾ p., illus.) 20c.

10813—COST OF ZINC MINING—The Rise in Cost of Zinc Mining in Wisconsin. W. F. Boericke. (Eng. and Min. Journ., Mar. 29, 1919; 2 pp.) 20c.

10814—MILLING—Metallurgy of the Oklahoma-Kansas District. Robert W. Johnson and C. E. Heinz. (Eng. and Min. Journ., Mar. 29, 1919; 2½ pp.) Abstracted from "Joplin Globe." 20c.

OTHER METALS

10815—ALUMINUM—L'Industrie Allemande de l'Aluminium pendant la guerre. (Journ. du Four Electrique, Mar., 1919; 1 p.)

10816—MANGANESE—Electric Smelting of Domestic Manganese Ores. H. W. Gillett and C. E. Williams. (U. S. Bureau of Mines, War Mineral Investigations Series, No. 10. 1918; 44 pp.)

10817—MANGANESE—Problems Involved in the Concentration and Utilization of Domestic Low-Grade Manganese Ore. Edmund Newton. (U. S. Bureau of Mines, War Minerals Investigations Series, No. 9, 1918; 19 pp.)

10818—MANGANESE—The Manganese Ores of the Cairns District. H. I. Jensen. (Queensland Govt. Min. Journ.. Feb. 15, 1919; 1¼ pp.) 60c.

10819—NICKEL—Pulverized Coal in Blast Furnaces at Plant of International Nickel Co. W. L. Wotherspoon. (Can. Min. Journ., Feb. 5, 1919; 1 p.) 20c.

10820—PLATINUM—Notes on the Black Sand Deposits of Southern Oregon and Northern California. R. R. Horner. (Tech. Paper 196, U. S. Bureau of Mines, 1918; 42 pp., illus.) 20c.

10821—PLATINUM AND MANGANESE—An Investigation of Certain Canadian Platinum and Manganese Resources. G. C. Mackenzie. (Bull., Can. Min. Inst., Apr., 1919; 9½ pp.)

10822—QUICKSILVER—Fume and Other Losses in Condensing Quicksilver from Furnace Gases. L. H. Duschak and C. N. Schuette. (Tech. Paper 96, U. S. Bureau of Mines, 1919; 28¼ pp., illus.) 20c.

10823—QUICKSILVER—Our Mineral Supplies. F. L. Ransome. (Bull. 666-FF, U. S. Geol. Surv.; 8¼ pp.)

10824—RADIUM—The Radium Industry and Reconstruction. John S. MacArthur. (Eng. and Min. Journ., Apr. 5, 1919; 1½ pp.) Abstract from "Min. Journ." 20c.

10825—TIN—Ancient Tin Mines of the Transvaal. Max Baumann. (Jour. Chem., Met. and Min. Soc. of So. Afr., Feb., 1919; 12½ pp., illus.) 60c.

10826—TUNGSTEN—The Scheelite Field Near Percyville. H. I. Jensen. (Queensland Govt. Min. Journ., Jan. 15, 1919; ¾ p.) 60c.

NON-METALLIC MINERALS

10827—FLUORSPAR—Kentucky Fluorspar Mining. E. V. Rawn. (Iron Age, Mar. 27, 1919; ¾ p.) 20c.

10828—GRAPHITE—Preliminary Report of an Investigation Into the Concentration of Graphite from Some Ontario Ores. (Can. Min. Journ., Mar. 26, 1919; 9 pp.) 20c.

10829—MAGNESITE and Dolomite in Australia and New Zealand. P. G. Morgan. (New Zealand Journ. of Sci. and Tech., Vol. I, No. 6, 1918; 14 pp.)

10830—MAGNESITE on the Island of Margarita, Venezuela. Charles F. Z. Caracristi. (Eng. and Min. Journ., Apr. 12, 1919; 3 pp.) 20c.

10831—MAGNESITE MINING at Hemet, Calif. (Min. and Oil Bull., Mar., 1919; 2¼ pp., illus.) 20c.

10832—NEW ZEALAND—Commercial Uses of New Zealand Minerals (Chiefly Non-metallic) and Rocks. P. G. Morgan. (New Zealand Journ. of Sci. and Tech., Jan., 1918; 6 pp.)

10833—SAND AND GRAVEL in 1917. R. W. Stone. (Mineral Resources of the U. S., 1917—Part I; 15½ pp.)

10834—SILICA MATERIALS—High-Grade Silica Materials for Glass, Refractories and Abrasives. R. J. Colony. (N. Y. State Museum Bull., Nov. and Dec., 1917, published in 1919; 29 pp., illus.)

10835—SULPHUR—Operations and Properties of the Texas Gulf Sulphur Co. (Eng. and Min. Journ., Mar. 29, 1919; 2½ pp.) 20c.

PETROLEUM AND NATURAL GAS

10836—ALBERTA—Peace River Section, Alberta. F. H. McLearn. (Summary Report, Can. Geol. Surv., 1917, Part C; 7½ pp.)

10837—ALBERTA—Viking Gas Field, Structure of Area. S E. Slipper. (Summary Report, Can. Geol. Surv., 1917, Part C; 7¼ pp.)

10838—ARIZONA—A Study of the Oil and Gas Possibilities of the Holbrook Area, Navajo Co., Ariz. Dorsey Hager. (Min. and Oil Bull.. Mar., 1919; 4 pp., illus.) 20c.

10839—MONTANA—Oil and Gas Geology of the Birch Creek-Sun River Area. Northwestern Montana. Eugene Stebinger. (Bull. 691-E. U S. Geol. Surv., 1918; 35½ pp.)

10840—SAVING GAS—Traps for Saving Gas at Oil Wells. W R. Hamilton. (Tech. Paper 209, U. S. Bureau of Mines, 1919; 34 pp., illus.)

10841—TEXAS—A Review of the Development in the New Central Texas Oil Fields During 1918. W. G. Matteson. (Econ. Geol., Mar.-Apr., 1919; 53 pp., illus.) 60c.

10842—UTAH—Oil Possibilities of the Rio Virgin Anticline. W. E. Calvert. (Salt Lake Min. Rev., Mar. 30, 1919; 3 pp., illus.) 20c.

ECONOMIC GEOLOGY—GENERAL

10843—CANADA—Explorations in the Vicinity of Great Slave Lake. A. E. Cameron. (Summary Report, Can. Geol. Surv., 1917, Part C; 6½ pp.)

10844—COLORADO—Relation of Landslides and Glacial Deposits to Reservoir Sites in the San Juan Mountains, Colorado. Wallace W. Atwood. (Bull 635, U. S. Geol. Surv., 1918; 38 pp., illus.)

10845—NEW ZEALAND—Notes on the Geology and Mineral Occurrences of the Wakamarina Valley. J. Henderson. (New Zealand Journ. of Sci. and Tech., Jan., 1918; 5 pp.)

10846—NEW ZEALAND—Notes on the Geology of the Waikato Valley Near Maungatautari. J Henderson. (New Zealand Journ. of Sci. and Tech., Jan., 1918; 4½ pp.)

10847—NEW ZEALAND—The Geology of the Te Kuiti District, With Special Reference to Coal Prospects. J. Henderson. (New Zealand Journ. of Sci. and Tech., Mar., 1918; 4 pp.)

10848—ONTARIO—Ogahalla to Collins on the National Transcontinental Railway. Percy E. Hopkins. (Ann. Report, Ont. Bureau of Mines, 1918; 13 pp., illus.)

10849—UTAH—Relation of Ore Deposits to Thrust Faults in the Central Wasatch Region, Utah. B. S. Butler. (Econ. Geol., Mar.-Apr., 1919; 5½ pp., illus.) 60c.

MINING—GENERAL

10850—BRITISH COLUMBIA—Mineral Production of British Columbia for 25 years, 1893-1918. (Min. and Eng. Rec., Jan., 1919; 28½ pp., illus.) 60c.

10851—BRITISH GUIANA and the Problem of Its Development. Sir Walter Egerton. (Bull. Imperial Inst., July-Sept., 1918; 35¼ pp.) Paper before Royal Soc. of Arts.

10852—CALIFORNIA—A Trip to Calaveras County, California. Leroy A. Palmer. (Salt Lake Min. Rev., Feb. 28, 1919; 4¾ pp., illus.) 20c.

10853—CONCRETE—The Use of Concrete in Underground Works. (Chem., Eng. and Min. Rev., Feb. 5, 1919; 2½ pp., illus.) Describes work done by Wallaroo & Moonta Mining and Smelting Co. 40c.

10854—CO-OPERATION AMONG SMALL MINES with a View to Increasing Efficiency of Operation. R. W. Brigstocke. (Bull. Can. Min. Inst., Mar., 1919; 3¼ pp.)

10855—DUST—The Effects of Dust Inhalation. J. S. Haldane. (Journ., Chem., Met. and Min. Soc. of So. Afr., Oct., 1918; 8¾ pp.) Continued discussion of paper previously indexed.

10856—EXPLOSIVES. Robert S. Lewis. (Min. and Sci. Press, Feb. 22, 1919; 8¼ pp., illus.) Notes on the leading explosive compounds in use and suggestions regarding their application. 20c.

10857—ITALY—L'industria Mineraria e Metallurgica Toscana. Gaetano Castelli. (Rassegna Mineraria, Oct., 1918; 5 pp.)

10858—ONTARIO—Statistical Review of the Mineral Industry of Ontario for 1917. Thos. W. Gibson. (Ann. Report, Ont. Bureau of Mines, 1918; 76½ pp., illus.)

10859—ORE RESERVES—Application of the Theory of Probability in the Determination of Ore Reserves. G. A. Watermeyer. (Journ. Chem., Met. and Min. Soc of So. Afr., Jan., 1919; 11½ pp.) 60c.

10860—POWER—A Small Hydro-Electric Installation in Yorkshire. E. P. Hollis. (Min. Mag., Mar., 1919; 2 pp., illus.) 40c.

10861—PROSPECTS—Marketing the Mine Prospect. E. S. Boalich. (Eng. and Min. Journ., Apr. 5, 1919; 1 p.) 20c.

10862—RHODESIA—The Mineral Resources of Rhodesia. F P Mennell. (So. Afr. Journ. of Ind., Oct., 1918; 9 pp.)

10863—SOUTH AFRICA—Exploitation of Our Mineral Resources, the Opportunities Created by the War. T. G. Trevor. (So. Afr. Journ. of Ind., Oct., 1918; 4 pp.)

10864—MINE SUPPLIES—Notes on Economies in Mining Engineering Supplies. W. Elsdon-Dew. (Jour. So. Afr. Instn. of Engrs., Mar., 1919; 10 pp.) Discussion of paper previously indexed.

10865—TAXATION—Principles of Taxation. (Eng. and Min. Journ., Mar. 29, 1919; 2 pp.) Abstract from an address by Prof. E. R. A. Seligman before N. Y. Section, Min. and Met. Soc. of America. 20c.

10856—TIMBER-HANDLING PLANT—Economical Timber-Handling Plant at an Anthracite Mine. Ralph A. Smith. (Coal Age, Feb. 20, 1919; 2 pp., illus.)

10857—VENTILATION—Mine Ventilation in the Coeur d'Alenes. Robert N. Bell. (Eng. and Min. Journ., Apr. 5, 1919; 2¾ pp.) From report of State Mine Inspector. 20c.

METALLURGY—GENERAL

10858—ACCIDENTS at Metallurgical Works in the United States During 1917. Albert H. Fay. (Tech. Paper 215, U. S. Bureau of Mines; 18½ pp.)

10859—AIR-VOLUME REGULATION in Smelting and Refining Furnaces. C. H. Smoot. (Eng. and Min. Journ., Apr. 12, 1919; 3 pp., illus.) 20c.

10860—BRASS—Corrosion of Brass in Sea Water. Paul T. Bruhl. (Chem. and Met. Eng., Mar. 1, 1919; 1 p.)

10861—DECOMPOSITION of Metal—I. Col. A. I. Krynitzky. (Chem. and Met. Engr., Mar. 15, 1919; 5½ pp., illus.) A critical review of various theories which have been advanced from time to time to explain the so-called "disease of metal

10862—ELECTROSTATIC PRECIPITATION—Notes on Electrostatic Precipitation. H. D. Braley. (Advance Copy, Am. Electrochem. Soc., Apr., 1919; 44 pp., illus.)

10863—SAFETY—Army Gas Masks in Sulphur-Dioxide Atmospheres. A. C. Fieldner and S. H. Katz. (Eng. and Min. Journ., Apr. 19, 1919; 3 pp., illus.) 20c.

SAMPLING AND ASSAYING

10864—CARBON DIOXIDE—Rapid Carbon Dioxide Determination. A. Craig. (Eng. and Min. Journ., Apr. 19, 1919; ¾ p., illus.) 20c.

10865—LIME—Determination of Available CaO in the Different Classes of Lime Supplied to Rand Reduction Works. C. A. Meiklejohn. (Journ., Chem., Met. and Min. Soc. of Afr., Dec., 1918; 4 pp.) 60c.

10866—RED LEAD—Notes on the Chemical Analysis of Red Lead. W. F. Edwards. (Chem. and Met. Eng., Jan. 1, 1919; 2 pp.)

FUELS

(See also "Petroleum and Natural Gas"

10867—BRIQUETTES—Some Notes on the Manufacture of Fuel Briquettes. E. H Robertson. (Trans. Min. and Geol. Inst. of India, Sept., 1919; 13¼ pp.)

10868—CONSERVATION—Saving Coal in Steam Power Plants. (Tech. Paper 217, U. S. Bureau of Mines; 8 pp.) Reprint of Eng. Bull. No. 2, of U. S. Fuel Administration. 20c.

10869—LIGNITE—Combustion Experiments with North Dakota Lignite. Henry Kreisinger, C. E. Augustine and W. C. Harpster. (Tech. Paper 207, U. S. Bureau of Mines, 1919; 39½ pp., illus.)

10870—STORAGE—Deterioration in the Heating Value of Coal During Storage. G. Cecil Jones. (Journ. Soc. of Chem. Ind., Feb. 28, 1919; 1 p.)

10871—U. S. FUEL ADMINISTRATION—Distribution of Coal Under U. S. Fuel Administration. J. D. A. Morrow. (Bull. A.I.M.E., Mar., 1919; 4¼ pp.) 40c.

MINING AND METALLURGICAL MACHINERY

10872—BOILER-WATER TREATMENT. (Tech. Paper 218, U. S. Bureau of Mines, 1919; 8 pp.) Reprint of Engineering Bull. No. 3, U. S. Fuel Administration. 40c.

10873—DRILLS—Hammer Drills, Their History, Design and Operation. Henry S. Potter. (Journ. So. Afr. Instn. of Engrs., Nov.-Dec., 1918, Jan. and Mar., 1919; 20 pp., illus.)

10874—MOTORS—Cooling of Electric Motors, With Special Reference to Totally Enclosed Machines. P. A. Mossay. (Trans. Min. Inst. Scot., Vol. XI, Pt. 8, 1919; 14½ pp., illus.)

10875—RESCUE APPARATUS—Uses and Limitations of Respirators, Gas Masks and Oxygen Apparatus. (Eng. and Min. Journ., Mar. 15, 1919; 1¼ pp.) 20c.

10876—STEAM ECONOMICS in Simple Terms. S. A. Worcester. (Eng. and Min. Journ., Mar. 29, 1919; 2 pp.) 20c.

10877—WELDING—The Development of the Oxy-Acetylene Welding and Cutting Industry in the United States. Henry Cave. (Engineering, Feb. 7, 1919; 2¾ pp., illus.) Paper before Instn. of Mech. Engrs., Feb. 7, 1919. 40c.

INDUSTRIAL CHEMISTRY

10878—AMMONIUM NITRATE—The United States Ammonium Nitrate Plant, Perryville, Md. (Atlas Powder Co.). (Chem. and Met. Eng., Apr. 1, 1919; 6½ pp., illus.

10879—COAL BY-PRODUCTS—Coal: Its Value as a Raw Material for Distillation Products. J. A. Wilkinson. (So. Afr. Journ. of Ind., Dec., 1918, and Jan., 1919; 24 pp.)

INDUSTRIAL CHEMISTRY

10880—NITRATE—Muscle Shoals Nitrate Plant. Andrew M. Fairlie. (Chem. and Met. Eng., Jan. 1, 1919; 10 pp., illus.)

10881—NITROGEN COMPOUNDS—The Production of Nitrogen Compounds. Jack P. Montgomery. (Chem. Engr., Feb., 1919; 4½ pp.)

10882—NITROGEN FIXATION FURNACES. E. Kilburn Scott. (Advance copy, Am. Electrochem. Soc., Oct., 1918, 32 pp., illus.)

10883—POTASH—Separation of Potash Salts. H. P. Bassett. (Chem. and Met. Eng., Jan. 15, 1919; 1½ pp.)

10884—SODIUM SALTS in 1917. Roger C. Wells. (Mineral Resources of the U. S., 1917, Part I; 36½ pp.)

10885—TANKS—Storage Tanks Made of Reinforced Concrete. F. W. Frerichs. (Chem. and Met. Eng., Mar. 1, 1919; 5 pp., illus.)

10886—SOUTH AFRICA—Inorganic Chemical Industries. I. Caustic Soda, Common Salt, Niter Cake and Glauber Salt. M. Rindl. (So. Afr. Journ. of Ind., Oct., 1918; 10 pp.)

10887—SULPHURIC ACID—Continuous Sulphuric Acid Sampler. S. A. Ionides. (Chem. and Met. Eng., Jan. 1, 1919; ⅜ p.)

MATERIALS OF CONSTRUCTION

10888—CEMENT in 1917. Ernest F. Burchard. (Mineral Resources of the U. S., 1917, Part I, 24¾pp.)

10889—CONCRETE as a Chemical Engineering Material. Maximilian Toch. (Chem. and Met. Eng., Mar. 1, 1919; 2 pp.) Address before Am. Inst. of Chem. Engrs., Jan. 16, 1919.

MISCELLANEOUS

10890—BRITISH COLUMBIA—Mining Convention at Vancouver. (Eng. and Min. Journ., Apr. 12, 1919; 6 pp.) Account of proceedings of Internat. Mining Convention, held Mar. 17. 20c.

10891—BURMA—The Development of the Trade of Burma. A. S. Judge. (Bull. Imperial Inst., July-Sept., 1918; 35½ pp.)

10893—LABOR—Development of Americanization Project. Charles H. Paull. (Industrial Management, Mar., 1919; 4¼ pp., illus.) 40c.

10894—LABOR—GROUP INSURANCE for the Industrial Worker. Edward E. Rice. (Industrial Management, Mar., 1919; 3 pp.)

10895—LABOR—Reducing the Cost of Disability. Douglas C. McMurtrie. (Iron Age, Feb. 6, 1919; 1½ pp.)

Personals

W. A. McGonagle has returned from a trip in California.

Harry J. Wolf visited mining properties in the Cripple Creek district recently.

C. D. Keading, general manager, has returned to the Dome mines at Porcupine.

F. F. Sharpless leaves for Sonora, Mexico, on May 3 on professional business.

E. J. Carlyle is now with the British America Nickel Corporation at the Murray mine.

Robert Bryce, after examination of a property in Nova Scotia, has returned to Toronto.

Maj. Arthur S. Dwight, formerly of the 11th Engineers, is expected from France within the next few weeks.

E. P. Mathewson was in Butte recently on a periodical tour of inspection of properties which he represents.

E. L. Bruce, of the Geological Survey of Canada, is giving a series of lectures at the University of Manitoba.

Fred Flink has returned from overseas service and resumed his position as mining engineer at the Crosby mine, Nashwauk, Minn.

Walter Harvey Weed is consulting engineer for the Crystal Copper Co., which is operating the Goldsmith mine, at Walkerville, Mont.

Lieut. R. H. Burrage, formerly of the 27th Engineers, has been ordered to Camp Humphreys as instructor in the engineering school.

A. F. Coyne, president and managing director of Northern Production Co., and **G. L. Stebbing** were recently in Toronto en route to England.

R. E. McConnell has just returned from Germany, and is on his way to Los Angeles, Calif., where he will resume his mining engineering practice.

George C. Mackenzie resigned his position with the Mines Branch, Ottawa, and became general manager of Electric Steel and Engineering Co. on Mar. 14.

William Gibson, former superintendent of the Butte & Zenith Mining Co., Butte, has succeeded Cecil Hull as superintendent of the Goldsmith mine at Walkerville, Mont.

Fred W. Denton, consulting engineer for the Copper Range properties, and now residing in Boston, is in Houghton for an extended visit to the mining properties.

Victor Ziegler, of the Geology and Mineralogy Department of the Colorado School of Mines, has tendered his resignation, to be effective at the close of the school year.

R. G. Wayland, formerly superintendent and chief engineer for the Alaska Treadwell Mining Co., has been appointed chief engineer for the Homestake Mining Co. at Lead, S. D.

Bernard V. Matson, of Deadwood, S. D., has been appointed superintendent of the refining department of the U. S. Mint at Denver. Until a few weeks ago Mr. Matson was employed in the Government Mint at New York City.

H. H. Armstead will be permanently situated in Seattle, being associated with **C. V. Bob** and **L. A. Levensaler** in the Standard Snow Motor Co. for the manufacture and introduction of these motors in Alaska, Siberia and certain sections of the United States.

John Black, manager of the Flin Flon Syndicate, **John Hammell**, of the original owners, **Prof. R. C. Wallace**, and **J. A. Campbell**, M. P., of The Pas, were part of a delegation which waited upon the government in reference to the New Manitoba railway development.

Erle Dudley has resumed his position as construction superintendent for the Bunker Hill & Sullivan Mining and Concentrating Co. after serving for 15 months as captain with the U. S. Engineers, most of which time was spent in France on organization and construction work.

C. M. Weld, on May 1, returns from his war work as assistant executive of the War-Minerals Investigations, Bureau of Mines, Washington, and will resume his former consulting practice in New York. His office will be temporarily at No. 2 Rector St., and his office staff will be as before.

Jay A. Carpenter has returned to Tonopah after eight months' absence as superintendent for the Nevada Wonder Mining Co. at Belmont, Nev. He will open an office as consulting engineer, specializing in the management of small properties. Mr. Carpenter will take charge immediately of the work at the Ben Hur and Keystone properties.

Edwin C. Holden, general manager of the Davison Sulphur and Phosphate Co. since its inception, having brought the Carlota mine, in the Province of Santa Clara, Cuba, to a shipping stage, is moving May 1 to the headquarters of the company in Baltimore. **Chester A. Fulton**, superintendent, succeeds him in the active management in Cuba.

William H. Schacht, general manager of the Copper Range mines, recently delivered a lecture to students at the Michigan College of Mines on the steam regenerating system in use at the Champion copper mine. **James MacNaughton**, vice-president of the Calumet & Hecla, will deliver a lecture during this week regarding practical improvements in underground haulage.

Richard B. Moore, of the U. S. Bureau of Mines, has been voted the Edward Longstreth Medal of Merit by the subcommittee on literature of the Franklin Institute. The medal was awarded for Mr. Moore's biography and review of the work of Sir William Ramsay, which was described by the subcommittee as a most lucid and informing exposition of the great chemist's life and work.

Harry A. Garfield was the guest of honor at a reception and dinner given in complement to him by the executive heads of the U. S. Fuel Administration last week. William B. Symes, Jr., solicitor of the Fuel Administration, presided. Dr. Garfield was presented with a bronze reproduction of the familiar "Soldier and Miner" poster. Among the 40 guests were J. D. A. Morrow, general director of the distributing division of the Fuel Administration; M. L. Requa, general director of the oil division, and W. E. Hope.

Obituary

Clyde McKenzie, formerly connected with the Tonopah Belmont as field engineer, died recently in Tonopah, at the age of 30 years. He was graduated from the Mackay School of Mines of the University of Nevada in 1910 and began his career with the Tonopah Belmont Development Co. as draftsman, being later promoted to field engineer, until placed in charge of the Emma mine, in Colorado. Mr. McKenzie enlisted in the 27th Engineers as a private in 1918, and later was commissioned a first lieutenant in the Chemical Warfare Service, receiving his discharge in January, 1919.

William S. Rheem, president of the Standard Oil Co. of California, recently died suddenly at Santa Cruz, Calif., of heart disease. Mr. Rheem succeeded D. G. Schofield, who died two years ago. He had been with the company for the last 25 years, beginning his career as an expert refiner in one of the company's Eastern plants. He went to California in 1900 from Whiting, Ind., and established the Standard refinery at Port Richmond, later becoming secretary and vice-president of the company in California. He is survived by his widow and three sons. Mr. Rheem was 57 years old.

Verner Z. Reed, who was a member of the Special Mediation Commission appointed by the President to undertake the adjustment of industrial labor troubles soon after the United States entered the war, and made a trip in 1917 of many weeks' duration through the West investigating deportations and unrest in the Arizona copper districts, and labor troubles elsewhere, died on Apr. 20 at Coronado, Calif. Mr. Reed was born in Ohio in 1863, and for many years was engaged in mining, banking, petroleum development, land reclamation, and irrigation enterprises in Colorado, Wyoming, and other states. He was a member of the Explorers' and Rocky Mountain clubs.

Societies

Engineers' Club of Northern Minnesota held a meeting on Apr. 26, when H. A. Higgins addressed the club on "Mine Accounting."

Canadian Mining Institute, Manitoba Branch, held a meeting at Winnipeg on Apr. 19, and the following officers were elected: Chairman, Dr. R. C. Wallace, The Pas; vice-chairmen, W. J. Dick, Winnipeg, and G. R. Bancroft, The Pas; secretary-treasurer, J. S. DeLury, Winnipeg; executive committee, B. S. McKenzie, G. B. Hall, E. W. Jackson, F. de Sieyes, and D. C. McArthur, Winnipeg, and Walter Neal and J. A. Campbell, The Pas. A resolution was adopted approving of what had been done by the council of the Institute to urge upon the Canadian government the employment of returned soldiers as prospectors.

Industrial News

Hatton, Klein & Holmes is a partnership recently formed between Norman Hatton, William J. Klein and S. E. Holmes for the purpose of conducting a practice devoted to general engineering, architecture, machinery lay-outs, heating and ventilating, and industrial engineering.

Sullivan Machinery Co., Chicago, announces that Lieut.-Col. George W. Blackinton, the former office manager at Denver and now serving in the American Army in France, has been recently promoted from the rank of Major and is expected to return in June, having been transferred to 353d Infantry of the 89th Division.

Charles Leroy, a Jeandelize par Conflans, Arrondissement de Briey, Meurthe et Moselle, France, an Italian engineer familiar with European mining properties, particularly those in the Bassig de Wriey section and western France, Spain and Italy, is desirous of getting in touch with American firms interested in mining, with a view toward forming a coöperative business relationship.

Traylor Engineering and Manufacturing Co., Allentown, Penn., in a circular recently issued, extends an invitation to the company's friends to visit its shops during the week of Apr. 28 and view the largest stone crusher in the world, the 60-in. Traylor "Bulldog" gyratory, built for the Michigan Limestone and Chemical Co. This crusher has two receiving openings, each 60 x 190 in., and a capacity of 2500 tons crushed stone per hour.

American Zinc, Lead and Smelting Co., with offices in St. Louis, New York and Boston, has made arrangements with the American Zinc Sales Co. to handle Azo zinc oxides. For the convenience of its increasing trade, and to facilitate shipments of L. C. L. lots of Azo zinc oxides, in Chicago and adjacent territory, the American Zinc Sales Co., with offices at 1415 Conway Building, Chicago, will act as the exclusive representative of the American Zinc, Lead and Smelting Co.'s products in this territory. A. C. Eide has been appointed manager of the Chicago office of the American Zinc Sales Company.

Chicago Pneumatic Tool Co. announces the election of Allan E. Goodhue as managing director of its English subsidiary, the Consolidated Pneumatic Tool Company, Ltd., whose offices are at 170 Piccadilly, London, the plant being in Fraserburg, Scotland. Mr. Goodhue will also be in charge of European sales. Mr. Goodhue was for a number of years connected with the sales department of the Midvale Steel Co. and Midvale Steel and Ordnance Co. in Philadelphia, Chicago, and Boston, leaving in March, 1918, to enter the service of the Government. From that time until Jan., 1, 1919, when he became connected with the Chicago Pneumatic Tool Co., he was assistant manager of the steel and raw-material section, production division, of the Emergency Fleet Corporation. Mr. Goodhue is to sail for England May 13 on the "Mauretania."

Trade Catalogs

Soot Cleaners for Boilers. Vulcan Soot Cleaner Co., Du Bois, Penn. Folder descriptive of soot cleaners for return tubular boilers, and relation of soot to efficiency.

Insulated Hangers. The Ohio Brass Co., Mansfield, Ohio. Illustrated folder describing the O-B Type S insulated hangers, allowing alignment of clamp to eliminate kinks in the wire.

Precipitation of Cyanide Solutions. The Merrill Co., San Francisco. A pamphlet on "Comments of the Technical Press on the Crowe Vacuum Precipitation Process. A New Method of Precipitation of Cyanide Solutions in Conjunction With Either the Merril Precipitation Process or With Zinc Boxes."

Leather Belting. Charles A Schieren Co., New York City. Catalog No. 10; 6 x 9; 10 pp, illustrated. Descriptive of various Schieren beltings, giving price lists; table of widths and lengths of laces, hydraulic leather, waterproof cement, and belt dressings. The Lenix Drive, a device for increasing the arc of contact, is described in the last pages.

The Use of Shoveling Machines in Underground Mining. Myers-Whaley Co., Inc., Knoxville, Tenn.; 8¼ x 10¼; 20 pp., illustrated. Bulletin descriptive of the operations of Myers-Whaley shoveling machines in metal and coal mines Capacities in tons per shift, distributive costs and other data are given for operations under various conditions and material handled.

Nickel Copper Steel, Nicu Steel Corporation, Ltd., Box 128, Welland, Ontario; 5½ x 8; 8 pp. A pamphlet entitled "Nicu Steel," which is a high-grade alloyed steel able to stand hard usage and rough treatment. The catalogue describes "Nicu Steel" transmission shafts and gears, crank shafts, axles, springs, valve stems, rods, and similar parts. This company has a New York office at 43 Exchange Place.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Cast Iron—Manufacture of Gray Cast Iron. Walter Birkett Hamilton, Yorkshire, England. (U. S. No. 1,296,384; Mar. 4, 1919.)

Concentrator—Ore Concentrator. George W. Burnhart, Denver, Colo. (U. S. No. 1,295,267; Feb. 25, 1919.)

Concentrator—Ore Concentrator. James A. Brent, San Francisco, Calif. (U. S. No. 1,295,960; Mar. 4, 1919.)

Conveying Apparatus for Disintegrated Material. Louis Ellman, Pittsburgh, Penn., assignor to the Hagan Corp., Pittsburgh, Penn. (U. S. No. 1,296,497; Mar. 4 1919.) 1919.)

Copper—Process for Treating Ores and Metals in Reverberatory Furnaces. George Campbell Carson, San Francisco, Calif. (U. S. No. 1,296,478; Mar. 4, 1919.)

Crushing—Grinding Mill. Johan S. Fasting, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,295,288-91; Feb. 25, 1919.)

Crushing—Grinding Mill. John Willis Garrow, Copper Cliff, Ontario, assignor of one-third to James D. Cumming and one-third to George R. Craig, Copper Cliff, Ontario. (U. S. No. 1,295,726; Feb. 25, 1919.)

Crushing—Gyratory Crushing Apparatus. Joseph E. Kennedy, New York, N. Y. (U. S. No. 1,295,757; Feb. 25, 1919.)

Crushing—Tube Mill. Johan S. Fasting, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,295,289-90; Feb. 25, 1919.)

Desulphurizing Metal Sulphides, Process of. Arthur B. Foster, Washington, D. C., assignor to Sulphur Syndicate, Ltd., London, Eng. (U. S. No. 1,296,585; Mar. 4, 1919.)

Drill. Arthur L. Hawkesworth, Butte, Mont. (U. S. No. 1,296,078; Mar. 4, 1919.)

Drill Bits—Joint for Drill Bits and Other Purposes. Henry Haus, Pope Valley, Calif. (U. S. No. 1,296,954; Mar. 11, 1919.)

Drill Puller. Willis A. Cook, Republic, Wash., assignor of one-half to Alex. McKay, Republic, Wash. (U. S. No. 1,295,700; Feb. 25, 1919.)

Dump Car. Ernest Junghanns, Anaconda, Mont. (U. S. No. 1,297,356; Mar. 18, 1919.)

Electric Furnace. Albert E. Greene, Seattle, Wash. (U. S. No. 1,297,149; Mar. 11, 1919.)

Electric Furnace and Method of Melting Metals and Smelting Ores. Parvin Wright and Ivan B. Wright, Seattle, Wash. (U. S. No. 1,296,896; Mar. 11, 1919.)

Electric Induction Furnace. Oscar Brophy, Philadelphia, Penn. (U. S. No. 1,296,752; Mar. 11, 1919.)

Electrolysis—Apparatus for the Electric Dissolution and Precipitation of Metals. Edward R. Holden, Los Angeles, Calif. (U. S. No. 1,295,752; Feb. 25, 1919.)

Filter-Scraper Shifter (Automatic). Paul D. Sidey and Glen L. Harley, Goldfield, Colo. (U. S. No. 1,296,865; Mar. 11, 1919.)

Flotation—Process for Separating Ore Materials from Each Other. Robert S. Towne, New York, N. Y., and Frederick B Flinn, Orange, N. J., assignors to Bubble-Column Corporation. (U. S. No. 1,295,817; Feb. 25, 1919.)

Lamp. Acetylene Lamp. Augie L. Hansen, Evanston, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. Nos. 1,295,743 and 1,295,744; Feb. 25, 1919.)

Leaching. Process for Treating Ores. Joseph Irving, Bisbee, Ariz. (U. S. No. 1,296,523; Mar. 4, 1919.)

Oil Wells, Method of Operating. Charles A. Waitz, Rouseville, Penn. (U. S. No. 1,295,243; Feb. 25, 1919.)

Ore-Treating Apparatus. Alfred Leslie Blomfield, Denver, Colo., assignor to the Dorr Co. (U. S. Nos. 1,294,759 and 1,294,864; Feb. 18, 1919.)

Ore-Treating Apparatus. Alfred Leslie Blomfield, Denver, Colo., assignor to The Dorr Co. (U. S. No. 1,294,864; Feb. 18, 1919.)

Sample-Taking Device. Redus D. Dodds, Humble, Tex. (U. S. No. 1,295,134; Feb. 25, 1919.)

Separating Tanks, Overflow Control for. Charles Allen, El Paso, Tex. (U. S. No. 1,296,252; Mar. 4, 1919.)

Steel-Smelting Furnace. Walter G. Perkins, San Francisco, Calif., and William H. Fitch, Pittsburgh, Penn. (U. S. No. 1,295,586; Feb. 25, 1919.)

Zinc. Process of Treating Zinc Ores. Augustus P. Craft, Galena, Ill. (U. S. No. 1,295,857; Mar. 4, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Apr. 22

Consolidated Virginia and Ophir produced in excess of $17,000 in the week ended Apr. 19. Mexican mill ran 92% of the time, and crushed a total of 407 tons from Consolidated Virginia, average $30.49, and 182 tons from Ophir, averaging $27.31 per ton. Consolidated Virginia production included 29 cars from 2150 level that averaged $165 per ton, the highest-grade ore that has come from this mine in the last 25 years. Some excitement was created by this strike of ore, which showed assays as high as $2000 per ton. It is not probable that such returns will be constant Whitman Symmes, manager, is reported to have stated that there are several places where $2000 ore can be picked out, but that this does not mean the average will hold.

Annual Report on Oil Fields by the State Oil and Gas Supervisor, R. P McLaughlin, contains a detailed account of all field operations in California for the last fiscal year, which ended June 30, 1918 The report also sets forth the general conditions of all the fields, including distribution of ownership of proved oil lands and statistics of production by fields Comparison of results from the various methods of shutting off water is presented showing a wide variation in oil-field practice The supervisor believes that the experiences of operators and a comparison of methods in the last year will result in a saving in the present year of a total of approximately $250,000 needlessly expended in the last year Interesting facts regarding the loss resulting from drilling wells too close together are briefly set forth The report shows advancement in caring for oil lands due to coöperation with the State Mining Bureau

Litigation Over Patent to Roche Rock Lode, situated in the heart of the town of Grass Valley, being granted to the Golden Center of Grass Valley Mining Co., which company claims said lode by purchase and possession, may be initiated by the City Trustees of Grass Valley. A protest has been filed in the U. S. Land Office at Sacramento, Calif. When the U. S. Government granted a townsite patent in 1872 to what was then the town of Grass Valley, the owners of a number of lots and the mining claims failed to acquire townsite deeds. Some of these lands were operated as prospects or as mines for many years thereafter, and operations finally ceased. The situation remained unchanged for many years, and up to about the time that the applicant company found a producing mine—hence the application for patent to the Roche Rock lode. The point involved is whether this land was a known mine or a recognized mining possession at and prior to June 18, 1869, the date of entry of the townsite, and contains minerals of such extent as to justify expenditures for the purpose of extracting them. On Feb 15 last the Secretary of the Interior ordered tho hearing Many of the lot owners in the city are apprehensive that should a mineral patent be issued for this claim other applications will follow and mining might become general under the city, millions have already been extracted from deep-mining operations under lands not in conflict with this Roche Rock claim. The application is simply to acquire title and not to establish a precedent, although future litigation may follow as a result of such patent With only a change in the procedure it is a case of mineral against townsite to be fought all over again, and it promises to be a long contest The hearing is set for May 21

BUTTE, MONT.—Apr. 26

Anaconda Copper Mining Co. is operating 11 properties out of 31 which it either owns or has under control The production is about 55% of normal, and, roughly estimated 5000 men are employed. The smeltery of Anaconda is running close to 60%, as it is treating some custom ore in addition to the ore from the company's properties in this city. According to reports the company is going into the manufacture of calcium carbide. At present one of the five furnaces originally built to manufacture ferromanganese for the Government is to be used, and the lime needed will be obtained from one of the quarries near Great Falls now operated by the company First test will be to make 25 to 30 tons of calcium carbide. To handle the carbide it will be pressed and sealed in tin cans.

DENVER, COLO.—Apr. 25

Leadville Strike Situation has been one of the most serious mining problems that Colorado operators have faced in many months, because it involved the possible abandonment of a famous mining camp, great financial loss to operators and investors, and a most critical development in a local labor problem which might easily result in far-reaching and embarrassing consequences. Briefly, the situation developed under the influence of three chief factors, viz., the high cost of commodities, high wages, and low market price for metals produced. The readjustment of wages was the chief factor in the controversy, as it was clearly beyond the power of either party in the contest to vary the other factors involved The usual contributary causes of friction between the interested parties, such as lack of diplomacy on the part of officials on both sides, or their failure to appreciate underlying reasons for the existing mutual dissatisfaction, served to obscure the real issue for a time and delay a settlement, but perhaps to less extent than is usual in such cases. On Apr 18 Governor Shoup, accompanied by two members of the State Industrial Commission, William L Reilly and J C Bell, went to Leadville in answer to an appeal from the miners Though both operators and miners appeared to appreciate the Governor's efforts, the operators claimed that the mines would have to close unless men could be obtained at a $3.50 minimum wage, and the miners claimed that they could not live on less than $4.50 per day. Some of the mines laid plans to pull their pumps, which greatly added to the gloom of the situation, as it was realized that if the properties were allowed to fill with water, many of them would become unworkable for a long period of time. On Apr. 20, at the beginning of the Sunday shifts, the miners of many of the large properties walked out. The principal properties affected were the Yak, Iron-Silver, Mikado, Down Town Mines, Garbutt, and Ibex. About 600 miners, engineers, and pumpmen quit work. Just prior to the walkout, some of the mines pulled their pumps in order to avoid loss of valuable equipment. The striking miners then formed a union and appointed a committee to confer with the operators' committee on a proposed compromise $4 wage scale. The situation became more hopeful, although the serious possibilities of flooding underground workings as a result of cessation of pumping operations were fully realized. On Apr. 22 the miners' committee and the operators agreed on a minimum wage of $4 a day. This represented a wage reduction of 50c. instead of $1 as originally announced by the operators in their proposed sliding scale based on the state of the zinc market. It is not yet known whether the mines will continue to operate at full capacity under the present low prices for metals. The operators entering into the agreement with the miners include the managers of the Yak, Down Town Mines, Ibex, and Garbutt groups. Some of the pumps that were pulled have not been reinstalled, and these properties are already partly flooded.

The strike was rather unusual in that it was marked by good feeling on both sides, each faction maintaining that it was willing to make every possible financial concession to keep the mines in operation. In many properties the pumps were kept working by volunteer pumpmen, the miners supplying some of the volunteers. No matter how peaceably a controversy of this character may be settled, every strike has its aftermath. In this case there will be many unemployed in Leadville, as several mines will not reopen, at least for the time being. The Mikado shaft of the Iron-Silver Mining Co. will not resume for an indefinite period, as many of the workings are under water, the pumps having been removed when the miners announced that they would strike. It is said, also, that the Greenback shaft of the Greenback Mining Co. will not resume operations. Both the Mikado and the Greenback companies have agreed to pay the existing wage scale when they reopen. The Yak, Penrose, Garbutt, and Ibex shafts will resume operations soon, but it is thought that these properties will probably reduce their working forces. During the last two weeks there has been a marked exodus of single men from the district. During the strike no attempt was made to operate the mines with outside labor, the operators agreeing that this would be a serious mistake because such a step could lead to no ultimate solution of the difficulty, and their principal concern was to keep the pumps operating at the deepest mines of the district so as to prevent disastrous flooding.

SALT LAKE CITY, UTAH—Apr. 26

The State Board of Equalization has received a statement concerning the mining properties of the Knight interests for taxation purposes which shows the following returns during 1918: Dragon Consolidated, gross yield, $374,082; deduction, $317,749; net proceeds, $56,332; valuation for taxation (three times net proceeds), $168,978. Iron Blossom, gross yield, $878,156; deductions, $771,612; valuation for taxation, $319,633. Swansea Consolidated, gross yield, $15,648; deuctions, $14,283; net proceeds, $1363; valuation for taxation, $4092. Empire Mines, gross yield, $43,247; deductions, $88,994. Colorado Consolidated, gross yield, $264,755; deductions, $288,426. Tintic Drain Tunnel, gross yield, $1083; deductions, $52,234.

High Freight Rates imposed under Government railroad management are being protested by some of the smelting companies operating in Salt Lake Valley. The complaint alleges that, though the increase was said to have been only 25%, the actual advance on smelting products amounted to 170%. Also it is pointed out that there has been a large increase in the prices of most articles of commerce, that the price of copper as fixed by the Government during the war was far below the market quotation, and that the cost of production of smeltery products had advanced more than 75%. Relief is asked as well as reparation for alleged overcharges. Coal companies, 15 in number, operating in Salt Lake, are asking a refund on alleged excess freight rates—in round numbers, $500,000—paid the Denver & Rio Grande R.R. on coal brought in from Carbon County. In the complaint, filed with the Public Utilities Commission, a refund of 35c. a ton is asked, except in the case of coal from Sunnyside and Thompsons, where the excess is given as 45c. per ton, extending over a period of two years.

WALLACE, IDAHO—Apr. 25

Employment for Returning Soldiers has up to date not proved a serious problem in the Coeur d'Alene district. It is estimated that three or four hundred have returned to this county, and, so far as can be learned, not one of them is idle who desires work. In fact, there is an actual shortage of labor for the mines, particularly experienced miners. This is probably due to the demand for labor in the agricultural districts and on the coast, and also to the fact that the rate of pay in the mines of Butte is 50c. per day above the rate here. It is believed, however, that this situation will adjust itself in a short time.

Improvement in Lead Market is indicated by the resumption of operations by the Hercules Mining Co. and the Tamarack & Custer Consolidated Mining Co., or at least that is the view taken by the Days, who control both these mines, and also the Northport smeltery. The Hercules and Tamarack mines closed down just before Christmas for a holiday of 10 days, but at the end of that period employes who returned to work were informed that the shutdown would be continued indefinitely. The Northport smeltery, which handles little if any business outside of the Day mines, closed a little later. The fact that all other lead mines of the Coeur d'Alene district continued production, although with reduced output, caused much speculation as to why the Days closed down tight, it being contrary to the Days' policy to give out any information regarding their affairs. Following the shutdown persistent rumors were circulated that the Guggenheims were negotiating for all the Day holdings, and color was given to these rumors by the arrival of William Loeb, vice-president of the American Smelting and Refining Co., in Spokane, where it was reported that he conferred with the Days. If there was any basis for these rumors, it is evident now that nothing resulted from the negotiations. A more plausible explanation of the action of the Days in closing their mines and smeltery is that the failure of the lead market following the signing of the armistice found them with a large stock of lead on hand, for which there were no buyers, and to continue production meant a steady increase in the surplus and the consequent tying up of a large sum of money. At the same time they probably considered that, as the smeltery was running on ore from their own mines, it would be the part of economy to leave the ore in the mines rather than convert it into pigs that could not be sold. Accepting the last explanation as correct, the fact that the Day mines are again active is taken to mean that the Days believe the crisis in the lead market has been passed and that a growing demand for lead may be expected which will insure profitable production.

DULUTH, MINN.—Apr. 26

The Ore-Royalty Tax Bill, which passed the Minnesota House by an overwhelming majority, has been defeated by the Senate by the close vote of 34 to 33. The bill provided for a tax of 3% on all income from ore royalties, in addition to the regular state and Federal income taxes.

Minnesota Steel Co. blast furnaces in Duluth have been reduced to an operating basis of one-third of capacity. The men are being worked on short time, in order to employ as many as possible and hold the forces together. Rumors of a shutdown are denied by company officials, as they are hopeful that the trade will improve in the near future.

A Storage Charge on Ore shipped from the Minnesota ranges to the head of the Lakes will be imposed during the coming season, according to new tariffs on file by the ore-carrying railroads. Shippers have been notified that, effective Mar. 15, a storage charge of ¼c. per ton per day will be charged on all ore remaining in cars more than 10 days. The same document carries the information that last year's rates of 95c. per ton for transportation and 5c. per ton dock charges will continue effective.

A Severe Curtailment of Operations has followed closely the opening of ore shipments from the Lake Superior district. Many mines remained on the shipping list for one day only, and many others, which had shipped for several days, have since stopped and reduced their operating forces considerably. Independent operators are shipping practically nothing, and the Steel Corporation is loading slowly. A variety of reasons, ranging from non-appearance of boats to a poor ore market, are assigned, but the fact seems to be that the condition of uncertainty permeating the steel business because of the railroad price squabble has been reflected on the ore business.

A Worker's Manual in the form of a handbook covering all phases of mining on the Minnesota ranges is to be published by the Engineers' Club of Northern Minnesota, and work has been started on it. Each phase of the work will be covered by a separate treatise, and each treatise will embody not only the writer's experience and knowledge, but also the best that can be selected from present literature on the subject and through collaboration with other men in the same line of work. L. D. Davenport is editor-in-chief and the following assistants have been selected to aid in the work: A. B. Holley, mechanical; W. E. Bates, underground mining; F. R. Mott and E. P. Ericson, steam-shovel mining and stripping; H. S. Rankin, concentrators; Ellery Anderson, ore grading; Odin Sundness, ore sampling and analysis; A. E. Anderson, blasting; W. F. Simpson, milling; F. E. Downing, mining costs; B. K. Dutton, screening plants; H. J. McInnins, iron ores, value, market, and similar subjects; A. C. Borgeson, ore drying; A. F. Benson, magnetic ores and treatment; A. A. Krogdahl and W. W. Sullivan, safety and "first aid"; F. A. Wildes, mine inspection; H. E. Loye, glossary of mining terms; J. F. Wolff, geology; C. M. Boss, history; and W. L. Taylor, explorations.

Experimentation in Peats, of which there are great quantities in northern Minnesota, has been conducted by the office of F. A. Wildes, engineer of state mines. These experiments were first undertaken with the idea of developing peats for fuel, steam and domestic, and thus releasing Minnesota from the domination of the coal operators, whose prices are high. But it has now developed into an attempt to utilize peat for the beneficiation of paintrock, a lean iron ore high in silica and alumina and charged with moisture. Most mines on the Mesabi and other ranges carry a considerable tonnage of this material, not only valueless but a positive detriment to the miners, as it exists in strata that must be removed to get at the merchantable ore beneath. The experiments have been conducted on paintrock from two mines owned by the state's school fund, the total available tonnage from which is understood to be about 80,000,000 tons, and whose paintrock is supposed to be in the neighborhood of 20,000,000 tons. This latter runs from 30 to 40% iron and contains from 20 to 30% of water. Mixed with peat in a pugmill in the proportion of about 5% of peat to 95% of paintrock, pressed into briquets and burned, it becomes a hard somewhat porous, red ore of from 50 to 51% iron. It is non-bessemer, and that coming from these two mines contains from 1 to 1.5% manganese. This sort of ore is commercial in all probability, although its silica and alumina are as high as 15% or even more, and it has practically no lime nor magnesia. The state does not appear to regard this high silica as precluding the enterprise.

It has been estimated that there are in northern Minnesota not less than seven thousand million tons of peat, and the late Charles A. Davis, peat expert of the U. S. Bureau of Mines, stated that it is equal in all respects to peat that is used in other countries. It contains a considerable volume of ammonium sulphate, and the experiments of the state show a saving of about 150 lb. per ton of dry peat; also other valuable byproducts in quantity. Assistant State Engineer Hindshaw, who has been conducting these experiments, estimates that the state has a value in this peat far in excess of what it has in iron ore. How much paintrock there may be in the mines of northern Minnesota is impossible to estimate, but if the central portion of the Mesabi Range runs on the average as do the two mines referred to, it is probable that not less than 100,000,000 tons of 50% ore might be made from it.

SPOKANE, WASH.—Apr. 25

Much Activity in the Gold Camps of central Idaho, especially at Elk City, Orogrande, and Buffalo Hump, is predicted during the coming summer as a result of the announcement made by the acting director of the Bureau of Public Roads, Washington, D. C., that a first-class wagon road will probably be constructed from Harpster to Elk City. It is officially announced that the survey of the road is to begin soon and that actual construction will follow as promptly thereafter as is practicable. The estimated cost of the road is $300,000. It will connect at Harpster with a good road to be constructed to that point from Stites, the terminus of the Clearwater branch of the Northern Pacific, 13 miles distant from Harpster. The expense of building this road is to be defrayed by the citizens of Stites. Mining men of Spokane and vicinity are extensively interested in the districts to be given transportation by the new road through the National Forest Reserve. Many properties have been developed to the point of production, and the owners have been waiting for transportation. With this provided, active operations will be started. It is believed that development of a number of promising prospects in the territory will begin as soon as the contract is awarded for the construction of the Government road.

AUSTIN, TEX.—Apr. 26

Blue Sky Law on the statute books at present has proved wholly inadequate in preventing the organization of dishonest and irresponsible oil-stock-selling companies. Enormous amounts of worthless securities have been sold to innocent people in Texas and other states during the last several months. It is estimated that many millions of dollars have been paid for stocks that have no value whatever. According to reports, organizations of holders of these stocks have been formed in Dallas and other towns for the purpose of investigating the standing of the various companies and to protect the stockholders' investments. The Dallas organization is called the Texas Oil Investors' Protective Association. W. J. Condon, who was elected president, said that the organization would be state-wide in scope, and one of the first acts would be the investigation of several companies which promised dividends but have failed to pay any.

BIRMINGHAM, ALA.—Apr. 26

No Fatal Mine Accidents occurred in 1918, which sets a new record. Other accidents showed a decrease, and, in view of the conditions, which made necessary the employment of considerable unskilled labor, the record is a good one. This is the first time in 29 years that the mines of this state had not a fatality in a 12-months' period.

The Alabama State Legislature has before it a compensation act which probably will be enacted into law. The act was discussed at the January session, but the labor representatives and the employers were unable to agree on a suitable bill. The mining interest as a whole will welcome any law that provides a fair and equitable compensation for injuries received while in performance of duties.

Operations Are Coming to a Standstill and little of note is taking place in this district. The most important change in iron and steel operations to be recorded during the third week of April is the closing down of the Tennessee Coal, Iron and Railroad Co.'s furnace at Oxmoor, Ala. This curtailment of production will be balanced by the expected blowing in of the company's furnace at Ensley, Ala., which had been down for repairs. Two furnaces at Bessemer, Ala., are expected to begin operations soon, a considerable amount of iron being required in the manufacture of steel. The Oxmoor furnace, just closed down, is said to be the oldest operative furnace in the district and had been in continuous operation for the last six years.

With the exception of the increase of the Tennessee company, already mentioned, there is little prospect for larger output from any of the other companies. The Tennessee company is undoubtedly the best equipped to meet the present quiet pig iron market, as a large proportion of the iron manufactured goes to the company's own plants in various parts of Birmingham, notably the steel plant at Ensley, Alabama.

A further step in curtailment of production of iron was made in this district during the fourth week of April, when the Tennessee company's ore mines at Muscoda, Ala. (Muscoda division, Bessemer, Ala.) discontinued night work with the exception of that at the company's No. 6 mine.

WASHINGTON, D. C.—Apr. 26

Increased Freight Rates put into effect by the Railroad Administration were protested in a complaint filed by 11 large mining companies with the Interstate Commerce Commission. The complainants are the American Smelting and Refining Co., American Smelters Securities Co., United States Zinc Co., Garfield Smelting Co., Baltimore Copper Smelting and Rolling Co., Consolidated Kansas City Smelting and Refining Co., Federal Lead Co., Ray Consolidated Copper Co., Utah Copper Co., Chino Copper Co., and Nevada Consolidated Copper Co. Relief from the unjust rates alleged and compensation for the overcharges claimed were asked. It was also requested that the carriers be requested to establish transit rates through Baltimore such as are in effect through other refining points.

TORONTO, ONTARIO—Apr. 26

Discovery of Platinum in Eby Township is causing much interest among mining men. A strong sulphide dike running across the Baldwin gold property is believed to contain this mineral, which is known to occur with sulphides in the Sudbury district. A party of 30 men left Toronto on Apr. 24 to inspect the Baldwin mine and make investigations as to the occurrence of platinum in the locality.

Regulation of Use of Natural Gas is provided in a bill introduced in the Ontario Legislature by Hon. G. Howard Ferguson, Minister of Lands, Forests, and Mines. It gives the Minister power to shut off the supply of any company or individual; to regulate the construction of machinery using natural gas and the division of fields of production between producing companies; to order the closing of gas wells or works; and generally to exercise control of the production, transmission, and consumption of natural gas for the purpose of conservation.

Important Amendments to Mining Laws of Ontario were made by the Provincial Legislature during the session just closed. The principal changes provide more stringent regulations to prevent accidents and disease which have been rendered necessary by the larger scale upon which mines have latterly been operated and the introduction of deep mining. The regulations as regards sanitation, the use and care of explosives, protection in shafts and working places, and similar rules are made much more detailed and specific; and provision is made for frequent inspection of the machinery and equipment to keep its requirements up to the modern standard, especially strict rules being laid down as regards hoisting machinery. An important regulation provides for the testing of a section of the hoisting rope every six months at a testing laboratory, and a monthly examination of the hoisting ropes and the safety appliances of the cages and shaft conveyances. Elaborate provisions are also made for the safety of the workmen employed in blast furnaces, and the rules governing the use of electricity are adapted from those of the Bureau of Standards at Washington. The changes in the law with respect to the taking up and working of mining claims are important, providing that a prospector can locate a group of six iron ore or iron pyrites claims, and do the assessment work on one of them; and that the actual cost of the survey of a mining claim shall count as labor performed under the working conditions at the rate of $4 per day, but for not more than 25 days' labor. Before the act was prepared the changes it embodies were considered by both mine managers and representatives of labor, and its provisions met with the general approval of all concerned

The Mining News

ARIZONA

Cochise County

BENSON SMELTERY to be started again May 15, according to Charles E. Goetz, who has been in charge of work of rebuilding old plant

MASCOT (Wilcox)—Machinery of new concentrator being installed.

Gila County

CHILITO, on San Carlos reservation, eight miles north of Hayden, is center of excitement through cutting of 3-in quartz stringer, in 2-ft vein, showing gold. Claims have been named Aztlan and Chimera. Owned by Nelson O'Shaughnessy and other New York men. Managed by E. R. Tufts

Greenlee County

ARIZONA COPPER (Clifton)—Closed No 4 concentrator at Clifton; reduced working time No 6 at Morenci to 12 shifts per week. Metcalf Division mines, supplying ore to Clifton concentrator, closed on Apr 15. Coronado Division mines, supplying ore to No 6 also closed same date for ore production but 1100 adit being driven ahead. About 450 men thrown out by curtailment. Reduction in ore tonnage approximately 50% based on January, 1919

ASH CREEK (Duncan)—Worked for 15 years. To install 100 ton cyaniding mill. Silver sulphide, carrying gold in quartz

Mohave County

SILVER PICK (Kingman)—Bought by C. T. Griffith and E. W. House.

ALCYONE (Oatman)—Near Boundary Cone, under development, now 400 ft. deep; 4 ft. milling ore reported.

GOLD ROAD BONANZA (Oatman)—Drifting on 550 level.

NELLIE (Oatman)—To extend eastward drifting on unwatered 530 level. In Black Range section, managed by H. E. Woods

OATMAN UNITED (Oatman)—Will continue 600-ft. main shaft to 800 ft. before crosscutting to vein.

RED LION (Oatman)—Developing between Bald Eagle and Ben Harrison claims of Tom Reed.

TOM REED, JR (Oatman)—Bought by W A Brooks and others; shaft 250 ft deep

Pinal County

MAGMA COPPER (Superior)—Has acquired all ground of Queen Copper Co with consideration of $75,000 for 11 adjoining claims. Original Magma ground was two claims of old Silver Queen, held by Queen Copper under option, surrendered after striking copper sulphide. Magma claims to have found nothing by drilling Queen ground which will be used for long tunnel that will connect main shafts with surface plant.

Yavapai County

GOLD NUGGETS of unusual size found on southern slopes of Bradshaw range. One worth $300 found by Mexican.

GRAND ISLAND (Jerome)—Mineralized quartz vein cut on 500 level. Continuation of ledge developed at 170 feet

UNITED VERDE COPPER (Jerome)—Contracted for sinking No. 6 shaft, 15 x 15 ft. from 430 to 1650 level.

UNITED VERDE EXTENSION (Jerome)—Grading smeltery townsite at Verde, employing 125 men, 12 miles of streets graded on system radiating from common center, buildings planned involving $2,000,000 cost

COPPER QUEEN GOLD (Stoddard)—Given verdict of $15,000 in Superior Court against Arizona Binghamton company; sued for $200,000 for alleged breach of contract to take 100 tons of ore a day. Defendant claimed plaintiff was not able to furnish such amount

Yuma County

CASTLE DOME DISTRICT, 40 miles northeast of Yuma active. Hull and reorganized United Mines Co working two shifts. Mabel developed water at 315 ft for camp and operation of its mill. J. A. McCaddon, of New York, interested.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Fire practically out and fully confined to 3750 level. New raise being driven to provide new upcast to insure protection of burned area and prevent revival of fire. H. M. Wolflin, mine inspector, supervising the work.

KENNEDY (Jackson)—Operation, interrupted by gases from Argonaut fire, resumed without damage to mine.

CENTRAL EUREKA (Sutter Creek)—Good milling ore developed below 3350 level. Large tonnage going to mill.

Calaveras County

SHEEPRANCH (Sheepranch) — Golden Gate Exploration Co. purchased A. W. Poe Hotel and Sheepranch mine, formerly a large producer, as nucleus of holdings being acquired. Recent development extended to 1550-ft. point. Average width of vein matter said to be 5 feet.

Nevada County

BULLARDS BAR proposed dam, 28 miles west of Grass Valley, on Yuba River, will be 140 ft. long and first section 80 ft. high. Water will be backed up 6½ miles. Tailings from Brandy City hydraulic mines will be impounded in reservoir and overflowing water utilized for electrical power. Mine operators will be charged for storage. Preliminary work began last season. Contracts let to W. F. Mandry and others for hauling machinery and materials to site.

NORTHSTAR MINES (Grass Valley)—Developing on large scale owing to reduced steel and powder costs. Central shaft mill running full capacity.

Trinity County

BONANZA (Trinity Center)—Mill running during winter on ore stored in bunkers before deep snow stopped transportation from mine to mill. To increase extraction and development when weather permits. Snow now 10 ft. deep.

ESTABROOK DREDGE (Trinity Center)—First 20-cu.ft. bucket dredge ever built for placer mining nearing completion. Built by Union Construction Co., Oakland.

PACIFIC DREDGE (Trinity Center)—New ground to be dredged at this and other locations.

COLORADO

San Juan County

HAMLET (Howardsville)—To resume operations. Small force employed in development and repair work.

GOLD FOUNTAIN MINING (Silverton)—Recently incorporated to develop Gold Fountain property near Silverton. O. C. Hand, president; A. W. McArthur, vice-president; N. J. Bradley, secretary-treasurer.

San Miguel County

ALTA (Ophir Loop)—In Gold King basin. Belmont-Wagner Mining Co. to resume operations. Power will be supplied by Western Colorado Power Co. John M. Fox, manager.

BLACK BEAR (Telluride)—Taken over by Smuggler-Union interests; will be developed and operated in conjunction with Smuggler properties. Directorate consists of Bulkeley Wells, president; O. J. Larson, vice-president; Ike Nevala; H. J. Jackson, and E. B. Adams. C. N. Bell, general manager; John L. McMenamin, secretary and treasurer.

PRIMOS CHEMICAL CO. (Vanadium)—Construction of mill on site of old plant destroyed by fire is well under way. Development operations along San Miguel River show considerable commercial ore. Many smaller properties being developed and operated by lessees. Small, independent operators are active in anticipation of market for their product in the near future.

Teller County

DEADWOOD (Victor)—Owned by the United Gold Mines Co.; being operated under lease by Rocky Mountain Leasing Co. of Denver. Shaft being equipped with steam hoist.

KEYSTONE (Victor)—Being developed under lease by E. G. Fink. Has opened vein of sylvanite ore on 400-ft. level south heading.

PORTLAND (Victor)—Veins of high grade opened on Lee 5 and Portland veins at 2130-ft. point, the Roosevelt Tunnel level.

ROOSEVELT TUNNEL (Victor)—Flow from tunnel fallen below 2400 gal. per minute; maximum was above 15,000 gal.

TRAIL (Victor)—Opened 2-ft. vein on 1400 level of Dexter shaft for 25 ft. During March five carloads shipped. This ground being operated under lease by Anderson and Benkelman.

IDAHO

Shoshone County

NATIONAL (Mullan)—Mill shut down, will start about May 1, when installation of new machinery is completed. Enough ore broken to run mill three months. Low-grade copper.

WEST HUNTER (Mullan) — Working under new management. Crosscutting 150 ft. to vein. Three shifts after May 1. Situated between Morning and Hunter properties.

INTERSTATE-CALLAHAN (Wallace)—Stockholders' meeting at Phoenix, Ariz., on Apr. 14 elected C. W. Newton, mine manager, and Gust Carlson, of Duluth, directors. S. S. Titus, of Grand Forks, N. D., and A. L. Warner, of Duluth, reëlected, filling four vacancies. Meet in June to decide removal of main office from New York to Wallace.

REX CONSOLIDATED (Wallace) — Agreement with Red Monarch company to extend crosscut to point under Rex shaft now 700 ft. deep, and raise 200 ft. to connection. Expect to develop new orebodies; also provide drainage and ventilation. Rex company acquired copper mine in Arizona, being equipped with hoist and other facilities. Known as Cima Copper Syndicate.

MICHIGAN

Copper District

MICHIGAN (Rockland) — Shipped 6057 tons of rock in March to the mill. Smelter returns show 26 lb. per ton. First quarter this year, 15,000 tons of rock shipped to mill, averaging 28.3 lb. fine copper. During quarter 17 machines operating, six stoping and 11 drifting and crosscutting.

Gogebic Range

NEWPORT (Ironwood)—As in previous loans, will handle employees' subscriptions, allowing five or six months for payment, the same as the banks do.

OLIVER IRON (Ironwood) — Standard gage tracks being laid to C shaft, East Norrie mine, and E shaft, Aurora mine, preparatory to shipping. Shafts recently equipped with steel headframes, loading pockets and electric hoists, are five-compartment, 20 x 10 ft. 8 in. outside of timber, with steel sets and reinforced-concrete lath; replace three wood-lined shafts now being dismantled. Plan to aid employees in buying Victory Loan notes provides for payment in 10 monthly installments.

Marquette Range

HARTFORD (Negaunee) — Suspended underground operations on May 1 until further notice. There is little available room for stockpiling, and 200,000 tons are ready for shipment. Many of the miners will be given employment at the Rolling Mill mine.

MINNESOTA

Mesabi Range

BENNETT (Keewatin)—Shipping contracts for 1919 re-let to Guthrie & Co. Erecting several small dwellings.

STEVENSON (Keewatin)—Closed down indefinitely Apr. 21, account poor ore market. Corrigan-McKinney property and one of the oldest and most consistent shippers.

ALPENA (Virginia)—Small slide of ground Apr. 12, resulting in one fatality.

MONTANA

Deerlodge County

GREAT FALLS rod and wire plant is running to capacity on domestic business and also Canadian and English. Quality of goods is said to be satisfactory. English concern pronounced wire and rods superior to any yet used.

Silver Bow County

ANACONDA (Butte) — Production and development of silver-zinc bodies increasing. Opened 35-ft. silver-zinc deposit on 500 level of Orphan Girl, of milling grade. Shipping from this shoot in Anglo-Saxon fissure. Drifting on Orphan Girl and Orphan Boy fissures. Operating about 60% capacity.

BUTTE COPPER AND ZINC (Butte)—Silver-zinc orebody recently cut on 1000 level of Emma may be downward extension of orebody now mined on 800, making to the east. Anaconda operating Emma on 50% profit-sharing arrangement. James Brennan, superintendent.

BUTTE & SUPERIOR (Butte)—Tonnage increased to 75% of normal from 50; made favorable contracts with American Metal Co. for smelting concentrates.

CRYSTAL COPPER (Butte)—Will sink from 500 level of Goldsmith mine. Shipping two carloads gold and silver ore monthly. Oreshoots opened in North and South veins. William D. Gibson, superintendent.

DAVIS-DALY COPPER (Butte)—Enlarging 2500-ft. station of Colorado mine preliminary to sinking to 2700 level; objective, three productive fissures cut on the 2500. New steel change house to accommodate 600 men and steel and concrete 800-ton ore bins to be constructed. Operating 60% normal. William Frazier, superintendent.

ELM ORLU (Butte) — Sinking shaft. Raising and drifting in connection with action against Butte & Superior involving extralateral rights on Rainbow vein beneath surface of latter's Black Rock claim. William N. Rossberg, superintendent.

NORTH BUTTE (Butte)—Daily tonnage, 400; copper costs 14.2c. per lb. Development on more than 12 levels; Edith May vein, opened below 3000 level, shows good ore on three levels. L. D. Frink, superintendent.

RAMSDELL COPPER (Butte) — Ramsdell shaft reached 300 level, where Lizzie and Hesperus veins, under lease from Davis-Daly, will be crosscut. Production halted until copper market improves. John D. Pope, superintendent.

TUOLUMNE COPPER (Butte)—Sinking Sinbad shaft of Main Range, now 100 ft. below 800; to cut Spread Delight fissure on 1000 and 1200 levels; expect to reach objective about July 15. Crosscutting for vein on 1000 level will be pushed simultaneously. Daily tonnage, 100. Mose Little, superintendent.

NEVADA

Elko County

ELKORO (Jarbidge)—Started 100-ton mill Mar. 1, 1918. Grinding with March and Hardinge mills. Cyanide process consists of Dorr counter-current system, followed by filtration with Oliver continuous filters. Ore from Long Hike mine giving excellent recovery. Owns or controls 75 claims in district, principal being Long Hike, Starlight and O. K. O. B. Perry, general manager; E. A. Austin, resident manager.

JARBIDGE NEVADA MINING (Jarbidge)—Will use flotation. Company states saving higher with cyanide, but ore developed insufficient to justify much greater cyanide installation expense.

Lincoln County

PIOCHE DISTRICT shipments during week ended Apr. 17 were: Prince Consolidated, 26 cars; Virginia-Louise, 10 cars; Harney (Stindt and Donohue lease), one car.

BLACK METALS (Pioche)—Completing hoisting equipment, preparatory to shipping ore, already broken in stopes.

HARNEY (Pioche)—Stindt and Donohue lease. Rich orebody, first encountered two months ago, increasing in size and contents with depth. Vein, 3 to 9 ft. wide, carries gold, silver, lead, and copper. Smelter returns on April shipments about $16,000; 24 men employed. On Big Five lease, sinking shaft to intersect orebody encountered on adjoining Stindt and Donohue lease.

VIRGINIA-LOUISE (Pioche) — Shipped during March 1650 tons of fluxing ore. Davidson orebody, recently encountered on 2d level, proved length of 220 ft. following high grade on 4th level.

Nye County

TONOPAH SHIPMENTS for week ended Apr. 12 were 7620 tons of estimated gross milling value of $129,540, comparing with 7072 tons the previous week. Producers were: Tonopah Belmont, 2492 tons; Tonopah Mining, 1050; Tonopah Extension, 2100; West End, 957; Jim Butler, 114; Montana, 277; Tonopah Divide, 420; MacNamara, 210; North Star, 52 tons.

NEW MEXICO

Grant County

NEW MEXICO CALUMET MINING (Pinos Altos)—Mining ore from Langston and transporting to mill one mile distant; ore is complex, carrying gold, silver, lead, copper, and zinc. Mill is nearing completion.

A. R. DAVIDSON (Fierro)—Shipments of good-grade copper smelting ore being made; milling ore is being blocked out also.

HANOVER-BESSEMER MINING (Fierro)—Shipments of iron ore continue at rate of 800 tons per day.

BLACK HAWK MINING AND MILLING (Hanover)—Substantial headframe erected on No. 1 shaft, now down 60 ft., on Combination claim. Shaft on "97" claim down 40 ft., where zinc sulphide is found.

EMPIRE ZINC (Hanover)—About 200 tons daily being put through dry concentrator; tailings are stored on ground for future flotation treatment.

REPUBLIC MINING AND MILLING (Hanover)—Developing on 100, 150, and 200 levels. Good grade milling ore being blocked out. Shipments of high-grade zinc-sulphide ore being made at rate of 300 tons per month. Planning for mill.

UNITED STATES COPPER (Hanover)—Shaft No. 2 down 700 ft., where it will be enlarged from two compartment to three, and sinking continued.

BOSTON-HECLA (Lordsburg) — Word received from Boston to begin at once construction of new headframe and double-compartment shaft to be carried to 300 level. Contract for first 40 ft. let. Understood that $75,000 has been subscribed for this work. R. E. Vandruff, of Lordsburg, is president.

LAST-CHANCE (Lordsburg) — Pyramid Mining Co. on Mar. 28 made payment of $10,000, being the third on account. Shipped second car concentrates during March.

WILLIAM DOCKER AND ASSOCIATES (Pinos Altos)—Work on Docker ground in Bear Creek country recently started. Copper-silver ore has been shipped.

NEW YORK

Saratoga County

MACO DEVELOPMENT (Ballston Springs)—Recently incorporated; will erect frame and brick buildings and install machinery at Milton and Greenfield to mine feldspar; cost estimated, $75,000. Ellsworth H. Cohen, Schenectady, N. Y., interested.

SOUTH DAKOTA

Lawrence County

BOLGER (Galena)—Incorporation being perfected to take over this and adjacent ground. Extensive development and erection of mill planned this year.

HOMESTAKE (Lead) — Erie two-yard steam shovel purchased for handling coal at newly constructed bins.

DARK HORSE (Trojan) — Leased to Manion, Stewart & Harris; already shipped several cars to Trojan mill. Idle for 15 years.

TEXAS

DUDLEY MINING BILLS VETOED by Governor Hobby. First bill gave state only $280 per acre royalty, no matter what mineral found; second provided owners of railroad-grant lands either pay taxes on mineral prospects or release rights so prospecting could be resumed.

Brazos County

GULF PIPE LINE CO. (Freeport)—Will build loading docks below Freeport on Brazos River. A subsidiary of Gulf Refining Co.

Fort Bend County

NEW STRIKE ON BLUE RIDGE, near Almeda, by Gulf Production Co., when No. 2 well came in with 1000 to 2000 bbl. per day, caused intense activity in buying leases. Greater portion of dome covered by Bassett Blakely farm of 6000 acres. No. 1 abandoned eight months ago by Gulf Production Co.; drilling for two years. No. 2 capped awaiting storage facilities.

Harris County

HUMBLE OIL AND REFINING CO. (Houston)—Refinery of 60,000-bbl. capacity to be built near Goose Creek; constructing eight 55,000-bbl. tanks. Ten of same capacity to be built at Webster and oil pumped to Goose Creek and to either Galveston or Texas City. Pipe line to West Columbia progressing, and line to Ranger surveyed.

PITTSBURGH STEEL (Houston)—Will establish big warehouse and distributing plant. I. & G. N. cotton sheds temporarily leased until permanent location secured on Houston ship channel.

UTAH

Juab County

SHIPMENTS FROM TINTIC week ended Apr. 19 amount to 151 cars, as compared with 163 cars week preceding; 19 properties shipping.

EUREKA KING (Eureka) — Elected board of directors at stockholders' meeting Ray Van Cott, G. M. Chiulos, A. E. Moreton, G. W. Bywater, and F. J. Silvester. Mine in good condition and well equipped. Will consider consolidation with recently formed Paymaster Mining Co., adjoining; could be developed through Eureka King shaft.

MAMMOTH (Mammoth)—Net annual proceeds reported to hoard of equalization, $22,270. Gross income, $386,893, from 21,997 tons of ore produced in 1918.

Salt Lake County

ALTA CONSOLIDATED (Alta)—Connections made with Michigan-Utah aërial tramway. Good shipping season in prospect.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Better weather making possible clearing up of narrow-gage line from Wasatch; hope to reach South Hecla bins soon.

SOUTH HECLA (Alta)—Stated to have 1000 tons of ore broken and awaiting shipment.

MONTANA-BINGHAM (Bingham)—Delinquent date for recent assessment of 2c. a share extended from Apr. 25 to May 9. Two assessments antedating, for 3 and 10c. a share respectively.

OHIO COPPER (Bingham)—Operations suspended. Production amounted to 5,000,000 lb. copper yearly.

UTAH COPPER (Bingham)—Preliminary figures, March output, 8,366,000 lb. copper, lowest in years. January, 10,335,000 lb. and February, 10,500,000 lb. making quarterly production 29,200,000 lb. Preliminary figures from quarterly reports show 1918 profits to have been $18,945,780, $11.66 a share, as compared with $29,984,868, $18.45 a share, for 1917.

GARFIELD CHEMICAL (Garfield)—Loss from fire month ago said to be placed at $20,000 by adjuster. Greater damage prevented by volunteer fire department. At time was producing about 150 tons of sulphuric acid daily. Present production 50 to 75 tons daily. Used in Utah Copper leaching plant.

WOODLAWN (Salt Lake)—Main tunnel in 1400 ft., and management encouraged by opening of some ore. Grizzly fissure expected in 125 or 150 ft. Shipment to be made from new ore as soon as roads permit.

Summit County

PARK CITY SHIPMENTS, week ended Apr. 19, 1380 tons, compared with 1240 week preceding. Shippers: Ontario Silver, Judge Mining and Smelting, Silver King Coalition, Silver King Consolidated, Daly Mining, and Daly West in order named.

GLEN-ALLEN (Park City)—Mill to be ready for operation soon.

IOWA COPPER (Park City)—Assessment of 1c. a share, payable May 19, levied to meet working expense. Some ore being taken out in development. Contact expected soon on 200 level.

PARK-UTAH (Park City)—Suing Judge Mining and Smelting Co. and heirs of David Keith and Bankers Trust Co. in regard to partitioning Rattler, Rattler No. 2, and Curtis claims, asking that, for equitable partition, the claims be sold and divided.

SILVER KING COALITION (Park City)—Large tonnage being produced from old workings, and new ground on 1300 level being developed. Work begun on 15 leases let on upper levels.

SILVER KING CONSOLIDATED (Park City)—Lead-silver-zinc ore being developed on 250 level of Comstock section for new mill; at present working only one shift owing to partially frozen water supply. Stockpiled 250 to 300 tons of zinc concentrates, averaging 37% zinc. Thaynes Canyon tunnel in 9750 ft. in gray limestone; ore-bearing fissures expected in near future.

Tooele County

IN DUGWAY DISTRICT, 55 miles from railroad, work being done at Silver Queen, (from which small shipment made of silver-lead ore taken out in development), Lucky Star, Metal States Mining and others. Haul to railroad to be shortened and bettered by completion of Lincoln highway over Johnson's Pass.

LION HILL CONSOLIDATED (Ophir)—Taken over by Walter H. Farmer, of Boston, under foreclosure proceedings, and new company—Ophir Metals—formed, capitalized at 2,000,000 shares, par value $2. Old stockholders allowed 200,000 shares at 15c. a share under certain fixed conditions. Operated in early days by Marcus Daly for the Walkers.

WASHINGTON

Ferry County

LAURIER MINING CO., in Boundary district, leased property for one year near Laurier, close to international boundary line, to C. A. O'Neil and five associates, of Coeur d'Alene and Butte. Lessees to receive first $5 received above smelter returns, 75% of the second $5, 50% of the third $5 and 10% of everything above. Chiefly copper-silver content.

Stevens County

LEAD TRUST MINE in Northport district is installing a compressor, engine, and 50-hp. boiler. Machine drills are to be used in advancing Tunnel No. 3, 350 ft. to cut vein found in upper workings. Lower tunnel in 200 ft., giving depth of 500 feet.

WYOMING

Converse County

IN MOSS AGATE AND MULE CREEK FIELDS, situated 16 miles west from Edgemont, S. D., several wells being drilled by larger concerns with encouraging results. Oil reported at depth of 1400 feet.

THE OHIO OIL COMPANY has brought in its second well in the Lusk field at a depth of 3460 ft., with a flow reported at 1500 bbl. per day. Pipe line is to be rushed to completion and will connect field with Lusk, a distance of 20 miles, from which point it will be shipped to refineries at Casper.

LORIMER MINERALS (Lusk)—Operating under lease and making regular shipment of uranium ore, four carloads to date. Ore averages 4% uranium oxide, recovered from quartzite by open-pit methods.

CANADA

British Columbia

FLORENCE SILVER MINING CO., in Ainsworth district, announces dividends will be quarterly instead of monthly and at same rate. Mill to be operated continuously; three shifts employed. Increased earnings will accumulate a surplus above dividend requirements. Silver ore.

Ontario

ADANAC (Cobalt)—Opening oreshoot.

BEAVER CONSOLIDATED (Cobalt)—Development work renewed at 1400 ft.; promising vein encountered. J. H. Black elected director in place of F. B. Mercer.

EDWARDS & WRIGHT (Cobalt)—Unwatering old Green Meehan mine; will start shipments again.

MINING CORPORATION OF CANADA (Cobalt)—Production for 1918 was 1,708,252 oz. of silver, compared with 4,485,641 in 1917, and net profits were $925,760, as compared with $2,557,091. Amount to credit of profit and loss was $3,025,347, as against $3,448,377 for the previous year.

OPHIR (Cobalt)—High-grade vein 4-in. wide encountered at 540 feet.

COTTER (Boston Creek)—Willeston Gold Mining Co. organized to operate this property. Additional diamond drilling will be undertaken.

ONTARIO-KIRKLAND (Kirkland Lake)—Shaft down 320 ft. High record established during the work, sinking 120 ft. and timbering in 30 working days. Crosscut will be run at 300 level to pick up vein which left shaft at 175 feet.

ANZAC (Porcupine)—Diamond drilling. Formerly the Armstrong-Booth, comprising eight claims adjacent to Pennaurum. Surface showings good, but never operated extensively.

DAVIDSON (Porcupine)—New vein, reported high grade, encountered at 200 level.

DOME EXTENSION (Porcupine)—Being developed from 6th level of Dome and ore zone entered showing high grade.

McINTYRE (Porcupine)—Sinking drain shaft from 1000 to 1500 level. Developments at 1000 level of Plenaurum reported favorable.

SOVEREIGN (Porcupine)—Funds to carry on development furnished by sale of 300,000 shares treasury stock. Contracted for diamond drilling.

LUCKY CROSS (Swastika)—Taken over by Marigold Mining Co., will be reopened, shaft will be sunk to 600 level and cyanide plant added to mill.

CHURCHILL (West Shining Tree)—Purchased two additional claims adjoining, giving total of 236 acres. Active development will be started soon.

MEXICO

OIL LANDS are being or will be investigated by commissions from many European nations. Americans are now exploring districts in Chihuahua near the Durango border.

The Market Report

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver		Apr.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
24	4.6550	101⅛	48⅞	28	4.6750	101⅛	48⅝
25	4.6650	101⅛	48 13/16	29	4.6650	101⅛	48 11/16
26	4.6675	101⅛	48¾	30	4.6575	101⅛	48⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
24	15.15 @15.20	†72½	4.85 @4.90	4.60 @4.65	6.05
25	15.25 @15.30	†72½	4.85 @4.90	4.60	6.05
26	15.25 @15.30	†72½	4.85 @4.90	4.60	6.02½
28	15.27½ @15.32½	†72½	4.80 @4.85	4.60	6.02½
29	15.25 @15.30	†72½	4.80 @4.85	4.57½	6.00 @6.02½
30	15.30 @15.35	†72½	4.75 @4.77½	4.55 @4.57½	6.00

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Apr.	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
24	75½	75½	80½	225½	224¼	24¼	23¾	35
25	75¾	76	80½	226½	225	24¼	23¾	35
26	...	...	...	...	...	...	...	...
28	76¾	77½	80½	226	225	24¼	24	35¼
29	76½	76¾	80½	226	225	24½	24	35½
30	76½	76¾	80½	226¼	225¼	24½	24	35½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Apr. 30, 1919

The noteworthy features of the metal markets this week were an increase in the business in copper at advancing prices, the exhibition of real pressure in lead, and the failure of zinc to respond to a fair inquiry. In none of the metals has the curtailment of production been sufficient. The strength in copper is due more to the firm stand of the producers, on the ground that present prices are at or below cost of production, rather than to any improvement in the statistical position.

Transatlantic freight rates remain at 1@1¼c., with great difficulty, or impossibility, of obtaining early space. Transpacific freights are unchanged at $15.

The highest court of Germany recently delivered judgment to the effect that contracts made before, or extented during, the war in which overseas goods are concerned, are to be regarded as canceled, altered conditions having to be viewed as rendering them permanently impossible.

British papers repeat the reports in German papers that zinc production in Germany has continued large and is now in excess of the domestic demand. The War Metals Co. is reported to be delivering metals to consumers at prices in marks that correspond with 16c. for copper, 3.3c. for lead, 50.5c. for tin and 25c. for aluminum. It is reported that the stocks of copper and brass are relatively large, and there is said to be a certain amount of unrestricted trade in all metals without license, especially in scrap and in copper produced by German mines.

Copper—A considerably larger volume of business for domestic account was transacted than in the previous week, wire drawers being the chief, if not practically the sole, buyers. Brassmakers report a depressed condition in their business, and in previous weeks they covered their immediate requirements pretty well. It was intimated in our report last week that the copper offered from speculative and second hands was nearly cleaned up, and that buyers would have to go to the large producers. This proved to be the case, and they had to pay the prices asked by the producers. The latter ceased selling on the basis of 15⅜c., delivered, on Apr. 24, and most of them raised their price to 15½c., delivered, regular terms, but that was shaded by a few points by some producers until Apr. 30, when the full price was realized on some business of fair size. Right through the week manufacturers apparently stood ready to take larger quantities at 15⅜c., delivered, equivalent to about 15.22½c., cash, New York, but no producers were willing to meet such bids. There are not many producers who are getting a new dollar for an old one at the present prices; wherefore, the firmness of their attitude at present. However, there is undisguised concern over the failure of curtailment of production to be more than so far has developed.

An interesting feature this week was the consummation of some export business, for forward shipment. It appears probable, however, that this business is to be regarded as involving some special conditions rather than as the forerunner of a general resumption of export trade. The real market price in London appears to be 10s. or so below the quotations that are cabled from the Metal Exchange.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17@17½c. per lb. f.o.b. mill, carload lots.

Tin—The situation remains unchanged. Everybody is in the dark respecting the position and intentions of the Government and the U. S. Steel Products Co. The situation is absolutely in the hands of the Government. It is foreseen, however, that there are bound to be irregularities when a free market is again permitted, and it is considered to be a reasonable demand that the Government should so apprise the trade of facts that it will be able to make proper preparations. One lot of tin of 99% grade turned up out of warehouse this week and was offered at 71c.

Lead—Real pressure developed in this market, which is not of speculative character, but is ascribable to the simple facts that the production is being maintained at too large a rate and that lead that is being produced has got to be sold. There were numerous rumors of the Government selling lead at low prices, in some cases ridiculously low. There did not seem to be any authenticity in these specific rumors, but it is probable that they had sufficient basis to justify the conclusion that the Government is in some way spoiling the market, which is thin anyhow. On Apr. 30 lead was offered by first hands at 4.77½c. in the morning, without finding buyers, and late in the afternoon it was offered at 4.75c.

Zinc—The market having had a feeble advance to 6.05c., some galvanizers exhibited considerable interest on Saturday and Monday. Some producers refused to talk business at all on the present level of prices, but there were plenty who would. Those who quoted 6.05c., however, failed to get orders, which were taken mainly at 6.02½c. On Apr. 30 sales were made at 6c.

Negotiations with the Government for the taking over of its stock of spelter by producers on lines similar to those of the arrangement for copper are under consideration, but no further progress during the last week is reported.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Nominal at 33c.

Antimony—An increase in the volume of business was reported, and prices were firmer. We quote spot at 6⅞@7c.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Owing to increased demand and reduction in the stocks in New York, which are now light, this market was stronger. We quote $75@77 for California virgin, and $73 for Mexican virgin. San Francisco telegraphs $72, demand fair.

Silver and Platinum

Silver—Prices remain practically unchanged. Shipments to London for the week ended Apr. 26 were 440,000 oz. London cable advices are to the effect that there has been no change in the value of the rupee since about this time last year, but there are grounds for the belief that a further rise is possible.

Mexican dollars at New York: Apr. 24, 77½; Apr. 25, 77½; Apr. 26, 77½; Apr. 28, 77½; Apr. 29, 77½; Apr. 30, 77½.

Platinum—Refined ingot was in strong demand at $100, which we quote.

Palladium—There was an improvement in the demand for this metal. We quote $122½@125.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 26—Blende, per ton, high, $41.60; basis 60% zinc, premium grades, $38@37; Prime Western, $36@34; sludge, $34@33; flotation, $31@30; calamine, basis 40% zinc, $24@22. Average settling prices: Blende, $37.94; calamine, $24.25; all zinc ores, $37.35.

Lead, high, $63; basis 80% lead, $58@55; average settling price, all grades of lead, $57.43 per ton.

Shipments the week: Blende, 6847; calamine, 308; lead, 1342 tons. Value, all ores the week, $344,330. Shipments four months: Blende, 178,419; calamine, 4880; lead, 24,906 tons. Value, all ores four months, $8,908,150.

Heavier buying by Oklahoma smelters recently threatened with strike indicates a settlement of differences.

With prices still lowering, it looks as if this district may be compelled to discontinue business. Should it come to that, it may be several years before normal resumption of operations will be possible.

Platteville, Wis., Apr. 28—Blende, basis 60% zinc, $39.50 base for premium grade and $38 base for high-lead blende. Lead ore, basis 80% lead, $53 per ton.

Shipments reported for the week are 2125 tons blende, 45 tons galena, and 856 tons sulphur ore.

For the year to date the totals are 31,744 tons blende, 1720 tons galena, and 1917 tons sulphur ore.

During the week 2372 tons blende was shipped to separating plants.

Other Ores

Molybdenum Ore—No business was reported.

Manganese Ore—Buyers indicate prices between 50 and 60c. per unit

Tungsten Ore—There was continued activity, and considerable business was done at $7 for spot and $6.50 for future deliveries. Sales were chiefly of Chinese ore. High-grade ore is held at $10@11, but buyers are unwilling to pay any such prices.

Pyrites—Spanish pyrites is quoted at 20½c. per unit for furnace ore, c.i.f. New York or any South Atlantic or North Atlantic port.

Iron Trade Review

PITTSBURGH—Apr. 29

A few branches of the finished-steel market show slightly increased volume of business, but on the whole the market is even quieter than it was a week ago. In sheets, several large interests report slightly increased bookings in the last week. In one important case the increased rate, if maintained, would permit of operations at 60% of capacity, instead of at the present 50%. In tubular goods there is a slight improvement in buying, and in the oil-country goods branch of this trade orders are practically all that could be desired. Active work is being done in oil-country development, though merchant steel pipe, boiler tubes, and similar forms remain dull.

Although there have been frequent references throughout the steel trade to the probabilities of there being an "open market," it has become plain that the leaders in the trade have no such expectations, but intend to adhere to existing steel prices until there is a change in conditions, or as long as they are able to do so. Their theory is that no great increase in demand would occur through lowering of prices, that investors in construction work of various descriptions are not ready to go ahead, and that therefore the most profitable course is to maintain existing prices, as the current everyday buyer will pay them almost as freely as he would pay reduced prices.

As reported a week ago, the steel trade regards the Industrial Board price-stabilization plan as practically a dead issue, and no interest is taken in the so-called "Peek-Hines" controversy, which the Washington dispatches are still discussing.

Steel prices are being held rigidly, nearly all the reports of price cutting being found to be without foundation, or to refer merely to the payment of commissions to middle interests. Orders offered are so small individually that there is little incentive to cut. Buyers interpret the rigidity of the market as indicating that profits are considerable, or producers would not be so afraid of precipitating a drop.

Pig Iron—In eastern Pennsylvania there is actually an open market in pig iron, with competitive prices being quoted. In the western Pennsylvania and Valley districts the furnaces regard the market as open, but they have not received inquiries of sufficient size to justify quoting competitive prices, and the market is quotable, though largely nominal, at the prices which became effective Mar. 21. The largest sales reported locally last week were two lots of 100 tons each of foundry iron and one lot of 200 tons of high-silicon bessemer, the foundry iron going at the regular price, though the special bessemer went at an extra of $1.05 per ton, in keeping with the pre-war differential, rather than the large differential allowed under war-time regulations. We quote: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—A large steel interest, usually an important factor in unfinished steel, reports that it has had no inquiries in the last week, and that specifications on contracts have been of only moderate proportions. Middlemen report practically no inquiry. The market is quotable at regular prices: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferromanganese—Inquiry is extremely light and re-sale offerings take care of all inquiry, being available at $115@125, delivered, for 80%, whereas the producers' asking price is $150. Spiegeleisen is nominal at about $40 for re-sale 18%, shipping point.

Coke—The Connellsville coke market has not declined in the last week, but is, if anything, a shade steadier, this being due to the production-curtailment program having caught up with the conditions. As to costs, the average operation would make a profit on furnace coke at $3.75 if running full, but would lose when operating at 60% or less, and, as few can operate better than 60%, some are closing entirely, even though thereby they lose their organizations. The spot market is $3.65@3.75 for furnace, with contract settlements likely to be made at about $4 for May deliveries. One operator has given up a contract rather than accept the price for May coke insisted upon by the furnace, this being below $4. Spot foundry coke is $4.25@6, depending on brand, all prices being per net ton at ovens. The byproduct ovens are not offering any coke in the market.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75.630	88 702	101.125	36 682	44 356	48 438
Feb	77.585	85 716	101 125	37.742	42 792	48 027
Mar	73.861	88 082	101.126	36 410	43 620	48 121
April	73 875	95 346	101.125	36 963	47 215	48 856
May	74 745	99 505		37.940	48 980	
June	76.971	99 500		39 065	48 875	
July	79 010	99 625		40 110	48.813	
Aug	85.407	100 292		43 418	49.077	
Sept	100.740	101.125		50 920	49 500	
Oct	87.332	101.125		44.324	49 500	
Nov	85 891	101.125		43 584	48 969	
Dec	85 960	101 125		43.052	48 492	
Year	81 417	96 772		40 851	47 516	

New York quotations cents per ounce troy, 999 fine: London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan	23 500	(a)	110 000	92 238	125 000	106 619
Feb.	23 500	16 763	110.000	78 700	125.000	95 700
Mar	23 500	14 856	110.000	76 821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500		110.000		125 000	
June	23 500		110.000		125.000	
July	25 904		119.913		134.913	
Aug	26 000		122.000		137.000	
Sept	26.000		122 000		137 000	
Oct	26.000		122.000		137.000	
Nov	26.000		122 000		137.000	
Dec	(a)		118 447		133.167	
Year	24 628		115 530		130 507	

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85 500	67.702	293 227	248 557
February	92.000	66 801	311.525	223 963
March	(a)	67.934	318 875	236 843
April	(a)	72 500	329 905	225.275
May	(a)		364 217	
June	(a)		331.925	
July	(a)		360.347	
August	(a)		380 900	
September	(a)		343 905	
October	(a)		335 543	
November	(a)		323 550	
December	(a)		267 736	
Av. year	(a)		330 138	

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6 782	6 432	6 684	5 316	29 00	37 227
February	6.973	5 057	6 899	4 784	29 00	28 675
March	7.201	5 226	7 091	4 992	29 00	27 952
April	6.772	4 982	6 701	4 722	29 00	24 888
May	6.818		6 704		29 00	
June	7.611		7.511		29 00	
July	8 033		7.750		29 00	
August	8 050		7.750		29 00	
September	8 050		7 750		29 00	
October	8 050		7 750		29 00	
November	8 050		7 750		31.20	
December	6 564		6.324		40 00	
Year	7 413		7.222		30 10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7 836	7 272	7 661	6 922	54 000	56 045
February	7 814	6 623	7.639	6 273	54 000	46 150
March	7 461	6.500	7 286	6 150	54 000	38 500
April	6.890	6.465	6 715	6 114	54 000	36.118
May	7 314		7 114		54 000	
June	8 021		7 791		54 000	
July	8 688		8 338		54 000	
August	8 985		8 635		54 000	
September	9 442		9 092		54 000	
October	8.801		8 451		54 000	
November	8 491		8 141		54 100	
December	8 163		7 813		56 050	
Year	8 159		7 890		54 180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37 25	$33 60	$33 95	$31 40	$33 95	$32 40
February	37 25	33 60	33 95	31 40	33 95	32 40
March	37 25	32 54	33 95	31 40	33 95	29 12
April	36 15		32 95		33 95	
May	36 20		33 00		34 00	
June	36 30		33 16		34 16	
July	36 60		33 40		34 40	
August	36 60		33 40		34 40	
September	36 60		33 40		34 40	
October	36 60		34 40		35 40	
November	36 60		34 40		35 40	
December	36 60		34 40		35 40	
Year	$36 67		$33 70		$34 45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 29
Alaska Gold M	3
Alaska Juneau	2
Am.Sm.&Ref.,com.	72
Am.Sm. & Ref., pf	106
Am.Sm.Sec., pf., A	93
Am. Zinc	14
Am. Zinc, pf	48
Anaconda	62
Batopilas Min	1
Bethlehem Steel	74
Butte & Superior	22
Butte Cop. & Zinc	7
Cerro de Pasco	43
Chile Cop	22
Chino	36
Colo. Fuel & Iron	43
Crucible Steel	72
Crucible Steel, pf	94
Dome Mines	14
Federal M. & S.	12
Federal M. & S., pf	38
Great Nor., ore ctf	43
Greene Cananea	39
Gulf States Steel	54
Homestake	89
Inspiration Con	49
International Nickel	26
Kennecott	32
Lackawanna Steel	72
Mexican Petrol	176
Miami Copper	23
Nat'l Lead, com	72
National Lead, pf	108
Nev. Consol	16
Ontario Min	7
Ray Con	20
Republic I.&S.,com.	82
Republic I.&S., pf	103
Sloss-Sheffield	63
Tennessee C. & C.	14
U. S. Steel, com	101
U. S. Steel, pf	116
Utah Copper	76
Va. Iron C. & C.	60
Worthington Pump	68

BOSTON CURB*	Apr. 29
Alaska Mines Corp.	‡ 12
Boston Ely	1
Boston & Mont	.68
Butte & Lon'n Dev.	.12
Calaveras	.50
Chief Con	3
Contact	.05
Corbin	‡ .25
Cortez	.12
Crown Reserve	.38
Crystal Cop	.21
Eagle & Blue Bell	2
First Nat. Cop	1
Houghton Copper	.20
Intermountain	‡ 05
Iron Blossom	.40
Iron Cap	13
Majestic	.17
Mexican Metals	15
Mines of America	‡ 05
Mojave Tungsten	11
Nat. Zinc & Lead	.14
Nevada-Douglas	.10
New Baltic	1
Oneco	.20
Pacific Mines	‡ .25
Rex Cons	.12
Yukon Gold	76

SAN FRAN.*	Apr. 29
Alta	.04
Andes	‡ .25
Best & Belcher	.23
Caledonia	24
Challenge Con	‡ 03
Confidence	‡ 03
Con. Virginia	2.10
Gould & Curry	.09
Hale & Norcross	‡ 17
Jacket-Cr. Pt.	10
Mexican	46
Occidental	40
Ophir	1 05
Overman	10
Savage	‡ .25
Sierra Nevada	.19
Union Con	38
Utah Con	04
Belmont	‡3 00
Jim Butler	31
MacNamara	83
Midway	.46
Mont.-Tonopah	20
North Star	09
Rescue Eula	14
West End Con	1 80
Atlanta	04
Booth	‡ 30
Comb. Frac	‡ 03
Florence	40
Jumbo Extension	10
Kewanas	04
Nevada Hills	06
Nevada Packard	‡ 20
Round Mountain	39
Silver Pick	12
White Caps	36

COLO SPRINGS*	Apr. 29
Cresson Con	5 00
Doctor Jack Pot	04
Elkton Con	04
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	‡ 88
Granite	15
Isabella	05
Mary McKinney	06
Portland	1 00
United Gold M	18
Vindicator	30

BOSTON EXCH †	Apr. 29
Adventure	.50
Ahmeek	71
Algomah	25
Allouez	35
Ariz. Com	11
Arnold	‡ 20
Bingham Mines	‡7
Bonanza	‡ 10
Butte-Balaklava	‡ .30
Calumet & Ariz	59
Calumet & Hecla	395
Centennial	‡12
Copper Range	42
Daly West	2
Davis-Daly	5
East Butte	8
Franklin	2
Granby	66
Hancock	‡6
Hedley	‡12
Helvetia	‡ 25
Indiana	‡ .50
Isle Royale	25
Keweenaw	‡1
Lake	‡4
La Salle	‡2
Mason Valley	‡3
Mass	4
Mayflower	4
Michigan	‡3
Mohawk	57
New Arcadian	‡1
New Cornelia	17
New Idria	‡9
Nipissing	9
North Butte	10
North Lake	‡ 25
Ojibway	‡1
Old Dominion	33
Osceola	49
Quincy	56
St. Mary's M. L.	43
Santa Fe	‡ 25
Seneca	‡13
Shannon	2
Shattuck-Ariz	‡11
So. Lake	‡75
So. Utah	‡ 12
Superior	‡5
Superior & Bost	‡2
Trinity	‡2
Tuolumne	‡ 81
U. S. Smelting	50
U. S. Smelting, pf	46
Utah Apex	2
Utah Con	7
Utah Metal	1
Victoria	‡2
Winona	80
Wolverine	15

N. Y. CURB†	Apr. 29
Am. Tin & Tung	‡[illegible]
Big Ledge	[illegible]
Butte & N. Y	‡[illegible]
Butte Detroit	‡ .04
Caledonia	.32
Calumet & Jerome	[illegible]
Can. Cop. Corpn	[illegible]
Carlisle	‡[illegible]
Cashboy	10
Con. Ariz. Sm	1
Con. Coppermines	‡5
Goldfield Con	19
Goldfield Merger	.05
Hecla Min	4
Howe Sound	‡3
Jerome Verde	‡[illegible]
Louisiana	[illegible]
Magma	‡31
Marsh	07
McKinley-Dar-Sa	‡ 48
Milford	‡ 75
Mother Lode	41
Nixon Nevada	19
Ohio Cop	‡ 50
Rawley	‡2
Ray Hercules	2
Richmond	‡ 50
Rochester Mines	20
St. Joseph Lead	11
Standard S. L.	[illegible]
Stewart	36
Success	‡ 05
Tonopah	‡3
Tonopah Divide	10
Tonopah Ex	3
Tribullion	‡ 35
Troy Arizona	‡ 10
United Eastern	4
United Verde Ext	‡32
United Zinc	[illegible]
Utica Mines	‡ 08

TORONTO*	Apr. 29
Adanac	17
Bailey	03
Beaver Con	45
Chambers Ferland	‡ 10
Coniagas	2 00
Hargraves	02
Kerr Lake	5 37
La Rose	25
Lake Shore	98
Min. Corp of Can.	3 00
Peterson Lake	00
Temiskaming	34
Wettlaufer-Lor	04
Davidson	‡ 68
Dome Exten	27
Dome Lake	24
Hollinger	6 37
McIntyre	1.62
Newray	12
Porcu. Crown	25
Teck-Hughes	18
Vipond	20
West Dome	12

* Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

May 10, 1919

Volume 107 *Number* 19

Copper-Smeltery Slag From the Microscopic And Chemical Point of View

BY C. G. MAIER[*] AND G. D. VAN ARSDALE[†]

Consideration of the subject demonstrates that the available methods for studying the problems of the real constitution and the mutual behavior of fused slag and mattes are limited. Investigation of solidified slags is comparatively simple, although data on this phase of the subject are incomplete. Conclusions from such work must be of limited applicability to the fused state; but if the limitations are kept constantly in mind much can be learned. The method pursued in the investigations described was a combined microscopical and chemical one, and it has been found capable not only of yielding results from which more or less definite conclusions could be formulated as to the mode of occurrence of copper in slags, but it has also disclosed the possibilities of obtaining a more exact knowledge of some of the usual smelting phenomena. The authors present discussions and conclusions with respect to (1) the different forms in which copper occurs in the slags examined and the relative amounts of such different forms, and (2) reasons for the occurrence of these forms.

A NUMBER of theories have been proposed as to the form in which copper occurs in slag, and as an excellent review of the published work on the subject has been compiled by F. E. Lathe,[1] it is unnecessary to reiterate discussion of previous opinions. Comment, however, may be made on some of this published material, from the standpoint of the work summarized in the present paper. Lathe's summary has been utilized as well as the original articles.

W. A. Heywood[2] has illustrated by graphic method the relationship between the copper content of matte and its corresponding slag. The impropriety of speaking of the solubility of matte is emphasized in a succeeding paragraph. For the same reasons, and although there is doubtless a relationship between the grade of matte and the copper content of slags, this should be considered more as a rough practical assumption of condition rather than a true relationship. Lathe sums up L. T. Wright's[3] reasons for doubting that all the copper in slags is in the form of prills of matte as follows:

"1. That matte did not separate from slag kept in the molten state even for a long time."

As a matter of practical experience, it seems established that increased settling of some slags results in a separation of suspended copper. On the other hand, increased settling of other slags, under other conditions, as in Wright's work, does not result in any settling out, although it may be assumed that, in both cases, suspended copper is present. It is reasonable to believe that the cause for such different action may be found by a microscopic examination, as indicated later, and that the use of the method of determining suspended copper, to be described, will give the theoretical limit to which any particular slag can be settled.

"2. That no concentration of the valuable metals was possible by elutriation after fine grinding."

It is possible with some slags to make a separation by flotation, after fine grinding, of suspended sulphide constituents.

With respect to the fact that the proportions of gold, silver, and copper in slag are often different from those of the accompanying matte, it has been found, in the slag examined, that unaltered matte inclusions are comparatively rare. The proportions of gold, silver, and copper in the altered sulphide inclusions, visible under the microscope, would certainly be expected to vary from those in the original matte.

J. Parke Channing and J. E. McAllister[4], in commenting on Wright's work, were of the opinion that a considerable part of the copper entered the slag as oxide or silicate, and not as sulphide. Although this may be true of Wright's slags and of those at the Tennessee Copper Co., spoken of by Channing, it seems certain that this is not the case for the slags under present consideration.

F. A. Sundt[5], from results at Chilean smelteries, finds a relationship between the copper content of the charge and that in the slag. T. Kiddie[6] used treatment with dilute sulphuric acid as a method for direct de-

---

[*] Assistant chemist, research department, Phelps Dodge Corporation, 99 John St., New York.

[†] Consulting Chemist, Phelps Dodge Corporation, 99 John St., N. Y.

[1] *Eng. and Min. Journ.*, 1915, Vol. 100, p. 215.

[2] *Eng. and Min. Journ.*, 1904, Vol. 77, p. 395.

[3] *Trans.* A. I. M. E. 1909, Vol. 40, p. 492.

[4] *Trans.* A. I. M. E. 1910, Vol. 41, p. 885.

[5] *Eng. and Min. Journ.* 1910, Vol. 89, p. 1097.

[6] *Journ.* Can. Min. Inst., 1911, Vol. 14, p. 487

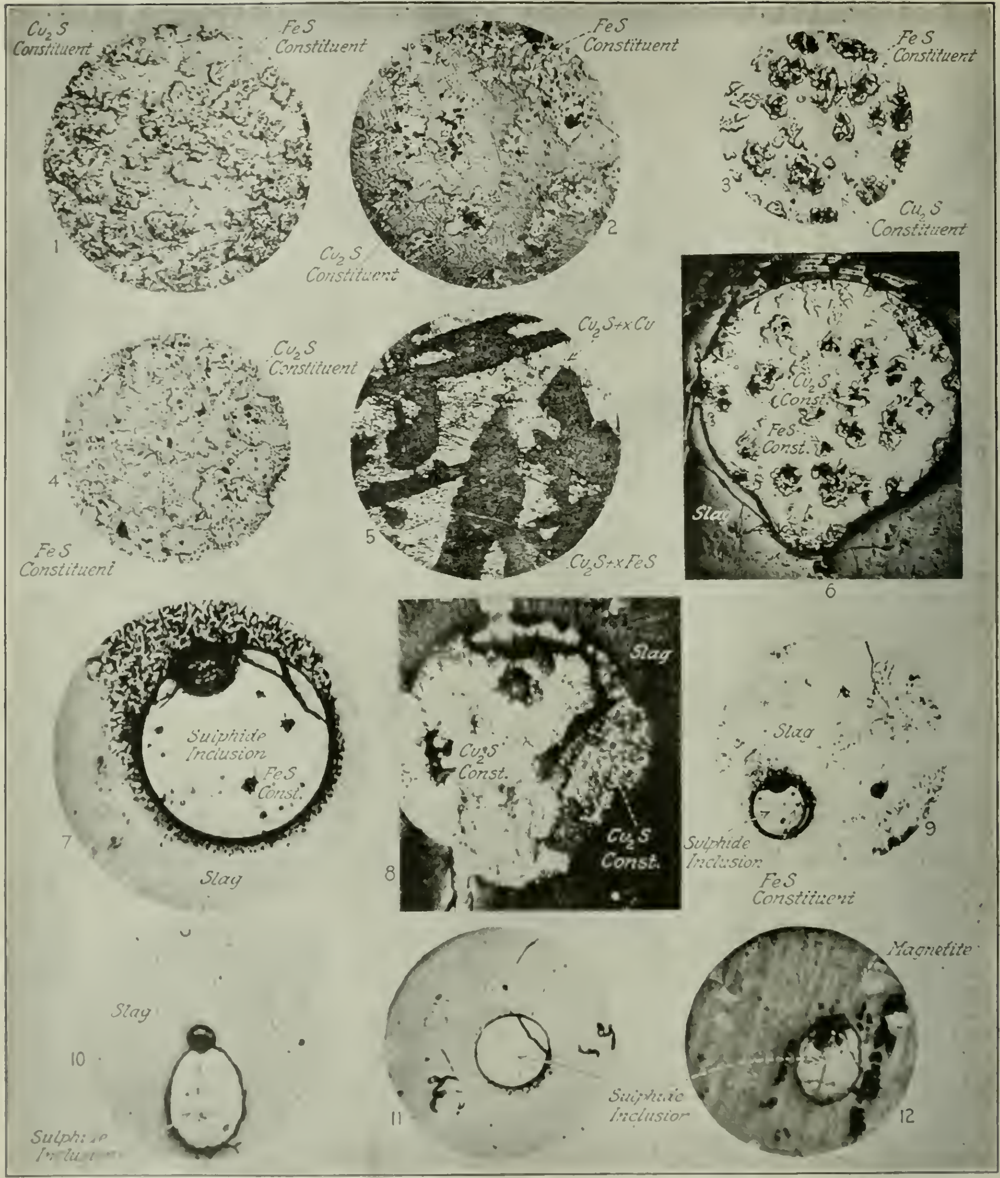


Fig. 1. Matte to converter, unetched. The islands of light material, surrounded by dark outlines, are FeS constituent, polished in relief. Fig. 2. Reverberatory matte, unetched. Picture taken with W. & W.-B. filter, to show more clearly lighter FeS constituent as islands in ground mass of copper-sulphide constituent. The dark spots are cavities, which may have been originally present, or more probably are due to breaking out harder but more brittle FeS constituent during polishing. Fig. 3. Blast-furnace matte, unetched. The appearance of the Cu_2S constituent in the ground mass is characteristic, and should be compared to later figures showing sulphide inclusions in slags. Fig. 4. Blast-furnace matte, unetched. Fig. 5. White metal. Tinted by standing in air and laboratory fumes. W. & W.-B. filter was used in taking this picture, as dark areas are nearly indistinguishable from the light by white light. Note similarity between light constituent and background of matte. Fig. 6. Blast-furnace slag, chilled, unetched. A sulphide inclusion is shown which is practically unaltered matte, as seen by comparison with Fig. 3. Note large size of inclusion, and partial separation of constituents by specific gravity, as seen by the distension of globule at bottom. Fig. 7. Blast-furnace slag, chilled, unetched. Shows a sulphide inclusion, with attached gas bubble at top, and surrounded by minute bubbles in body of slag. Note few remaining islands of FeS constituent. Fig. 8. Reverberatory slag, chilled, etched with HF. Small sulphide inclusion, highly magnified, showing the separation of iron sulphide containing material from residual copper-sulphide constituent by action of slag. Fig. 9. Blast-furnace slag, chilled, unetched. Only traces of iron-sulphide constituent remain, with well-defined field of minute bubbles about inclusion. Unassimilated charge is evident in the body of the slag as white and dark spots. Fig. 10. Blast-furnace slag, chilled, unetched. An excellent illustration of gas bubbles remaining after complete elimination of iron-sulphide constituent. Fig. 11. Blast-furnace slag, chilled, unetched, horizontal section. A sulphide inclusion free from iron-sulphide constituent. Some undigested charge. Fig. 12. Reverberatory slag, etched with HF. The relationship of the sulphide inclusion, and its attached gas bubble, to the vertical string of free gas bubbles, is clearly indicated. Skeletal crystals of magnetite forming on solidification show excess of Fe_3O_4.

termination of oxide copper in slags. It is known that ferric iron will cause the solution of sulphide copper, and that ferrous sulphide can precipitate copper from solutions. Slag samples, as usually obtained, contain ferric iron and at least some matte particles, so that the method for determining oxide copper in slag cannot be accepted as accurate in every case.

C. A. Grabill[7] classifies slag losses as physical and chemical, "the former consisting of those due to poor settling, insufficient difference of specific gravity of matte and slag, and gas flotation"; but he considered that "all of these were small under normal conditions. The chemical losses might be due to the formation of copper oxide or to solution of metals and sulphides." The last he considered most important. The experiments here under review indicate that gas flotation is an important cause of trouble in the slags examined. Copper truly dissolved in slag is also an important factor, so much so that in these slags it was reasonable to conclude that the two factors are the principal ones, and that others are negligible.

W. A. Wanjukoff[8] gives the results of an elaborate series of direct-solubility determinations by fusion in the laboratory, including the effect of variations of bases and acidity. Some of the photographs appended to his original article show inclusions which would warrant doubt as to the accuracy of certain of his conclusions on the relationship between the total copper content and the true solubility.

TABLE I. COPPER IN SLAGS

Microscopically	Visible				Invisible						
Physical Forms	Group 1 Macro } Micro } scopic particles				Group 2 { Ultramicroscopic particles { Colloidal solution			Group 3 True Solutions			
Possible Forms	(Matte)	Cu_2S	Cu	Dissolved in FeS	(a) Matte	Cu_2S	Cu Oxides and Silicates	Cu_2S	Cu and Oxides	Cu_2O } CuO } (SiO_2)	Cu_2O } CuO } { Fe_2O_3 { Al_2O_3
Actual occurrence as observed or concluded	Occasional	Usual	Seldom, oxides or silicates not observed	If so, very small in amount	Very improbable	Probable	Improbable	Probable	Improbable	Improbable	Improbable
Indicated lines for experiment.	Settling by control: { Temperature, Density, Viscosity Prevention of flotation.				Coagulation and Settling			Salting out: By variation of constitution. By additional agents.			

(a) Matte is a variable complex material containing at least two constituents, one of which is readily attacked by Fe_2O_3, and it is not proper to speak of its solubility as such. There must also, therefore, be a limiting size to the matte particles, below which they cannot exist in suspension.

J. W. James[9] concludes from the reduction of copper content of converter slag (passed into a reverberatory), by treatment with green poles, that much of the copper must have been present as oxide. It is probable that this effect may have been due to eliminating the factors causing the gas flotation of particles, to be referred to subsequently. The reduction of residual copper by the addition of pyrite, after this poling treatment, might be equally an indication of dissolved copper present as sulphide, which is reduced by the addition of pyrite, as in experiments to be described.

Mr. Lathe's[10] determinations of oxide copper are open to the same objections as Mr. Kiddie's. The method of determination, though possibly giving correct results on some slags, will certainly not do so on others.

As a preliminary to the presentation and discussion of results, Table I has been compiled. Granting that copper in slags may exist in two forms, visible and invisible under the microscope, the first or visible particles (Group 1) may be found obviously as micro- or macroscopic particles. The copper microscopically invisible may be divided as Group 2 (ultra-microscopic particles or colloidal solutions or suspensions), and as Group 3 (true solutions). The possible forms of occurrence under each main heading are as shown in the next horizontal division of the diagram. The actual observed occurrences and conclusions are as shown in the next horizontal division, and the indicated lines for experiment are shown next below.

Visual distinction between Group 1 and Groups 2 and 3 may be made directly by the microscope in a qualitative way; and, based on microscopic evidence, a chemical method has been worked out which it is believed can be used to distinguish quantitatively between particles of mechanically retained matte or copper sulphide and that dissolved either as true or colloidal solution.

Visual Evidence as to Suspended Sulphide Inclusions

That the matte and other sulphide inclusions in slag may be readily recognized, microphotographs of matte and white metal have been made. Figs. 1, 2, 3 and 4 show the appearance of polished surfaces of mattes of from 30 to 40% Cu, consisting essentially of a blue (dark) eutectiferous background with yellow (light) islands of iron sulphide. This identification may be accomplished with two etching agents, sulphuric acid, which attacks the iron sulphide constituents, and silver nitrate, which precipitates silver and silver sulphide on the Cu_2S-containing constituents.

For comparison, Fig. 5 shows a white metal of 75% copper, which consists of a ground mass of copper sulphide (probably containing dissolved copper) with a more readily oxidizable eutectiferous background ($FeS + xCu_2S$), corresponding to the ground material in Figs. 1, 2, 3 and 4. These two phases of white metal are difficult to identify microscopically, inasmuch as the ordinary etching agents attack them with practically the same activity, and the color of the freshly polished surface is nearly a uniform steely blue. For this reason, the pictures of inclusions in slag do not ordinarily show constituents. On slow corrosion in air (particularly laboratory fumes) however, the constituent containing iron sulphide becomes covered with a thin reddish film, probably consisting of Fe_2O_3. Appropriate color screens and color-sensitive plates may then be used to distinguish between the phases.

The examination of polished slag sections soon reveals the fact that matte, as such, and similar to Figs. 1, 2, 3 and 4, occurs only seldom, whereas it is usual

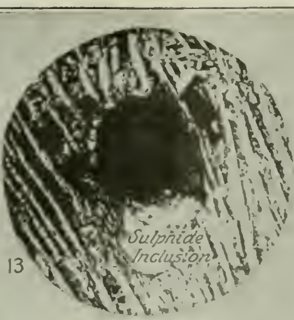
---

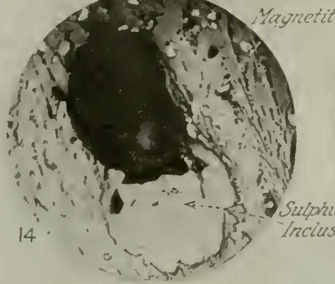
[7] *Eng. and Min. Journ.*, 1910, Vol. 89, p. 776.

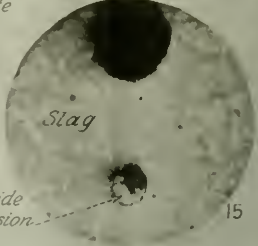
[8] *Metallurgie*, 1912, Vol. 9, p. 1.

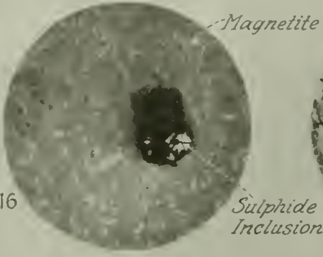
[9] *Eng. and Min. Journ.*, 1914, Vol. 97, p. 1114.

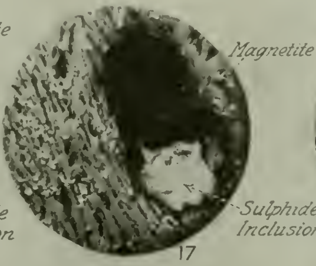
[10] *Eng. and Min. Journ.*, 1915, Vol. 100, p. 215.

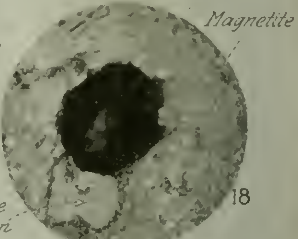


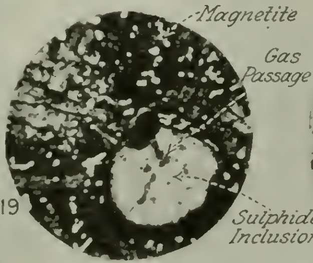


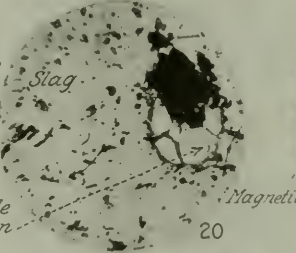


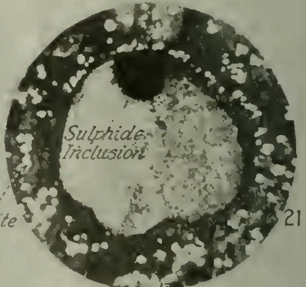


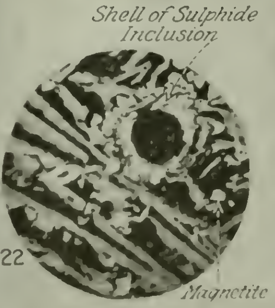


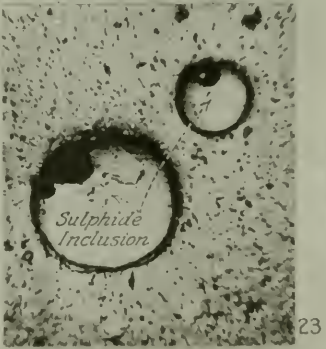












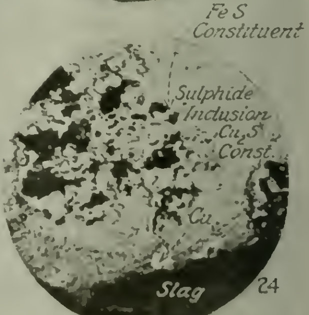


Fig. 13. Reverberatory slag, etched with HF and repolished. Note apparent disintegration of sulphide inclusion. Fig. 14. Limpid converter slag, unetched. The bubble seems to have been confined by the solidification just at point of leaving pellet of sulphide to which it is attached. Fig. 15. Limpid reverberatory slag, unetched. The clean bubble at the top may have left the lower one just before solidification. Fig. 16. Limpid reverberatory slag, unetched. Sulphide inclusions a mere shell. Fig. 17. Converter slag, unetched. The sulphide pellet was very large. Fig. 18. Converter slag, unetched. Fig. 19. Reverberatory slag, etched with HF. Gas passage in sulphide inclusion, leading to bubble at top, is of interest. Fig. 20. Blast-furnace slag, chilled, etched with HF. For comparison with Fig. 19. Fig. 21. Reverberatory slag, etched with HF. The eutectoid-like appearance of the sulphide inclusion shows the possible variation of copper content even in copper-sulphide constituent alone. Fig. 22. Reverberatory slag, etched the HF. A horizontal section which accidentally cut a sulphide inclusion and attached gas bubble near top, so that only ring of sulphide is visible. Fig. 23. Converter slag, unetched. The position of the bubbles in the two sulphide inclusions, in the same plane, is significant evidence of the flotation effect, as distinguished from purely accidental cavities. Fig. 24. Blast-furnace slag, unetched. The presence of metallic Cu in the sulphide inclusion is to be particularly noted.

to find considerable numbers of particles of copper sulphide constituent, similar to the copper sulphide-iron sulphide eutectoid, appearing as the background of matte in Figs. 1, 2, 3 and 4.

This fact is strikingly illustrated by a comparison of Fig. 6 with the subsequent pictures. Fig. 6 represents a rare case where the matte has been preserved practically intact. It is especially interesting to note a separation of constituents by specific gravity while still partly liquid, as is evident from the small projection at the bottom of the matte globule, containing FeS constituent. Fig. 8, a much higher magnification, shows a partly altered inclusion. Cu_2S (or $Cu_2S + X\ Cu$) Cu_2S — FeS eutectoid and FeS constituent are seen together, illustrating the process of disappearance of the iron-sulphide islands. In Fig. 7 the disappearance of the iron-sulphide constituent is practically complete. The gas bubbles surrounding the sulphide globule are of interest, and may be accepted as evidence of a reaction between some constituent of the slag and the original matte inclusion.

Fig. 9 shows a sulphide inclusion with still less visible iron-sulphide constituent. Fig. 11 illustrates a sulphide inclusion with no visible iron-sulphide constituent. Fig. 10 indicates the gas passages in the sulphide globule leading into the gas bubble at the top. The remaining figures up to Fig. 24 show characteristic sulphide inclusions in blast-furnace, reverberatory, and converter slag. Fig. 24 depicts the possibility of the presence of metallic copper. This is rare, and experience justifies the assumption that no metallic copper occurs except in sulphide inclusions.

By summing up in a general way the evidence furnished by these photographs, the following conclusions are warrantable:

1. Globules of copper-sulphide constituent (copper sulphide with dissolved FeS) or copper sulphide-iron sulphide eutectoid are a usual and universal constituent of all slags examined.
2. Matte, as such, is found only occasionally.
3. Copper has been identified, but only in the interior of sulphide inclusions.
4. Iron-sulphide constituent is seldom to be observed in sulphide inclusions, and, in cases of slags corresponding to high-grade mattes, no separate pellets of iron sulphide have been found. The copper content present in slags, dissolved in FeS, is, therefore, probably small and negligible, as the total solubility in FeS, as indicated by experiments to be discussed later, is only from 0.5 to 2.0 per cent.
5. A striking fact in connection with Figs. 6 to 24 is the frequent attachment of gas bubbles to sulphide particles.
6. It is evident that there is a chemical action between the original matte particle and some constituent of the slag. All stages, from the original matte containing iron-sulphide constituent, through the partial disappearance of the latter down to its final complete elimination, while Cu_2S is still present, can be traced, so that it is evident that this chemical action operates first on the iron-sulphide constituent of the matte. In some cases, a gradual reduction of the Cu_2S, with an occasional appearance of metallic Cu, may be noted, and it is probable that the reaction takes place also with Cu_2S, although more slowly than with the iron constituent.
7. It is evident that suspension of inclusions by gas bubbles in the fused slag must be one of the considerable sources of copper loss through retention of sulphide globules. Evidence will be presented as to the cause for this flotation of sulphide globules.

The determination of the amount of copper which might be saved by complete elimination of suspended particles is a subject of considerable practical importance. The visually evident fact that all particles do not contain uniform amounts of copper precludes attempt to make direct count and estimation by micro-metric means. Early in the investigation, when experiments were being made to determine the effect of various etching agents on slag and other products, it was noted that there was no microscopic evidence of action by dilute neutral silver-nitrate solutions on the body of the slag, but that there was rapid and distinct action of the solution on the sulphide globules. This seemed to indicate the possibility of the use of this reagent as a method of determining the amount of suspended copper and (by difference) the amount of invisible or dissolved copper.

The possibility of dissolving matte or copper sulphide globules in neutral $AgNO_3$ solutions, as a means of determining the amount of suspended[11] (and consequently, by difference, the dissolved) copper, rests on the following assumptions:

1. That the body of the slag, or its dissolved substances, are not attacked by the solution of silver nitrate.
2. That the copper-sulphide globules will be dissolved with reasonable rapidity and with a fair degree of completeness.

Assumption No. 1 was tested by direct microscopic observation, no visible action being found. To test the completeness of solution of the copper-sulphide globule content, samples of matte and white metal were finely ground and treated with 1% $AgNO_3$ solution in double excess over the amount theoretically required to dissolve copper sulphide according to the equation

$$Cu_2S + 4AgNO_3 = 2Cu(NO_3)_2 + 2Ag + Ag_2S$$

The results of the tests are shown in Table II.

TABLE II SOLUBILITY OF COPPER IN MATTE IN 1% $AgNO_3$ SOLUTION

	Per Cent. Cu	Per Cent. Cu Soluble in $AgNO_3$	Difference	Per Cent. of Total Cu Soluble
Blast-furnace matte	36.75	35.90	0.85	97.7
Reverberatory matte	33.40	32.75	0.65	98.1
White metal	76.00	75.50	0.50	99.3

The solution of the copper content is seen to be nearly if not entirely complete. The proportionate amount insoluble in a slag would be roughly a maximum at 2% of 0.35 (normal copper content in these slags) = 0.007% Cu, and because all the copper present is not soluble, the error is less than 0.007%, and consequently negligible.

If the statement of Gibb and Philip[12], that copper sulphide is completely soluble in this reagent, is assumed to be correct (and independent tests indicate this to be so), the slight difference represented by Col. 3, Table II, must be either copper dissolved in the iron-sulphide constituent of the matte, and consequently not soluble in $AgNO_3$ solution, or one-half of a proportionate amount of copper oxide present in the matte.

No copper oxide is microscopically evident in the mattes now the subject of discussion, and, moreover, it

---

[11] It should be understood that the method involves no conclusions as to the chemical form of this suspended copper, but is an empirical method for distinguishing between the two physical forms of suspended and dissolved copper.

[12] *Trans.* A. I. M. E., Vol. 36, p. 665.

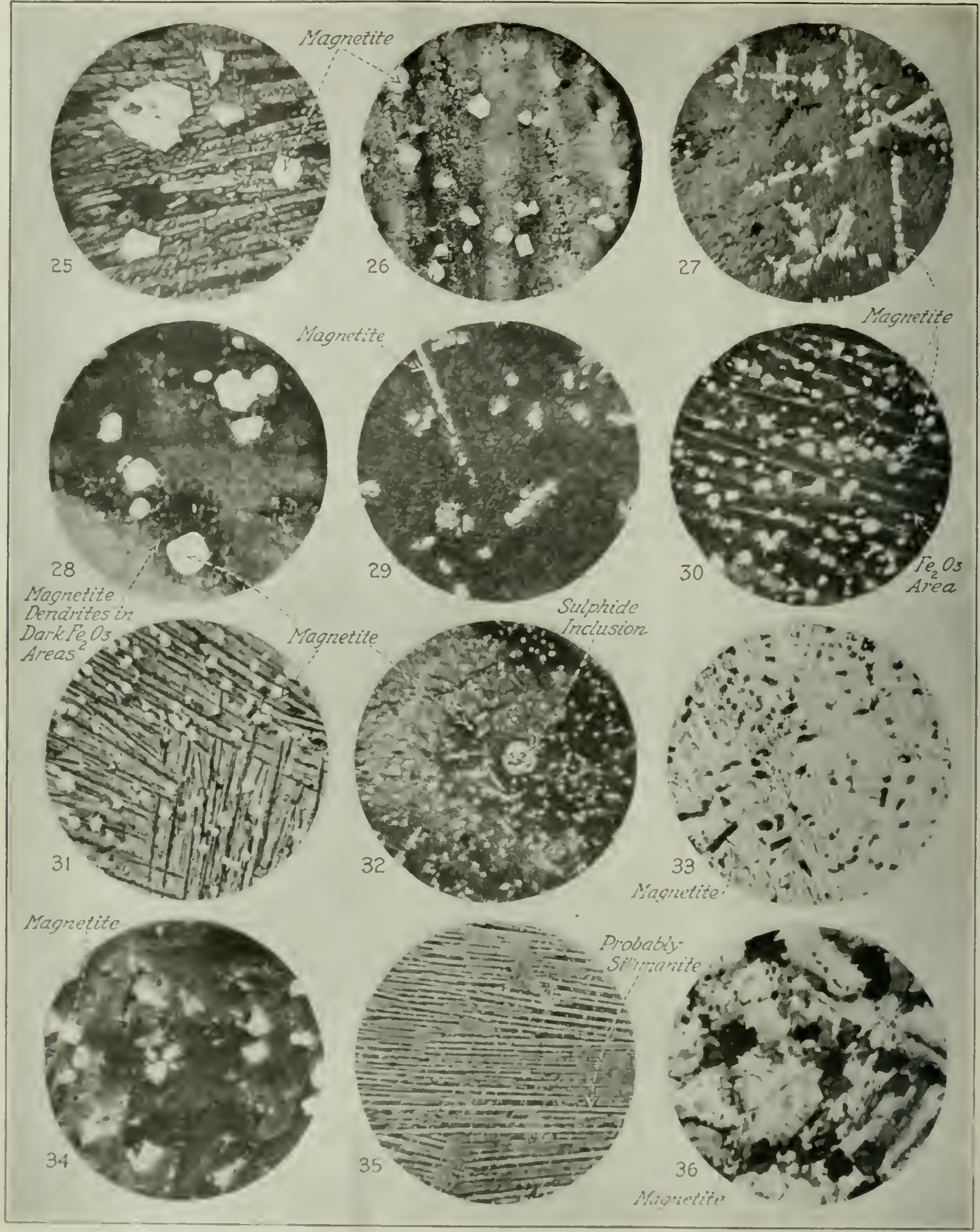


Fig 25. Reverberatory slag, well crystallized, etched with HF. Clean-cut edges of magnetite and well-defined crystallization of body of slag indicate the formation of former at a period somewhat previous to final solidification. Fig. 26. Reverberatory slag, unetched. Segregated, but not well crystallized. Dark areas adjacent to magnetite probably due to Fe_2O_3. Fig. 27 Reverberatory slag, etched with NaOH. Line formation of crystals indicates formation during solidification. Fig 28. Reverberatory slag, unetched. An increased magnification of Fig. 26, showing dendrites of magnetite in dark areas surrounding larger crystals. Fig 29. Limpid reverberatory slag, etched with HF. Minute crystals of magnetite separating on solidification. Fig. 30. Reverberatory slag, etched with HF. Segregated but not well crystallized. Fuzzy edges of magnetite crystals show final separation of Fe_2O_3 at solidification point. Figs. 31 and 33. Reverberatory slag. Fig 31, a polished specimen etched with HF, should be compared to Fig. 33, a thin, transparent section of the same material. The white magnetite shown by reflected light has become black and opaque in thin section of Fig. 33. Fig 32. Limpid reverberatory slag, etched with HF. The exceedingly minute crystals of magnetite should be compared to well-developed ones of Figs 25, 26, and 28. Fig 34. Reverberatory slag, etched with NaOH. Increased magnification of No. 30. Fig 35. Blast-furnace slag, well crystallized, etched with HF. Structure well indicated in columnar crystals, which may be alumina or silicate. Note absence of magnetite. Fig 36. Converter slag, first skim, heat tinted

is doubtful whether it could exist in the presence of the sulphide, so that one is forced to conclude that the solubility of the copper in the iron-sulphide constituent is roughly less than 2% in a 35% matte. The application of the silver-nitrate method is one of direct determination of the amount of copper dissolved by the weak neutral solution present in excess, and in the absence of metallic iron. To insure the latter condition, all samples were pulverized in porcelain. Table III shows the results obtained on some representative blast-furnace and reverberatory slags.

TABLE III. SOLUBILITY OF BLAST-FURNACE AND REVERBERATORY SLAGS IN $AgNO_3$ SOLUTION

Sample	Slags	Per Cent. Cu	Per Cent. Cu Sol. in $AgNO_3$	Difference	Deviation from Mean	Per Cent. Total Cu Sol.
1	Blast-furnace (1*a*)	0.343	0.175	0.166	0.019	51.0
1	Blast-furnace (2*b*)	0.35	0.20	0.15	0.003	57.1
2	Reverberatory (1)	0.238	0.072	0.166	0.019	30.3
2	Reverberatory (2)	0.25	0.10	0.15	0.003	40.0
3	Blast-furnace (1)	0.359	0.238	0.121	0.026	66.3
3	Blast-furnace (2)	0.35	0.22	0.13	0.017	62.9
4	Blast-furnace (1)	0.295	0.150	0.145	0.002	50.8
4	Blast-furnace (2)	0.30	0.15	0.15	0.003	50.0
	Mean difference				0.147	
	Average deviation from mean difference				0.011	

(*a*) Iodide copper determination on one sample by C. G. Maier.
(*b*) Electrolytic check determination on another sample of same specimen, by E. H.

The average analysis of the above slags for the period during which these samples were taken is:

Sample Slag	Sample 1, Blast Furnace	Sample 2, Reverberatory	Sample 3, Blast Furnace	Sample 4 Blast Furnace
SiO_2, %	36	37	37	35
FeO, %	38	42	34	34
CaO, % MgO, %	7	4.5	16	18
Al_2O_3, %	11	11	9	10

Examination of Table III brings out forcibly a constancy in the amount of dissolved copper as determined in this manner, which is so close as to seem to preclude chance of its being accidental. The natural conclusion is that this fact of practical constancy is a strong indication that the copper invisible under the microscope is present as dissolved sulphide, for there is no reason to suppose a definite maximum solubility so low in amount for oxide forms of copper.

The question of the relative amounts of suspended and dissolved copper sulphide in converter slags is also one of considerable practical interest. Table IV shows typical results of the application of the silver-nitrate method to samples that were taken from various stages of the blow.

TABLE IV. SOLUBILITY OF CONVERTER SLAG IN $AgNO_3$ SOLUTIONS

Sample	Per Cent. Cu	Per Cent. Cu Sol. in $AgNO_3$	Difference	Per Cent. Total Cu Sol.
Converter "A," No. 1 skim	7.48	7.10	0.38	94.9
Converter "A," No. 3 skim	3.37	3.28	0.09	97.4
Converter "A," No. 6 skim	2.95	2.88	0.07	97.6
Converter "B," No. 1 skim	2.23	2.09	0.14	93.8
Converter "B," No. 3 skim	4.05	3.90	0.15	96.4

Even in converter slags containing an appreciable percentage of copper, nearly all of this, down to the limit of a few tenths of 1% (as in the case of blast-furnace and reverbatory slags), is present in the form of sulphide particles, analogous to white metal or copper sulphide-iron sulphide eutectoid. Moreover, Col. 4 shows that, as the blow continues, the proportionate amount of copper in the dissolved form decreases. It is apparent from microscopic evidence and from the silver-nitrate method, that even at the end of the blow it is chiefly iron which has been oxidized and slagged off, without the formation of appreciable amounts of copper silicates, so that the decrease in the dissolved copper may be explained as being due to that copper originally dissolved in the iron-sulphide constituent. If the dissolved copper were present as oxide, an increase instead of a decrease would be expected as the blow continues.

The amount and kind of suspended copper in Group 1 of Table I is therefore microscopically and chemically capable of direct determination. There remains the problem of the identification of the remaining constituents of Groups 2 and 3. There is some evidence of solutions of a colloidal nature in chilled slags, as indicated by the somewhat reticulated structure and cloudy appearance of Figs. 29 and 8, but there is no ready method of identification of colloids in slags, except possibly by means of the ultramicroscope, which was not available for the work now under review. Moreover, even if colloidal particles were present, the task of differentiation between compounds such as Fe_2O_3 and Cu_2S would be difficult. Evidence has been found, however, for distinguishing between the individual constituents of Groups 2 and 3 in Table I.

Part of this evidence is based on the data of Tables V, VI, and VII, showing the effects of certain addition agents fused with slag samples. For comparative purposes the plotted data shown in the curves in Fig. 40 make the conclusions more evident. The original copper content of this slag (a sample of reverberatory slag which had received special treatment) was 0.31% Cu, but the silver-nitrate test showed 0.09% Cu as suspended sulphide globules, leaving an original dissolved 0.22% of Cu. This is indicated by the dotted line.

TABLE V. EFFECT OF FUSING REVERBERATORY SLAG WITH COPPER-BEARING PYRITES

(Cu = 2.11%)

	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Pyrites	0	4.8	11.1	20.0	33.3	50.0
Cu in slag	0.31	0.23	0.21	0.24	0.20	0.21

TABLE VI. EFFECT OF FUSING REVERBERATORY SLAG WITH COPPER-FREE FeS

	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
FeS	0	4.8	11.1	20.0	33.3
Cu in slag	0.31	0.20	0.18	0.17	0.13

TABLE VII. EFFECT OF FUSING REVERBERATORY SLAG WITH CALCIUM SULPHIDE AND PYRITES

	Per Cent.	Per Cent.	Per Cent.	Per Cent
Pyrites	0	11.9	11.1	10.0
CaS	0	4.3	10.0	18.2
Cu in slag	0.31	0.17	0.12	0.10

The effect of fusing at about 1300° C. with small percentages of pyrite containing 2.11% copper, shown in the upper curve, is to wash out suspended particles, after which, increases in the amount of the copper-containing pyrite, added to the fusions, produce no change in the copper content of the slag. The close concordance of the amount of dissolved copper determined by silver-nitrate solutions, and the residual dissolved copper not reduced further by the additional pyrites, in slags washed free from suspended globules, is strikingly illustrated by the near coincidence of the dotted line and the upper curve, and furnishes an excellent check on the usefulness of the silver-nitrate method as a criterion for determining the amount of dissolved copper. The lack of effect on the dissolved copper by the fusion with pyrites, which might be expected to occur, owing to distribution ratio, is doubtless accounted for by the fact that the pyrite used is already saturated with copper sulphide[13], and involves the supposition that the dissolved copper is present as sulphide. If the copper dissolved in the slag were present as oxide, representing some equilibria of the reaction

---

[13] Compare with the statement as to the maximum amount of dissolved copper in iron-sulphide constituent of matte.

$$FeS + Cu_2O \rightleftharpoons FeO + Cu_2S$$

then increasing amounts of pyrites should finally accomplish complete sulphidization and result in a decrease of copper in the slag proportionate to the pyrite added and less than the original dissolved copper.

If the dissolved copper, or a part of this, were present as metallic copper, the addition of copper-saturated pyrite should result in the presence of a constant per cent. of residual dissolved copper, differing from and less than the original dissolved copper by the amount of metallic copper present, because such metallic copper would be sulphidized and settled out from the slag already saturated with copper sulphide. The copper content, after adding excess pyrites, is nearly equal to the original dissolved copper, and one must conclude that the dissolved copper present is sulphide.

As corroborative evidence, the second curve (in Fig. 40) shows the effect of adding copper-free iron sulphide (FeS) to the fusions. After the suspended sulphide globules are removed by a small percentage of this iron sulphide, the reduction of copper in the slag becomes greater in proportion to the amount of iron sulphide added. No original copper is present in this added iron sulphide, so that the distribution effect between the slag and the sulphide phase may take place, resulting in the proportional decrease of copper in the slag above mentioned.

The lower curve (in Fig. 40) shows the effect of the addition to the fusions of a constant amount of pyrite with varying amounts of calcium sulphide. Again the percentage of dissolved copper in the slag approaches constancy, but this constant value was at a lower point than with pyrites alone. The saturation of the slag with calcium sulphide has decreased the solubility of the copper sulphide in it, as would be expected because of the common sulphide ion in case both calcium and copper sulphides were dissolved, and the pyrite, which constitutes the copper-bearing portion of the matte, is again saturated with copper, resulting in the ultimate constant residual dissolved copper. Even if all the calcium sulphide became oxidized or slagged, the decrease in the relative percentage of copper is greater than would be caused by the increased mass due to the addition of lime to the charge.

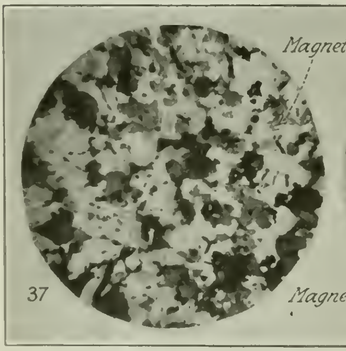


FIG. 37. CONVERTER SLAG, HEAT TINTED. × 100 (200)

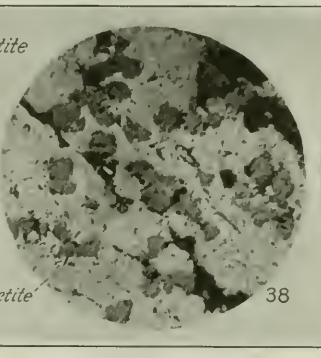


FIG. 38. CONVERTER SLAG, LAST SKIM, HEAT TINTED. × 100 (200)

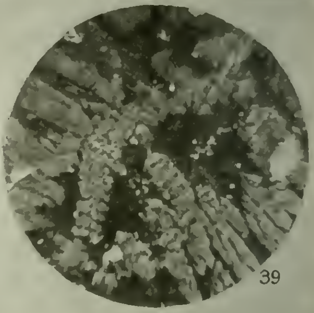


FIG. 39. REVERBERATORY SLAG, REFUSED WITH PYRITES AND CRYSTALLIZED, ETCHED WITH HF

Summing up the evidence for decision regarding the occurrence in slags of the various possible dissolved forms shown in the Groups 2 and 3 (Table I), the following points, may be recapitulated:

1. It is concluded that oxidized copper compounds are absent because:

(a) No definite compounds containing copper oxide have been identified in well-crystallized samples.

(b) The dissolved copper content of all blast furnace and reverberatory slags examined is approximately constant between 0.15 and 0.20% Cu. No reason is evident for such constancy if copper oxide was present.

(c) Behavior with sulphidizing agents does not indicate the dissolved copper to be in a form possible of reaction with them.

2. Metallic copper is not likely to be present because:

(a) The action of sulphidizing agents would prevent its appearance.

3. There is direct evidence of the presence of dissolved copper sulphide because of (a) the absence of sulphidizing action of copper-saturated pyrite; (b) the appearance of the distribution effect with copper-free iron sulphide; (c) the depressing action on the solubility of dissolved copper by another sulphide, which can be explained only by an effect similar to a common ion effect. Sulphur is the only possible common element, and the dissolved copper must, it is evident, be combined with it.

4. Matte as such (consisting of at least two constituents, as in Figs. 1, 2, 3 and 4) is only infrequently seen as larger particles in slag; consequently it seems still less likely to be present in the colloidal state. With regard to dissolved matte, this is at least a two-component system, so that one cannot speak of the solubility of matte as such unless the amounts of each constituent were dissolved in the same proportion as in the original matte, which seems highly improbable.

Although one may finally determine the dissolved or colloidally suspended copper constituent of the slag to be sulphide, the ultimate differentiation as to its physical form is more hypothetical, and the indirect evidence relating thereto is somewhat closely bound up with the second part of the experiments here reviewed, which has to do with the mechanism of retention of sulphide globules.

A close examination of Figs. 6 to 24 will serve to indicate that:

1. Iron sulphide as a phase of matte tends to disappear in the sulphide globules suspended in slag.

2. There is direct visual evidence of reaction between the sulphide particles and some constituent of the slag.

3. A gas is the apparent result of this reaction; and, being evolved and remaining in contact with the copper sulphide, it acts as a flotation agent.

The iron sulphide disappears, and the gas formed probably contains some of the substance of the same, and can consequently be assumed to be SO_2. The mechanism of the reaction must therefore be embodied in the equation:

$$FeS + 3Fe_2O_3 = SO_2 + 7FeO.$$

The following evidence is adduced in support of this equation: (a) The disappearance of FeS is a chemical phenomenon; (b) the oxidation of FeS by other substances possibly present is improbable; (c) Fe_2O_3 is present under the conditions of the reaction.

It has already been shown that one of the resultant products must be expected. The possibility of the disappearance of the FeS constituent by physical means is indicated in Fig. 6, showing the configuration of an inclosed matte globule. However, it is known that in the completely liquid state there is no separation of the constituents of matte; but that on partial or complete solidification, the two components separate. In the process of solidification there should always be some FeS constituent left in sulphide inclusions, because physical forces of separation will cease to act at this point. In many instances no such inclusions are to be noted, and, consequently, other forces of disintegration of the matte must be assumed.

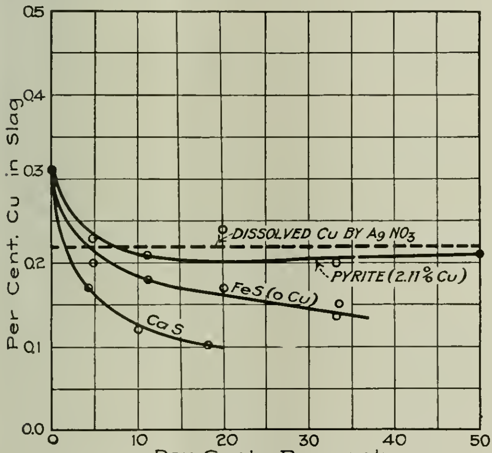


FIG. 40. EFFECT OF FUSING REVERBERATORY SLAG WITH SULPHIDES

The mere presence of gas bubbles as a reaction product, noted in some chilled samples, is in itself evidence of chemical reaction. Other substances which might react with iron sulphide are FeO, air, or carbon dioxide. Of these, FeO is precluded from consideration because the reaction product should be metallic iron, which has not been found in slags examined, although it might occur under certain conditions. Concerning air or carbon dioxide, there is no doubt that these must be the ultimate oxidizing agents. The oxidizing action still goes on in fused slags removed from the furnace, in their interior, or at the bottom of the material, and it seems more probable that some substance, other than dissolved or occluded gas, is directly responsible. Moreover, the reaction products, if air were the agent, should involve the presence of metallic copper, which is unusual.

The occurrence of Fe_2O_3 varies with the presence of magnetite, and the figures from 21 to 39 inclusive show various classes, which may be generalized as follows:

1. *Slags showing no crystals of magnetite.*—To this class belong all blast-furnace slags so far examined.

2. *Slags showing the formation of magnetite crystals during solidification.*—Most reverberatory slags show crystals of these types, which can be recognized because of:
    (a) Formation of crystals in rows, which is only possible if formed at the solidification point.
    (b) Skeletal or dendritic crystals, and minute crystals near larger well-developed ones, indicating later development.

3. *Slags showing well-developed crystals,* without dentrites, and consequently formed during a period of well-fused condition. Converter slags are representative of this type.

Fig. 27 is an excellent illustration of line formation. Figs. 28 and 32 show minute crystals and dendrites. If, therefore, magnetite crystals may be formed during the process of solidification, it follows that Fe_2O_3 must have been present in the magma. Fig. 28, moreover, shows dark areas surrounding magnetite crystals. On disintegration of such a sample of slag by fused caustic potash, magnetite crystals, surrounded by partly decomposed silicates containing Fe_2O_3, are clearly visible.

The question may be asked why the blast-furnace slags examined in the course of the experiments here detailed, which have not shown magnetite crystals, should also show flotation, although the tests have not proved the presence of ferric iron or observed magnetite. To this extent the evidence so far obtained is inconclusive, but re-fusion experiments show that magnetite does form when a strictly reducing atmosphere is not maintained during fusion of blast-furnace slags, and it may be possible that, in the more thoroughly mixed slags of this type, the reaction is sufficiently rapid to prevent the accumulation of ferric iron. Moreover, magnetite actually may have been formed, but may have nearly completely settled out because of its high density.

CONCLUSIONS AND POSSIBILITIES OF THE WORK

It seems reasonably certain that in the samples of slag examined, which are representative of the present practice of matte smelting at the Phelps Dodge properties, little or no oxide copper is present in either blast furnace, reverberatory, or converter slags. Naturally, no conclusion can be drawn regarding all slags, and those from oxide smelting or the production of high-grade mattes should be excepted, but there is strong evidence that sulphide copper is the usual constituent for the conditions under which these slags were produced.

Of this sulphide copper a portion is dissolved. The remainder consists of sulphide globules not characteristic of matte, but rather of white metal or matte free from iron sulphide. Consequently, improvement in settling practice, so long as present slag composition is maintained, cannot be expected to reduce the copper in slags below a certain minimum percentage (in the specific cases under discussion, 0.15 to 0.20%). Recovery of a part of this dissolved copper would require change in slag composition, or the addition of reagents capable of changing the solubility.

Flotative action, as far as the samples examined are concerned, is doubtless responsible for a considerable part of the retained suspended copper, and improved settling alone, under the conditions which cause this gas flotation, cannot be expected to reduce the copper content in the slag down to the theoretically possible amount above 0.15 to 0.20 per cent.

It is reasonably certain that this flotative action is due to the action of Fe_2O_3 on suspended sulphide particles, and that the elimination of such gas-suspended particles can take place only by a reduction or elimination of the amount of Fe_2O_3. Experiments to achieve this result have been suggested. In other words, one of the main results of this investigation is that it seems desirable to eliminate or reduce, as far as possible, the amount of ferric iron (or magnetite). This will, of course, involve (to produce the same grade of matte) a change in the ratio of sulphur to copper in the charge. For example, the purpose should be to eliminate more than the present amount of sulphur in roasting, preparatory to reverberatory smelting.

It is logical to assume that under the conditions of the experiments, and in the samples of slag examined, the presence of dissolved copper, copper oxides or silicates, or combinations of copper with alumina or iron as aluminates or ferrates, is improbable. Any or all of these, however, may be possible in other slags under suitable conditions.

SUMMARY OF RESULTS

The experiments outlined indicate that, in the slags so far examined[14], copper exists in two physical forms, chemically similar:

1. Dissolved copper sulphide:

In blast-furnace and reverberatory slags usually about 0.15% Cu;

In converter or mixed slags up to 0.5% Cu.

2. Mechanically suspended particles of sulphide copper varying in composition from matte to $Cu_2S + X Cu$ and in amount equal to total copper less dissolved copper.

The probable main cause of the retention of mechanically suspended particles, aside from inefficient settling and viscosity, is the attachment of gas bubbles, which probably is due to the action of ferric iron in the slag on iron sulphide in the matte.

The dissolved copper sulphide content acts like a saturated solution with respect to fusion with such addition agents as pyrite, iron sulphide, and calcium sulphide.

APPENDIX

The microscopic methods employed in the examination of slags on which the conclusions set forth herein are based were similar to those usually employed in metallurgical work, and do not require special explanation. Of the etching agents, hydrofluoric and hydrochloric acids were found most satisfactory for silicates; fused acid potassium sulphate gave good results for magnetite, and silver-nitrate, nitric acid, and other solutions were effective for the copper constituents.

Heat tinting in air was found useful for developing the structure, particularly of the iron-containing constituents of slags. Heat tinting in hydrogen failed to disclose oxide copper forms.

The application of neutral silver-nitrate solution for the determination of sulphide globules was a simple analytical procedure. The slag sample was ground to 100 mesh in porcelain. Experiments with finer grinding showed no appreciable increase in the dissolution of copper, thus indicating that the usual practice was sufficient to free all globules. A 1 to 5 gram sample was now weighed into a flask and treated with 1% silver-nitrate solution, sufficient to dissolve twice the total copper content. After frequent shaking and standing for 24 hours, the solution containing copper was filtered off, made acid with H_2SO_4, excess silver precipitated with HCl, and filtered off, the solution evaporated to fumes to get rid of HNO_3 and HCl, and the copper determined electrolytically in the usual way.

In making fusion experiments with pyrites, the assay crucibles used were covered after charging with a layer of calcined charcoal to preserve a reducing atmosphere, and fused at about 1300° C. for a period of about four hours. If a reducing atmosphere is not maintained, the crucibles bubble over, owing to the formation of viscous magnetite-rich films at the surface. After cooling, careful separation of the matte pellet and the lower part of the slag was made to secure a sample of slag as free as possible from matte pellet. The matte in all cases was low in copper, and such error as might be produced by some small inclusion would not be serious.

MAGNIFICATION OF PHOTOMICROGRAPHS NOT UNIFORM

The original magnification of the photomicrographs shown in Figs. 1 to 39 could not, for technical publication reasons, be preserved. The following are of identical magnification: (1) About 150 diameters, Figs. 1, 2, 4, 5, 7, 9, 10, 11, 12, 15, 16, 19, 20, 21, 22, 24, 27, 30, 31 and 33; (2) about 35 diameters, Figs. 3, 6 and 17; (3) about 750 diameters, Figs. 8, 25, 28, 29 and 32; (4) about 380 diameters, Figs. 13 and 14.

Geology of Ray and Miami Districts

As a result of his extended study of the copper deposits in the Ray and Miami districts of Arizona, F. L. Ransome, of the Geological Survey, feels justified in making, among others, the following statements:

"The ore, with the exception of one comparatively rich body in which square sets are used, is mined by caving systems of stoping. The orebodies have a marginal position with reference to intrusive masses of granite, granite porphyry, and quartz monzonite porphyry, but the ore occurs both in the schist and in the intrusive granitic or monzonitic porphyry. By far the greater part of the ore is metallized Pinal schist.

"The orebodies are the result of the operation of two general processes—upward or hypogene metallization as a consequence of the intrusion of granitic or monzonitic porphyries, and downward or supergene enrichment by percolating atmospheric water. The hypogene solutions are believed to have been of moderate chemical activity and must have carried copper and sulphur, with probably molybdenum and silicon. Metallization apparently involved no addition of iron to the rocks, the pyrite having been formed by the attack of the sulphur-bearing solutions on the iron already present in the schist and porphyry as oxides and silicates. Permeability of the rocks, permitting the ore-depositing solutions to penetrate them readily, was brought about by fissuring—largely by a multitude of small irregular fissures. This fissuring was doubtless a consequence of the intrusion and solidification of the granite porphyry and quartz monzonite porphyry.

"From the relation of the orebodies to the present surface, and from other considerations, it is concluded that the greater part of the enrichment was effected before the development of the present topography and probably before the eruption of the dacite."

Stand Up and Be Counted. Buy Victory Notes.

---

[14] Blast-furnace, reverberatory, and converter slags from Phelps Dodge Corporation plants.

Organization in the Settlement Of Industrial Disputes*

By V. EVERIT MACY†

The settlement of labor disputes cannot be attained when conflicting interests display selfish instincts, for each subject to the influence of public opinion and must realize its responsibility to society as a whole. Continuance of increased wages can be made possible only through increased production, and increased profits should be achieved by executive ability and not through control of prices and low wages. In this article, Mr. Macy emphasizes the fact that, after all, the "labor problem is merely a human problem," and unless similar methods are employed in dealing with it as have been found effective with other human problems, maximum production and industrial peace cannot be realized.

IT MAY seem like a contradictory statement, but I believe the social unrest prevailing in all countries can be largely attributed to the extension of the public press and the public school system. It is through these two sources of knowledge that the ambitions and desires of people are aroused. The greatest enemy of stabilized conditions is an awakened public opinion, for, until an awakening occurs, no progress can be made. The only cure for the grotesque theories of liberty and the unhealthy unrest now pervading the world is more education, based on broad principles.

We have reached the point in our education where we feel we have only to demand rights and privileges, but, unfortunately, little stress has been laid on the fact that every privilege carries its corresponding obligation and every right its responsibilities. In developing the individual we have failed to impress upon him his social relations to the community. Before industry can be fully developed and disputes reduced to a minimum, the public, the employer, and the employee must be educated along broader lines.

Each individual combines the triple relation of public, employer, and employee. Whether we are engaged in administrative work or in manual labor we are employees of that industry which we serve. When we purchase any article we are indirectly employers, the makers merely acting as our agents. And in all situations not directly involving our personal interests, either as employer or employee, we form what is called the public. In any situation that arises, the interest of the public is paramount, as it represents the greatest number and includes both employers and employees.

Our education has not kept pace with the rapid change in our civilization since the time when each family was a complete productive unit in itself to the present organization of society, where the community is the productive unit. It required war to force us to recognize that the welfare of each member of society is inseparably associated with every other member and that no appreciable number of individuals can take united action without seriously disarranging the normal life of the community. It was then demonstrated that independent selfish action by any group might even endanger the life of the nation. The public must be shown its rights in all industrial disputes, and it cannot longer follow the policy of allowing the economic force of organized groups to settle these disputes. This right places upon the public the corresponding responsibility of seeing that the average citizen is able to maintain a decent standard of living and have a reasonable opportunity for education and leisure, for otherwise the state cannot have desirable citizens.

Employers and employees must come to realize that their first responsibility is to society as a whole and that any interruption in production causes loss to all elements of society. No one's business can therefore longer remain his own, to do with as he chooses. As consumers we must be taught that we have a responsibility to pay a sufficient price for the purchases we make, in order to permit the articles to be produced under proper conditions. It was this principle that caused the passage of the various workmen's compensation acts, and these acts should now be extended to cover well-recognized occupational diseases.

Employers must be content to make their profits by means of their executive ability and not through the paying of low wages or the artificial control of prices. Employees must learn that wages and standards of living can continue to rise only by increased productivity, and if one does not produce in any given period as much in value as the wage received, he is injuring society. There seems to be a general idea that the Government has some mysterious way of meeting deficits, and that if the Government operated all industry the number of hours worked could be much reduced and the pay received largely increased. The fundamental principle that no industry can be run at a deficit indefinitely seems to be lost sight of.

One important teaching should be that human nature is the same and does not change according to one's occupation or financial position, or whether one is an employer or an employee, a brain worker or a manual laborer. To be sure, the opportunity to indulge one's vices or to gratify one's aspirations varies according to one's financial resources, but money neither creates vices nor supplies ambition—both of these qualities are either latent or expressed in the individual character, and are controlled only by education. It cannot be too strongly emphasized that the labor problem is merely another term for the problem of human nature. Labor disputes, like all partisan controversies, cause disputants to feel that justice and all the virtues are on the one side and all vices and privileges on the other, when, in fact, the desire of the average individual in both groups is only for fair play. The sooner we get over the implied inference that labor is something set apart and with different aspirations from the rest of the community, the sooner we will overcome some of our troubles. It is impossible to draw any sharp line as to what is meant by the term labor, for every occupation, no matter how simple or complex, requires a varying proportion of both manual labor and brain effort.

---

*Abstracts from an address at the Industrial Conference of the New York Business Publishers' Association, Hotel Astor, New York, on Apr. 11, 1919.

†President of the National Civic Federation.

Possibly those who speak of labor as something with definite limitations and set apart, do so through a survival of the old but discarded theory that labor is a commodity and subject to inflexible laws of supply and demand. This theory has been discarded because it does not recognize the fundamental fact that labor cannot be separated from the individual performing the work. It cannot be shipped from point to point in response to the law of supply and demand unless the individual is also transported. It cannot be stored and reserved for future use, for every day lost to the worker is so much output of labor capital gone forever. The theory that labor is a commodity also fails to recognize that the welfare of the individual worker, as well as that of his family and the state, depends upon the conditions under which the work is performed. In recent years we have discovered that the law of supply and demand is not inflexible, even when applied to material objects. We have seen this law materially modified or suspended through systems of tariffs and by the methods employed by certain trusts.

We need no further proof that human nature is the same, and not only reacts to the same incentives but attempts through the same means to gain its ends, than the similarity of action followed under given conditions by both organized employers and organized employees. For instance, note the common use of such weapons as the boycott, the restriction of output, and the artificial control of prices. We have heard many manufacturers' associations protesting at the "dumping" of foreign-made goods in this country below cost of production. This practice arouses the same resentment among them as union labor feels toward the scab worker who is willing to take his place at a wage below what union labor considers the cost of American standards of living.

Certain practices followed by organized labor have been severely criticised, and in principle cannot be justified, but experience has caused the organization to feel they are necessary as a means of self-protection. As an illustration, it is the natural desire of the employer, when business is active, to train an unlimited number of skilled men to do the required work. The workers have found, however, that when business is slack, the employers use the law of supply and demand, and the fact that there are more men than jobs, as an excuse for reducing wages. This has resulted in the unions establishing regulations for the number of apprentices in their respective crafts. They feel, like many professional men, that after they have spent four years, the usual duration of apprenticeship, in acquiring the skill of their craft, they have acquired a certain vested interest in that craft. Another bone of contention is that in modern industry efficient production is constantly tending toward the greater specialization of each process in industry, so that if a man is put on a particular machine for a long period he obtains little general skill as an all-around mechanic, but does become proficient on his particular machine. If such a man loses his position it is often difficult or impossible for him to find another opportunity to work, for he must find a place in which the same kind of machine is used; otherwise he will sink back into the unskilled labor class. In addition, the specialist naturally receives a lower wage than the skilled mechanic and is used to hold down the wage of the thoroughly trained man. This causes unions to look with disfavor upon specialization until the workman has first acquired sufficient experience to be a real craftsman.

One of the common criticisms against the union policy is that it favors the restriction of output. This charge may be well founded or not, according to the circumstances. Such restrictions are rarely the result of union action, but are brought about by the common consent of the men in a given plant. Many of those who make the charge, however, fail to realize that a man may run 100 yd. at a certain speed, but the greater the distance the slower will be the average speed maintained. No doubt if a workman were only required to perform a certain task for a year, he could turn out a greater average per day than if he were to continue the same occupation for five years, and he could turn out a higher average for five years than he can during the forty or fifty years of the average workman's productive life.

We have many illustrations of the fact that excessive speeding up of work does not always produce the results expected. For instance, many daily riveting records were made in the various yards during the war, but almost invariably the gangs that broke a daily record were so exhausted that at the end of one month their total output was not any greater than that of the gangs that did a fair day's work regularly.

Still another criticism of the policy of organized labor is that it demands the same wage scale for every man, regardless of his ability, and injures the prospect of advancement of the ambitious and highly skilled individual, thus bringing all men to a dead level. The union reply to this criticism is that it merely demands a uniform minimum wage and that the employer is free to recognize unusual skill or ability by paying above the minimum. When one stops to realize that where there are no trade unions the wage of the individual worker depends entirely upon the knowledge or caprice of the foreman, one is not surprised that the unions have established such an arbitrary rule to protect their members from the autocratic acts of a petty man. I have seen payrolls in which members of the same craft were rated at a difference of 1c. an hour, the wage paid running all the way from 35 to 68c. per hour. The greatest efficiency engineer in the world, or the wisest foreman, would find it difficult to convince any fair-minded person that he could distinguish a difference in value of 8c. a day between the work of each one of 33 men. It must be remembered that the duty of the foreman is to keep down the cost of production in his particular department. I believe that this unfortunate tendency upon the part of organized labor to recognize only one degree of skill would never have developed to the same extent if the interests of the members had been protected by some method for a fair hearing of individual grievances.

It is of the utmost importance for the peaceful and productive development of industry that both employers and employees should be thoroughly organized, in order that trade agreements may be worked out between them. Before this can be successfully accomplished, however, employers must place in the hands of broad-minded, experienced men the responsibility of formulating and carrying out their labor policies. Such men might be called labor advisers, administrators, or engineers. A group of such men representing the manufacturers of an industry should meet with the international presidents of the unions employed and in conference reach an agreement covering the questions of wages and hours for the entire industry or for districts. Local boards, on which the employers and employees should have equal representation, should then be set up for the purpose of establishing local, or district, working conditions and for the interpretation of the detailed application of the wage scale to individual plants.

In each plant of any size there should be a labor adviser, or engineer, and the workers in each craft employed in the plant should elect a committee from their number to represent their craft. The chairman of this craft committee should be a member of a general shop committee, to be composed of the various craft chairmen.

The above plan is given merely as an example of a method that proved successful in maintaining peace in the shipyards during the war. For a period of a year and five months there was practically no interruption of work in the shipyards due to industrial disputes, notwithstanding the fact that during this period the number of men employed quadrupled, with all the complications that such an abnormal increase naturally involved. The advantages of the plan suggested are, first, that the fundamental questions of wages and hours are taken out of the hands of local foremen and local labor leaders and placed under the control of responsible representatives of the employers and national labor leaders. In other words, such matters are thus decided by men of wide knowledge and experience instead of by men of limited vision and local experience. In dealing with labor questions for many years, I have found that nine-tenths of the difficulties start in the arbitrary actions of some petty official of the company or of the local union, and as soon as the question was taken up with the responsible executives of either side, the matter could be quickly and satisfactorily adjusted, unless the prestige and discipline of either party had become too much involved by the action of their respective subordinates.

Another important advantage is that, by determining a uniform minimum-wage scale for the entire industry or district, the success of a firm is then dependent upon the managerial ability of its officials. There is a wide scope for such ability, as shown by the fact that with a uniform wage scale in all the shipyards on the Atlantic Coast, the cost per ton produced varied over 100%. This method of fixing wages protects the well-managed and fair-minded employer from the competition of those willing to make their profits out of underpaying their workers. Profits are not determined by the wage paid, but by the unit cost of the article produced, and the unit cost is 90% a question of managerial ability. Good management always develops a high *esprit de corps* among the workers and attracts the most highly skilled craftsmen to the plant.

The local or district boards to be set up should be given a free hand, with full authority to decide all questions except the changing of the wage scale or the number of hours to be worked. During the last two years I have attended many conferences between employers' organizations and representatives of labor, looking toward the establishment of such boards. These conferences have all had the same history, namely, that at the first session both sides had innumerable limitations or conditions that they wanted included in the agreement and which they thought were necessary to protect their interests. At each succeeding conference these limitations were reduced in number, until finally it was usually decided that a board should be established with unlimited power to determine any question that arose, without restrictions. By leaving to these boards all questions except wages and hours, sufficient flexibility is provided to meet what are in reality purely local or individual plant conditions. In the past, far too much power has been left in the hands of petty foremen and petty local labor leaders.

The main purpose in providing for craft and shop committees is that through these committees grievances can be immediately taken up and settled. Delay in obtaining an impartial hearing for a real or supposed grievance is one of the most prolific causes of labor trouble, and it makes little difference whether the cause for complaint is real or imaginery. Another advantage of these committees is that they develop a sense of responsibility among the men. All individual disputes, or those involving a single craft, can be settled within that craft, without being brought to the attention of other employees not affected, while the general shop committee is in a position to take care of all questions involving more than one craft or the entire plant. Appeals from the decisions of the general shop committee or craft committees should be taken to the district board for final decision.

The great advantage of such a method of handling labor problems is that it is essential, in order to obtain increased productivity, that the employers should be able to present to the workers the limitations and problems under which the industry is conducted, and that the workers should understand their individual relation to the process and that of the industry to the community and other industries. At the same time, the employer can gain a more accurate knowledge of the conditions under which the work is conducted in his own plant. Frequently, by listening to the suggestions made by the workers, he can obtain suggestions that result in the lowering of the costs of production. It is surprising to find, even in the best-managed companies, how little the executive heads know of detailed conditions that seriously hamper the production of the workers.

I wish especially to emphasize the fact that the establishment of shop committees must in no way be taken as an alternative or as a counter weapon against agreements with the regularly constituted trade unions, for no plant committee can make agreements covering competing firms, nor do they have the responsibility of an organization behind them. Above all, they cannot have the advantage of being guided and controlled by men of national experience.

The presidents of the international unions are oftentimes better informed as to the national situation in their industry than many of the employers. This is not unnatural, as the time and thought of the most large employers of necessity must be given to the many problems in their own plants. The national labor leaders, on the other hand, are constantly hearing from thousands of agents of conditions and problems in all parts of the continent.

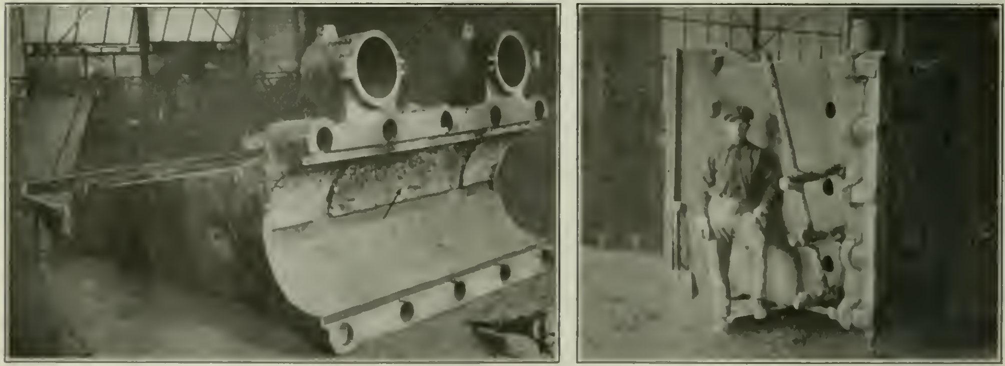
The establishment of mere machinery to settle any dispute cannot, however, take away the responsibility of the individual. Peace cannot be maintained in industry by both sides organizing merely for defensive purposes, any more than international peace can be secured by the maintenance of standing armies. We are learning that international peace can be secured only through the just consideration and discussion of the rights of each nation, and the same coöperative spirit must exist in industry.

The first lesson to be learned before modern civilization was possible was that the rights and obligations of the individual had to be subordinated to the public welfare. Why should we longer hesitate to apply the same methods to an aggregation of individuals who are associated in industry? Force settles nothing, whether it is applied in the case of individuals, to an industry, or a nation. Unorganized action, based on the selfish interests of the individual, or locality, merely produces such anarchy as now exists in Russia.

The time has arrived when each individual must take a stand, either for law or organized orderly development, or for the use of force and anarchy. Arbitrary, reactionary employers are as dangerous to society as revolutionary labor agitators. Must we suffer further catastrophes before adopting organized, lawful methods of dealing with all human problems?

Thermit Repairs to a Rock Crusher

An example of the conspicuous part which is being played by Thermit welding in restoring to operation many types of heavy steel mechanical equipment used in the mining industry, such as broken pitmans of rock-crushing machines, mining locomotive frames and side rods, mine-hoist drum shafts, hubs of mine fans, flywheels and numerous other parts of machinery, is afforded by a series of three successful repairs on the broken eccentric bearings of two cast-steel pitmans of a large rock crusher used by the Casparis Stone Co., Havre de Grace, Maryland.



THERMIT WELDING ON A ROCK CRUSHER

Photograph at left shows the second weld trimmed and ready for shipment; right shows the third weld, pouring gate, and riser after dismantling mold box

The Principles of Thermit Operation

To those who are not familiar with the Thermit process, it may be said in introduction that Thermit is a mixture of aluminum and iron oxide. This mixture can be ignited by means of special ignition powder, and on reaction produces superheated liquid steel and slag (aluminum oxide), at a temperature of approximately 5000° F. This Thermit steel is sufficiently hot to melt and dissolve any metal with which it comes in contact, and amalgamates with it to form a solid, homogeneous mass when cool.

Two breaks occurred about a year ago in practically similar positions in the first pitman of the Casparis crusher. These were successfully welded and the section was delivered to the owner. Before the delivery of the first pitman, however, a part of the eccentric bearing of a second pitman in use at the plant broke off, leaving a fractured surface extending longitudinally through the eccentric bearing, measuring 6 ft. 2 in. in length and averaging about 7 in. in thickness. A mechanical repair was first attempted on the new break, but this failed after only a few days of service, and the casting was then shipped to the Jersey City repair factory of the Metal and Thermit Corporation.

In each of the three welds the method of making the repair was practically the same. The broken sections in each case were lined up with each other and a gap of about 3 in. was cut out between sections with the oxyacetylene flame, to allow for contraction of the weld in cooling.

Manner of Preparing and Placing the Mold Box

The parts were then ready for the application of yellow wax to form a pattern. The wax was warmed until plastic, filled into the gap between sections, and shaped around the parts adjacent to the break, in the form of a collar. In the third weld 90 lb. of wax was used. After having formed the wax pattern, a huge mold box was constructed around the fracture, consisting of a sheet-iron box containing molding material. The material which was to come in contact with the Thermit steel was made of one part fire clay, one part ground fire brick and one part fire sand.

During the filling up of the mold box the molding material was carefully rammed down. Six wooden patterns were inserted horizontally in the mold in the proper position to supply openings for the preheating gates. A cylindrical-shaped wooden pattern directly above the wax pattern formed the space later necessary for the Thermit steel riser to occupy. It should be explained that the function of a riser is to hold a supply of steel which will remain liquid for a considerable length of time and take care of all shrinkage, so that, when a pipe is formed through shrinkage, this pipe will appear in the riser and not in the weld. The riser also acts as a depositary for loose sand and other foreign matter which may be washed into it by the Thermit steel in passing through the mold, and prevents this material from clogging in the weld. A section of pipe extending diagonally upward from the bottom of the break served effectually as a pattern for the pouring gate.

After the mold box was rammed up, the pipe and wooden patterns were removed, and preheating of the section was begun, for the purpose of drying the mold and bringing the sections to a good heat. before pouring the Thermit steel. This preheating was done by means of a double-burner gasolene compressed-air preheater. In the case of the third weld of the pitmans, the preheating was started at 4 a.m. The first 1½ hours of preheating were required to burn all the wax out of the mold.

Particular interest attaches to this repair, because an extra large automatic crucible, having a capacity for 2000 lb. of Thermit and of somewhat different design from the standard crucibles employed in this welding method, was used experimentally for the first time. The crucible was filled up almost to its total capacity, 1750 lb. of Thermit being used.

When everything was ready for the reaction, a small amount of special ignition powder was placed on the Thermit in the crucible, and this powder was ignited by means of a red-hot iron. The intense heat thus generated started the reaction.

After allowing one minute for the reaction to complete itself, the tapping pin in the base of the crucible was tapped upward by means of a long bar, and the liquid Thermit steel allowed to run out into the mold.

In spite of the enormous amount of Thermit formed in one crucible, the reaction and pour was accomplished with entire success, forming a perfect weld of strength just as great as, if not greater than, any other part of the pitman.

An accompanying illustration shows the arrangement of gates and riser, as indicated by the excess metal present after the mold box was finally removed after cooling.

Financing Foreign Enterprise

The purpose of the Foreign Bond and Share Corporation, which has just been formed, is to finance public and private enterprises in Central and South America, the Far East, Europe, and other parts of the world. It will also sell to American investors either the debentures of the corporation, which will be covered by the deposit of the securities of these foreign companies, or the foreign securities themselves. It is the intention to reach all classes of investors in the United States.

The organizers of this corporation include private banking firms and some of the strongest financial institutions throughout the United States. Among them are Brown Brothers & Co., J. & W. Seligman & Co., Guaranty Trust Co., Chase Securities Corporation, Central Union Trust Co., Columbia Trust Co., Hayden, Stone & Co.—all of New York; First National Corporation of Boston; Hibernia Bank and Trust Co., New Orleans; First Trust and Savings Co., Cleveland; Anglo & London Paris National Bank, San Francisco; Mercantile Trust Co., Mississippi Valley Trust Co., and interests associated with National Bank of Commerce—all of St. Louis; and the Central Trust Co. of Chicago.

A number of the subscribers of the Foreign Bond and Share Corporation are now actively identified with the Asia Banking Corporation, Mercantile Bank of the Americas, the American Foreign Banking Corporation, Banco Mercantile Americano del Cuba, the China & Japan Trading Co., and other American financial institutions which have branches in many parts of the world. For this reason, the new corporation is particularly well qualified to develop American trade, and to pass upon the value and to oversee the management of enterprises which it finances.

Owing to the war, the export trade of the United States has expanded enormously, and the same cause has been responsible for the creation in America of the greatest merchant fleet in the world. Neither, however, will avail the American people unless they are willing to invest some of their capital in the foreign countries to which the American merchant fleet sails and to which American merchandise is carried.

Latin-American and Asiatic and other countries which are undeveloped will buy merchandise from the nation which places capital at their disposal. It is in large part the secret of the success of British, German, and French trade in such countries.

As regards the European countries, they now owe the United States such enormous sums that the mere problem of exchange necessitates the taking of foreign securities by the American public in payment for our exports of merchandise to Europe, if such exports are to continue in anything like their present volume.

In the past London has been the great international market for the securities of every government, and of the industries that were among the principal sources of national wealth. British investors always have been large buyers of such securities. The new-found financial position of the United States should result in a similar appreciation on the part of American investors of this factor, which is vital to the future of our foreign commerce.

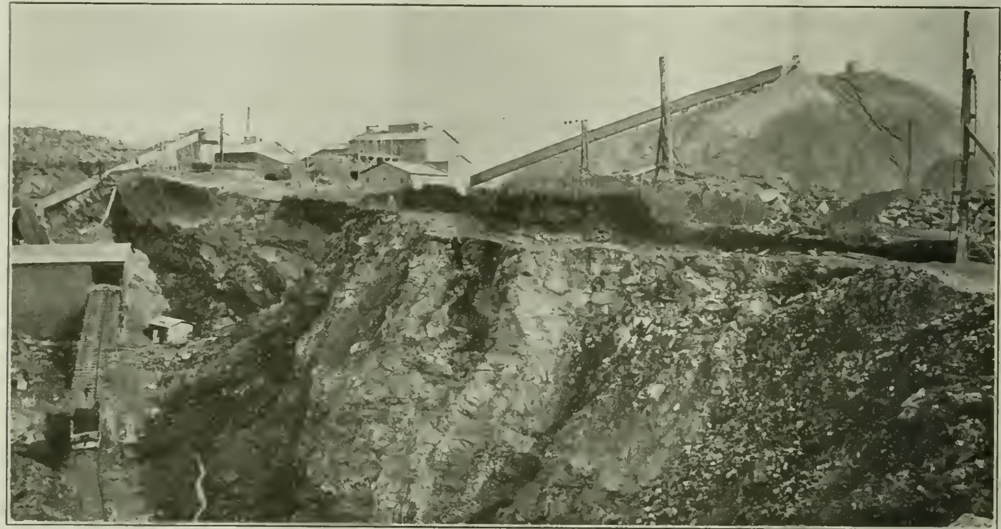
Investment returns in Latin-American and in Asiatic and other countries needing development are higher than in the United States. There is no reason why, under careful supervision, the American investor should not be given the benefit of such attractive rates of investment return, and at the same time have the protection of good security.

England, France, and Germany in the past have done most of the financing necessary for the development of foreign countries, and have reaped the benefits; but, as they are no longer in a position to supply the amount of capital needed for this purpose, Americans must furnish the larger part of it.

Mine Footage Cost of the Boston and Montana Development Co. during 1918 shows an increase of 50% over that in 1917, according to the company's annual report. Work done consisted of 1364 ft. of drifting, crosscutting, and raising. The company railroad from the mine to Divide, on the Oregon Short Lines, is to be completed in June. Work on the 500-ton concentration plant was delayed awaiting railroad completion, although the necessary tests have been made and the kind and character of machinery decided upon.

Mobilize Every Available Dollar for the final push. Buy Victory Notes.

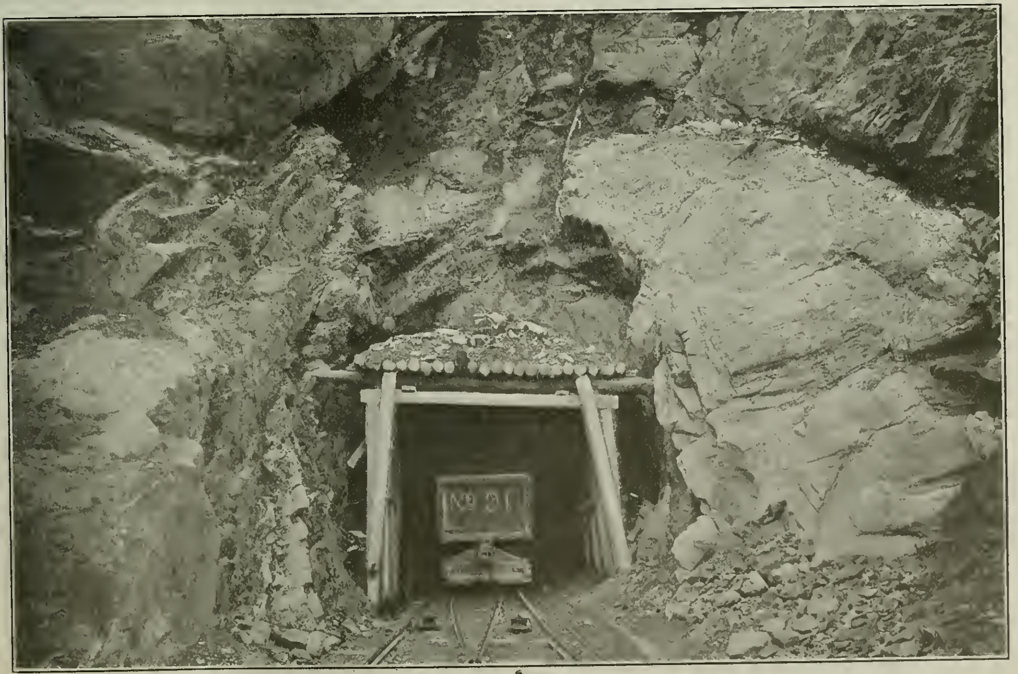
Asbestos Deposits of Quebec



PLANT AT EAST BROUGHTON, SHOWING PIT, STORAGE BINS, CRUSHER, MILL, AND DUMPS

ASBESTOS OPEN-CUT MINE, SHOWING TERRACES AND DUMP IN BACKGROUND

OPEN CUT AT THETFORD MINES, SHOWING CABLEWAY STANDARDS



TUNNEL AT ASBESTOS MINE. ASBESTOS ROCK TRANSPORTED FROM PIT TO HOISTING SHAFT

The Mexican Problem

By "OBSERVER"

HAVING spent 19 years in Mexico and several years in South American republics on professional business, I can corroborate what has been published in recent articles in the *Journal*. I left Mexico only a few months ago, and I know the conditions intimately. One need not exaggerate (as American correspondents felt inclined to do before the revolution); but to exaggerate in an optimistic manner is a most dangerous procedure, as it will lure hundreds of American business men, mine operators, professionals, and skilled laborers to ruin, to separation from their families, and, not unlikely, to death.

If we should abandon our American business interests in Mexico, other nations will take our places. The Spaniards, for instance, would be only too glad to see us retire. The only people that have been and still are the real masters over their former slaves—the anti-Spanish element in Mexico—are of no significance. It is through the Spaniards that we could reach these people, and this is exactly what the Germans have done. They invaded Spain by the thousands, and catered to the likes and dislikes of Spaniards, and soon were patronized in all Spanish countries. The application of justice pure and simple, the inborn principle of the Anglo-Saxon race, does not go far with these people. Flatteries, bowing and much hat raising are necessary first before we can gain any influence over them.

GERMAN METHODS

The Germans applied three distinct forces against the influence of the Americans—they made friends with the Spanish "*haciendados*," the principal land owners in all these countries; they catered to the Church, and last but not least they advertised themselves in a thousand ways—their schools, methods, discipline, the famous German Kultur, army and organizations. They learned the Spanish language as soon as they entered these countries and married the daughters of "better families." The Germans will be out of the game for some time, but they will remain the bitterest enemies of the English and Americans alike. They will constitute the same jealous and dissent-sowing elements; they will apply new and more secret working forces, unless the new German government shall appoint, as representatives in the diplomatic and consular service, men who are able and willing to work toward a general reconciliation, and who can apply a common-sense policy of a high moral order. But it is not likely that this will happen. The present and perhaps the first next generation of the Huns is still too much afflicted with the Prussian discipline.

The English have endured the greater losses, in comparison with the more numerous American companies in Mexico. They have kept records, but they feel when they go to foreign countries that they do so at their own risk. However, the English government keeps a careful and watchful eye on its nationals.

DIFFICULTIES OF OPERATING IN MEXICO

As to the mining industry in Mexico, it is the opinion of the more cool-headed Americans that it is advisable to keep on working mines and plants that can be operated and which are paying expenses or which can make a profit. To encourage new work or open former mines is not advisable. The spending of new money or the advancing of loans should be avoided. Only a few courts are open; judges will not conduct cases against the government or their own friends; lawyers will not accept lawsuits without demanding fees and expenses in advance, and will proceed only when, after having consulted the "judge," they are certain that the defendant has less influence, although he may have more money. Big and minor cases drag along for years; decisions, even when given, are seldom enforced.

The deplorable financial conditions in Mexico are too well known. Personal safety is only assured by going home in the early hours of the evening. No foreigner accepts a position in the interior of the country, or in places off the railroad, if he can help it. Although the Mexicans spy only on their own political enemies, and murder them in improvised fights, or in the dark of the night in the prison, in the streets or in the country, one is careful what he is talking about to his American or English friends, or acquaintances of other nations. There is a deep mistrust in personal relations and no confidence in business transactions.

GERMAN INFLUENCE AT WORK

It is no secret that the Carranza government was, during the war, decidedly pro-German. It is no secret that it has been anti-American. Whether it will continue to maintain this position can be answered only by the future. The danger of German propaganda has gone; there is no more money for the *caballeros illustros*. The Mexican Ambassador in Berlin, a German *Chileno*, is a red-hot anti-Ally; the one in Vienna much worse, but that fact makes no difference—of cash there will be none.

The Mexicans are entirely dependent on us; we know it and they know it. It behooves the Americans as next neighbors, though sick and tired of all the outrages by bandits and Mexican officials alike, to do some hard thinking about it. Shall we wait until the Republicans are in the saddle, or shall we demand, now, that Carranza has to quit? The "feed the stomach" antidote for revolutions, for preventing the poor from attacking the rich, is as old as the Romans. "Fishes and wines for the *populi* [mob]!" shouted Nero; "Amuse the brutes," says he; and forthwith the Christians were fed to the lions in the circus, and the streets lighted by the burning bodies of the Christian martyrs. As a final joke he burned the city.

The bigger American and English companies operating in Mexico are feeding the peons with corn and selling it at cost price. They move their incoming supplies and outgoing products in their own cars and by their own engines. But that is all they wish to do and can do, often risking the breaking point. The smaller companies and business houses fare worse.

Railroad cars with goods or supplies ordered from the United States are never moved after they have crossed the border line or are loaded in the ports. They are side tracked, and an excuse for congestion is thus purposely created. The buyers wait in vain for the goods to arrive; they start tracing, appeal to the consuls, to ministers and governors, even to the president. Finally the highest railroad official feels inclined to give preference to such and such a car, if the buyer would pay the extra expense for moving one which is congested among hundreds of others. Sometimes the expense is over 1000 pesos, never less than 500, and the buyer or his agent must look after the moving of the car himself. He must tip the station agent, the engineer, and the brakeman.

The continuous raising of the taxes for export by the Mexican government is an entirely Spanish habit. The Spaniards from early days of the present times not only excluded all foreigners from their colonies for more than 300 years, but after the change came they made the foreigners pay for developing their countries' resources. Only recently the English government called upon the Spanish government to explain the imposition of exorbitant taxes and export duties on everything produced by English capital and English engineers in Spain. Some of the South American republics are trying the same thing all the time. The once Latin system of isolation and home protection is a relic of European and Oriental statesmanship and economic laws of centuries ago. The persistence of it is a sign of inability or unwillingness to understand the policies of the open door, fair trading, and equal international rights.

AMERICANS NOT INTERESTED IN POLITICS

I recently read an article about Mexico in the January number of the *North American Magazine*, which can be of interest only to the most intimate student and personal observer of Mexican affairs. Eighty per cent. of the American old-timers in Mexico and other foreigners never bother themselves about Mexican politics or about this or that "chief." I hardly ever looked over Mexican newspapers except for war news. I studied for a while the greatest newspapers in the South—those of the Argentine and of Chile—but gave it up. The flowery language, the steadv recurrence of Cæsar, Brutus, Dante, Macchiavelli, Napoleon, and the French Revolution, but the lack of reference to English literature or England's great men in politics, or to the American commonwealth and history, disgusted me.

Although a professional smelting man and interested in other branches of the mining and metallurgical industry, I have no desire to report on the progress or conditions of mining or of metal production in Mexico or in South America. The larger companies and the mining journals are all well posted on these subjects. My personal experiences, my losses both in riches and health during six years of revolution in Mexico (and only on account of the revolution) fall into insignificance compared with the hardships of thousands, nay, millions, of soldiers, civilians, men and women during the war. The gains of the war profiteers, much less those of many foreign business houses in Mexico and in South America where Americans, English, French, Germans and Austrians alike bartered between themselves or together openly, shamefully, blacklist or no blacklist, cannot arouse my envy or my indignation.

I have enjoyed the life in the tropics—the wonderful life in the open. The beautiful colors in the skies down in the countries where the cactus grows. I hear again the *muchissimas gracias* of the brown and dirty Indian with the sombrero in his hand. I am waited on like somebody by a score of *mozos*. People take off their hats, to me; the ladies look at me; some smile, gray hairs or not. There are no blizzards or hot waves, no 20 below zero, or 120 in the shade, no hot rooms, or sleeping porches where one gets covered with dust. One can stretch his legs under the table, sit till midnight, and later, in the club, in the open, in the cafés, listen to agreeable music and shout for a drink—yes, for a drink of any kind.

Peoples have emigrated for many reasons, of course mostly for making a living, a better living in foreign countries. Compulsory military service has driven many out of Europe, and not a few, but many, of the better-class of Englishmen, who detested or could not keep up with social class distinctions at home. It is said that many American soldiers are held back by the fair maidens in *La Belle France* and in England. How many will flee from the United States when nation-wide prohibition and anti-tobacco fiends sweep the country?

I would rather be a big fish in a small pond than a small fish in a big pond—*Viva México, viva Perú, viva Brazil!*

Recent Events in the Mexican Situation

A brief summary, compiled from press accounts, of important events occurring during the last month in relation to the Mexican government, and to the American interests that are coöperating to make clear the status of the Mexican situation, as well as to stimulate action toward the settlement of the present difficulties, is given in the following:

Mar. 15.—Reported that the State of Morelos is completely under control of government troops, after being overrun for 10 years by bands under Emiliano Zapata.

Mar. 17.—State Department advised of capture of J. E. Whetten, an American, and Joseph Bentley, a bishop of the Mormon Church, by Villa forces at Cruices, 50 miles east of Pearson.—Report of a raid on Mar. 1 by 12 armed bandits on oil camps at Tampico, resulting in hanging of camp superintendent, M. Savioz, until unconscious, but he was cut down before life was extinct.—American negro ranch foreman "Bunk" Spencer, and nine Mexican families continue to be held by Villa's men in Chihuahua, despite payment of $5000 for their release.

Mar. 18.—Treasury Department of Mexico announces the Mexican government has no intention of forcing immediate collection of royalties on oil produced in country, during January and February, under Carranza decree of Feb. 18 directing the immediate collection of royalties.

Mar. 19.—Federico Servantes, with 18 men, arrested near Socorro, Tex., while attempting to cross to Mexico to join General Angeles, of the Villa forces. —Eight Mexican cowboys and "Bunk" Spencer, American negro, reported released by Villa's commander, Marin Lopez.—Francisco Villa, with 500 men and 14 wagons filled with sick and wounded, reported seen at Chihuahua City.—Resolutions favoring League of Nations and expressing sympathy with President Wilson introduced in the Mexican Congress on Dec. 13, 1918, were published.

Mar. 20.—Announced that 400 American business men and financiers representing many towns and cities in the Mississippi Valley would visit Mexico on the invitation of President Carranza.—Reported that Mexican diplomatic representative in Paris would not be received by the peace delegates.—Rafael Nieto, acting Minister of Finance of Mexico, in conference with the International Committee of Bankers and J. P. Morgan & Co. A loan for the Mexican government was not negotiated.—Message received from Bishop Bentley, that he and J. E. Whetten, and Albert Tietjen, all Mormons, were released by Villa's forces and are returning.—Fighting between federal cavalry and Villa forces occurred near Ascension, 60 miles south of Columbus, N. M., resulting in a number of Villa's men being killed and others captured.—Announced that airplane patrols would be established along the Mexican border by the U. S. Government when the Army is reorganized on a peace basis.

Mar. 21.—Proposed to eliminate retroactive features of Article 27 of Mexican Constitution, the republic to claim only future discoveries as nation's property.

Mar. 23.—Troops of 8th U. S. Cavalry returned to Marfa, Tex., after pursuit of Mexican bandits, across border, resulting in the recovering of 35 cattle and two horses taken by raiders the previous day. Oscar Wallace, an American ranch farmer residing at Hacienda Encinas, near Progreso, Coahuila, reported attacked by bandits and held prisoner.

Mar. 24.—State Department of U. S. Government advised that the Mexican government issued circular threatening to punish companies and individuals that drill oil wells or perform other petroleum development without permission.

Mar. 25.—Ambassador Fletcher, of the U. S. State Department, conferred with representatives of leading American oil companies in reference to threat of Mexican government to punish drilling of oil wells without permission.—The body of Oscar Wallace, who was recently kidnapped, was found near Progreso, Coahuila, according to advices received in Washington.

Mar. 29.—The Mexican Claims Commission, in session at Mexico City, was flooded with claims against the government, according to advices received in Washington. The number of claims arising from the Madero revolution will amount to about 8000, one third of which will be filed by foreigners.

Mar. 30.—Concessions were granted to Japanese to exploit agricultural lands in Lower California, according to a reported statement of General Amado Aguirre. Japanese Legation in Mexico City denies any official knowledge of the transaction. Washington believes the attitude of Japanese government will not permit Japanese to acquire land in Mexico without sanction of the United States.

Apr. 1.—Troop of 80th U. S. Cavalry, after a raid by Mexican bandits across the Rio Grande, overtook and killed five of the bandits, recovering the horses and cattle which had been stolen.

Apr. 3.—Under Secretary Amado Aguirre, of the Department of Agriculture and Development, denies statement attributed to him that Japanese companies had acquired land in Lower California.—Appeal made for recognition of the belligerency of the Diaz movement in a circular letter received by American consulate at Juarez. U. S. State Department officials said no official notice of the revolutionary movement would be taken, as the government of Mexico has been recognized by the United States.

Apr. 4.—Announcement of the landing of General Aurelio Blanquet on east coast of Mexico to organize the Diaz forces and overthrow the Carranza government.—U. S. Immigration officials announce Mexican border passports regulations are suspended in a zone 40 miles south of the border. Permits may be obtained by American citizens on verbal application.

Apr. 8.—Rafael Nieto, who for the last year has been Secretary of the Treasury, resigned, and Luis Cabrera, former Secretary of the Treasury, has been named. Cabrera is regarded as being antagonistic to the United States.

Apr. 9.—Announced that an investigation had been ordered by U. S. Department of State of the attack on passenger train between Tampico and Monterey by Mexican bandits on Apr. 4, in which J. P. Mennet, an American citizen, was wounded.—Diplomatic advices received in Washington to the effect that Mexican government is returning to the owners more than 400 mining properties in the State of Chihuahua.

Apr. 10.—"The Nation" editorially charges oil interests are attempting to influence American public opinion toward intervention, by charging Carranza with pro-Germanism.—On permission of American authorities, 2,000,000 rounds of 7 mm. rifle cartridges were taken across the border for the use of Mexican government forces.

Apr. 11.—Washington advices announce that an American citizen, Edward E. Morgan, was murdered at Chivela, 47 miles from Salina Cruz, on Apr. 8.—General Emiliano Zapata, of rebel forces, was killed by federal troops, according to announcement of the government.

Apr. 12.—New York Group of American Chamber of Commerce organized to promote trade between United States and Mexico.

Apr. 17.—General Blanquet reported killed by Carranza forces.—E. L. Dufourcq, an American mining engineer, killed by Mexican bandits.

Apr. 23—Acting Foreign Secretary Fernandez declared Mexico never had recognized and never would recognize the Monroe Doctrine.

Apr. 26—Information became known that Villa is concentrating all troops under his control in Chihuahua in attempt to reëstablish a rebel government.—Washington officials believe refusal of France to recognize Alberto J. Parie as Minister from Mexico was caused by protests from French bankers against seizure of French banks in Mexico.—Reported that intimation had been made to Mexico she would not be given a place in the League of Nations unless her policy of dealing with foreign aliens and foreign investors was modified.

Apr. 27—Mexican gunboat captured the American fishing schooner "Cape Horn" in Gulf of Mexico, alleging the smuggling of arms to rebels in Vera Cruz.

Apr. 29—Considerable interest aroused in Washington regarding identity of governments friendly to Mexico that requested Mexican Foreign Office to express an opinion on the recognition of the Monroe Doctrine as announced in official dispatches. Opinion expressed that if such an inquiry were made it probably came from Argentina and Chile.

Iron-Ore Exports From Algeria in 1918 were 782,047 metric tons, as compared with 1,065,512 tons in 1917 and 938,684 tons in 1916, according to *Echo des Mines*. Of the 1918 shipments only 7400 tons went to France, the rest having gone to the United Kingdom.

The New Price Revolution*

BY IRWIN G. FISHER†

There are glorious opportunities ahead. For all the years of the war we have neglected producing those things which could not be classed as "war material." Today there are empty shelves everywhere and a world-wide demand. The more rapidly we can increase production and stimulate consumption, the quicker we can speed up the process of exchange and the sooner shall we see the smiling face of Prosperity, waiting just around the corner —prosperity for capital and prosperity for labor.

IT IS INTERESTING to observe that many manufacturers think that prices must come down, including the price of labor; but they are ready to demonstrate to you that their own prices cannot come down, nor can they pay lower wages. Almost everything they buy somehow costs twice as much as before the war, and their labor is twice as dear. They cannot pay their labor less if labor is to meet the increased cost of living. Now, as a matter of fact, when we investigate almost any individual one of the so-called high prices for industrial products we are likely to find that individually it is not high; that is, it is not high relatively to the rest. Our quarrel is with the general level of prices.

Variations in the general price level may be compared to the tides of the sea, and the individual prices may be compared to waves. Individual prices may vary from this general level of prices for specific reasons peculiar to individual industries, just as the height and depth of waves vary from the general level established by the tide. The causes controlling the general price level are as distinct from those controlling individual prices as the causes controlling the tides are distinct from those controlling individual waves.

The general level of prices is dependent upon the volume and rapidity of turnover of the circulating medium in relation to the business to be transacted thereby. If the number of dollars circulated by cash and by check doubles, while the number of goods and services exchanged thereby remains constant, prices will about double.

The great price changes in history have come about in just this manner. The "price revolution" of the sixteenth century came upon Europe as a result of the great influx of gold and silver from the mines of the New World. Europe was flooded with new money. More counters were used than before in effecting exchanges, and prices became "high." People talked then of temporary "inflation," just as they talk of it now. But it was not temporary; it was a new price level.

A similar increase in prices all over the world occurred between 1896 and 1914, following the discovery of the rich gold fields of South Africa, Cripple Creek, and Alaska, the invention of the cyanide process, and the vast extension of the use of bank credit.

Circulating credit—that is, bank deposits subject to check, and banknotes—is a multiple of the banking reserve behind these deposits and notes; and the essence of this reserve is gold. Our present monetary system is an inverted pyramid, gold being the small base and banknotes and deposits being the large superstructure. The superstructure grows even faster than the base. The deposits are the important elements. They are transferred by check from one individual to another; that is, the circulation of checks is really the circulation of deposits.

Thus any increase in the country's gold supply has a multiplied effect. The possible extent of that effect is dependent upon (1) the amount of gold available, and (2) the gold reserve requirements, determining the volume of credit that can be put into circulation based upon the gold. Over a billion dollars in gold has come into this country from abroad since 1914, and a large amount has disappeared from domestic circulation. The gold from both these sources has found its way into the United States Treasury and into bank reserves.

On June 30, 1918, the portion of the gold reserve of the Federal Reserve banking system which supported national bank deposits and Federal Reserve notes was more than three times as large as the gold reserves under the old national banking system on June 30, 1914—$1,786,000,000, compared to $592,000,000. During the same period credit instruments (demand deposits and notes) increased about twofold—from $6,100,000,000 to $11,700,000,000. This increase of credit instruments is typical of the banking situation for the country as a whole, and largely explains the present high level of prices. The increase of gold has been so great, however, that the base has grown faster than the superstructure —which is contrary to the normal tendency.

The ratio of gold to credit has risen from 9.6% to 15.3%. The legal reserve requirements of the present system are such that for 1918 there is an excess of gold above these requirements of more than $700,000,000. The reserve required by law to support the $11,700,000,000 of credit instruments of 1918 is $1,070,000,000. The $700,000,000 of free gold could support an additional superstructure 70% as large as the existing one, which indicates that for the banking of the country as a whole a potential future expansion of 50% is a conservative estimate.

At the present time European goods are not "low priced" (however little the money wages of European labor will buy). Prices in Europe since the war began have risen more than they have in the United States. The price rise has been less the further from the seat of hostilities. It was least in Australia and New Zealand. It was next least in the United States, Canada, and Japan. Then came neutral Europe; then our present Allies; and finally Germany and Russia. Gold tends usually to flow from high-priced countries to low-priced countries, so that until "inflated" European prices fall, gold is not likely to flow thither. Prices are no more likely to fall there than here.

Looking into the still more remote future, there will be in Europe, particularly on the Continent, a vast increase in deposit banking. The need of the governments there for funds during war times hastened the introduction of deposit banking. Money went out of circulation into bank vaults, and there became the basis for circulating credits. This means a new habit which will lead to a great currency expansion. Far-away countries, like India and China, are also learning to use deposit banking. It is as if a new source of gold supply had been discovered. What has been discovered is a new way of using the gold supply. The world, during the course of the war, has thus started, or has hastened, an equivalent of the price revolution of the sixteenth century.

---

*Extracts from a paper read before a conference of state governors and mayors at the White House on Mar. 3, 1919, and abstracted from a pamphlet which is obtainable from the National Prosperity Campaign headquarters at Room 700, Commodore Hotel, New York City.

†Professor of political economy, Yale University.

Business men should face the facts. To talk reverently of 1913-14 prices is to speak a dead language today. The buyers of the country, since the armistice, have made an unexampled attack upon prices through their waiting attitude, and yet price recessions have been insignificant. The reason is that we are on a new high-price level, which will be found a stubborn reality. Business men are going to find out that the clever man is not the man who waits, but the one who finds out the new price facts and acts accordingly.

George Ferdinand Becker

Dr. George Ferdinand Becker, the well-known geologist, died in Washington on Apr. 20, at the age of 72. He was born in New York City and was the son of Alexander Christian Becker, of Denmark, and Sarah Cary Tuckerman Becker, the daughter of the Rev. Joseph Tuckerman, of Boston.

Dr. Becker was the last member of the group of distinguished geologists who in 1879 were associated with Clarence King at the time of the organization of the U. S. Geological Survey. He was a leader in mining geology and geophysics, and for many years had been the chief of the division of chemical and physical research in the Geological Survey, and the investigations under his direction led to the establishment of the geophysical laboratory of the Carnegie Institute, at Washington.

Dr. Becker was a graduate of Harvard, received the degree of doctor of philosophy at Heidelberg, and later was graduated from the Royal School of Mines in Berlin. He was for four years an instructor of mining and metallurgy in the University of California, from which he came to the U. S. Geological Survey. He was one of the pioneers in governmental efforts to guide and encourage the development of the mineral resources of the West. In 1880, when essentially the entire technical staff of the Geological Survey was utilized by the Bureau of the Census in taking the census of mineral production, the statistical work west of the Mississippi River was placed in Dr. Becker's charge. A little later his personal solicitations before committees of Congress were largely responsible for the permanent establishment, under the auspices of the Geological Survey, of the annual statistical canvass of the mineral industry of the country now conducted by the division of mineral resources.

In 1880, also, Dr. Becker began the study of the geology of the famous Comstock silver lode, which, even at that time, had yielded $325,000,000 in bullion and is imperishably associated with some of the most romantic episodes in American mining. The results of this work were published in monographic form in 1882. Becker's atlas of the Comstock Lode was a compilation of all the mine maps that were of interest. It also contained geological maps and sections. For a long time both the monograph and the atlas have been of use to mining engineers on the Comstock as well as serving to set a standard for that period. The summers of 1883 to 1885 were spent in the study of the quicksilver deposits of California, and in connection with these studies Dr. Becker made a visit to the famous old Almaden mine in Spain. He was one of the pioneers in the geological work in the coal and gold fields of southern Alaska, which he visited in 1895.

Copyright, Harris & Ewing, Washington, D. C.
GEORGE FERDINAND BECKER

Dr. Becker's geological observations and studies were not, however, confined to the United States, for in 1896, under the auspices of an English company, he visited the Rand gold fields, South Africa, some of his observations there being later published by the Geological Survey. In 1898 he reported to the Military Governor of the Philippines as geologist and spent 14 months in the islands. Although prevented from accomplishing much in the way of active field work, because of the hostile attitude of the natives, he was able, during that period, to compile a useful review of the geology of the islands as known at that time. In connection with this Philippine service Dr. Becker prepared a special report for President Roosevelt on the desirability of scientific explorations in the Philippine Islands.

Dr. Becker also rendered national service in the Canal Zone as a member of a special committee under the auspices of the National Academy of Sciences, for the purpose of investigating the geologic phases of the engineering problems of the Panama Canal.

Dr. Becker was a member of the National Academy of Sciences, the Washington Academy of Sciences, the American Institute of Mining and Metallurgical Engineers, and the Metropolitan and Chevy Chase clubs. In 1914 he was elected president of the Geological Society of America. He was the author of more than a hundred scientific papers, which cover a wide field in scientific research. Dr. Becker is survived by his widow, Florence Deakins Becker.

Correspondence and Discussion

Improved Conditions in Western Mexico

I have just returned from a trip to the west coast of Mexico, and believe that a letter as to conditions found there might be of interest. The Southern Pacific R.R. is running three through trains a week from Nogales, Sonora, to Acaponeta, Nayarit. The latter is a new state formed from the old territory of Tepic. In general, conditions may be said to be good, especially in Sinaloa. The Yaqui Indians are still giving a considerable amount of trouble in Sonora.

Hardly a week passes but several helpless Mexicans are murdered in outlying villages, so that it is not safe to leave the railroad. Several strong companies are working continuously in this district, but are able to do so only by employing a suitable guard. All trains between Nogales and Esperanza, Sonora, run in daylight only and with a heavy guard.

In Sinaloa a few bandits still operate, but offer no real danger. Conditions are similar to those of pre-revolutionary days; and, on the whole, the people appear more prosperous than they did 10 years ago. All, apparently, have benefited from the sale of the large crops of *garbanzos* (chickpeas), which have been exported to Spain during the last year. The people were never better clothed.

Our party left the railroad at Guamuchil, a small station on the Southern Pacific R.R. opposite Mocorito. We traveled muleback inland for three days, and never once felt in the slightest danger. I do not believe that such a journey would be possible in any other state in the republic at this time. During our trip through this country thousands of heads of cattle were noted—an odd but pleasant experience to one who has but recently traveled extensively through Central Mexico, where the sight of a single animal is a rare occurrence. We were well received at all villages en route, especially by the tradesmen, who now herald the arrival of engineering parties as a return to former peaceful conditions.

The Palmerito mines, in the Mocorito district, are working at full capacity. Shortage of wood has temporarily closed the Potrero mill. Grasshoppers during this last season destroyed the crops and pasturage, forcing all wood contractors to leave the district. The Calabacillas and San José de Gracia properties are being worked on a small scale. The latter has only recently been returned to its owners, who are Mexicans, by the government. Needless to say, the mine was badly "gutted" when returned. I was told that the big La Cruz oreshoot at this property had petered out, breaking up as the ledge passed from the andesite into the underlying sedimentaries, just as did the former bonanza shoot which was worked by the old Anglo-Mexicano Co. from 1894 to 1898.

Extensive development work has been started on a new silver mine near Bacubirito, Sinaloa, called Noche Buena. Rumors were heard that the Texas Scotch Co. was considering starting construction work on the new mill at the Rosario mine, at Guadalupe y Calvo, Chihuahua. Extensive work at such an out-of-the-way place is not possible now, because all supplies must come from Parral, and an attempt to start the project at the present time would probably only end in a repetition of the fiasco of 1911. Several Americans remained at La Cumbre de San Manuel, Chihuahua, during the entire revolution. They are now operating a small mill at this camp. Further south, conditions are said to be good as far as the state line of Nayarit. It is generally conceded that conditions in this state are worse than in any other part of the republic.

Mining operations on the west coast of Mexico are still seriously affected by numerous new labor laws, as a result of constant interference by the many petty officials in office, and especially by the lack of banking facilities. Except for federal business, Sonora uses only United States money. Sinaloa is still endeavoring to use the peso, but there is not enough actual money in the district to carry on business. United States money, other than gold coin, is discounted about 20% in Sinaloa. Sonora took to the dollar like a duck to water, and without bothering to change the price tag. Prices are now in dollars that were formerly expressed in pesos.

Faith in the west coast is evidenced by the large number of Americans entering this section since the close of the Great War. In reality a small boom is taking place. If no setback occurs, the west coast will soon be its old self. Conditions are unquestionably improved and are better than I had any hope of finding.

Denver, Colo., Apr. 13, 1919. BENNETT R. BATES.

Revision of Mining Laws

I note in the *Journal* of Apr. 26 that your Washington correspondent advises that another attempt to revise the mining laws will be made at the forthcoming session of Congress; and, further, he states that: "The real truth of the situation, however, is admitted to be lack of information as to what the mining industry wants. No comprehensive effort ever has been made to gather data on the subject."

Perhaps this is the impression that exists with some of the newer members of Congress, but it is far from being correct. The subject has been under discussion by individuals and associations for many years. Among the leaders of this discussion, H. V. Winchell, president of the American Institute of Mining and Metallurgical Engineers, has taken a most prominent part. In 1913, Mr. Winchell, as chairman of the committee on the revision of the mining laws of the United States, appointed by the Mining and Metallurgical Society of America, corresponded with a large number of American mining men in an attempt to learn their views respecting existing laws. As a result of Mr. Winchell's work, the Mining and Metallurgical Society finally issued a ballot asking for a vote on ten specific questions. The results of this ballot were tabulated in the March, 1914, Bulletin of the society. The summary there given indicates decided views and close agreement on several of the questions that were submitted. Work on this subject was continued by the society, and in 1915 every mining association in the United States was asked to give these questions consideration, and they were also referred to many mining companies.

In December, 1916, a meeting was called in Washington which was attended by representatives from many associations and many mines, and their views were placed before Congressmen and Senators. The proceedings of that meeting were published in Senate Document No. 233, 1st Session, 64th Congress.

Early in 1917 the Senate and House committees on Mines and Mining held numerous sessions at which mining laws were fully discussed by a large number of competent witnesses. These hearings have all been published in the reports of the committees.

It was the opinion of nearly all witnesses examined that the subject was so broad that no revision should be attempted until a competent commission had been appointed and taken evidence in all parts of the country that would be affected by changes in the law. Such a committee should then report its findings to Congress in the form of a bill, to be passed, modified, or rejected as Congress saw fit.

The commission plan was not acted upon favorably, owing largely to the fact that members of Congress felt that the mining men should get together, formulate such laws as they wished to have passed, and then submit them to Congress for adoption or rejection. The expense of the latter method, and the impossibility of securing a thoroughly representative committee that could give sufficient time to the matter, prevented its adoption.

Practically all data that mining men can carry to Washington are already there and on file with the committees on Mines and Mining. The need for revision of the United States mining laws is admitted. What remains to be done is the appointment of some properly constituted body to take further testimony in the various districts affected and then draw up such modification of existing laws as may seem proper. This can be done only through the appointment of such a commission by Congress. F. F. Sharpless.

New York, Apr. 30, 1919.

Employment for Engineers

You have recently made mention editorially of the assistance which the well-established employment agencies can give returning soldiers and sailors in securing work. We should like to take this opportunity of advising all engineers being released from military duty that the services of this agency are entirely open to them, without any registration fee.

For 16 years we have been securing mining and metallurgical engineers for mining companies, as well as civil, electrical, and mechanical engineers for the irrigation, power development, railroad, and construction companies. To maintain this service, it is necessary for us to make our regular charge, even for the soldiers and sailors, upon the securing of a position, but we understand that it is employment that they want, whether they pay for it or not. To men coming out of military service there is no initial registration charge. Business Men's Clearing House.

S. Sergeant Newbury,
President

Denver, Colo., Apr. 14, 1919.

More About Spanish

The other day a credit was cabled from South America through a famous bank which has recently entered the export field. The credit read: "Pay Mark R. Lamb two thousand dollars value canvas mas shipping charges," and the bank cabled to Bolivia to ascertain what kind of shipping charges these were, and it was advised that "mas" meant "moreover" or "besides."

Another credit covered a shipment of rails and read: "Pay Mark R. Lamb three thousand dollars valor rails." Upon presentation of documents for the shipment of steel rails, the bank insisted that the shipment covered "valor" rails instead of steel rails.

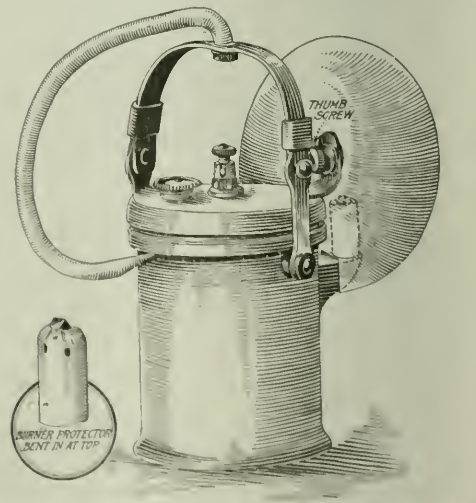
This will prove conclusively to your correspondent, "George Washington," that a knowledge of Spanish is not necessary even in the export game.

New York, Apr. 22, 1919. Mark R. Lamb.

Suggested Improvements for a Miner's Carbide Lamp

An article, "Improving a Miner's Carbide Lamp," appearing in the *Journal* of Feb. 8, 1919, suggests certain changes that may be made in a "Wolf" carbide lamp. The following ideas in this connection may be of interest:

Instead of a leather thong for holding the reflector, why not use a small setscrew, as shown in the illustration? If the metal tip protector is bent in, so that the burner will not pass through, and then firmly pushed down, it prevents a possible loss of the burner tip and also holds it firmly in place. One may secure practically the same effect provided by means of the improved handle by bending the handle furnished with the lamp, and springing it into place with the point under the rim of the carbide container. Such changes, which facilitate the handling of these lamps underground, will be appreciated. Engineer.



SUGGESTED CHANGES THAT MAY BE MADE FOR THE IMPROVEMENT OF CARBIDE LAMPS

Tyrone, N. M., Feb. 11, 1919.

Ore Dressing and Metallurgy

The handling of froth that obstinately refuses to "die" constitutes a problem in many phases of wet-chemical and flotation work. A method of removal of such froth from the overflow of a Dorr thickener which has proved satisfactory, and which yielded a product of higher lead content than the more easily settled concentrate, is described.

Improved methods of manufacture have resulted in the production of a number of handy and comparatively cheap materials for construction work. Expanded metal is one of these. It will find wide application around mills and reduction plants.

Opinions have differed as to the amount of gold that may be volatilized during metallurgical operations, and definite and conclusive data have been lacking. The results of a scientific investigation and the conclusions evolved by an authority on the subject, which are reprinted herewith, will be appreciated.

A new process, which is specially adapted for the treatment of mixed ores containing copper, both in the form of sulphide and as cuprite, and, possibly, in other oxidized minerals, is described. The process is essentially a combination of leaching with a dilute acid solution and flotation, and the two methods of application are described.

Froth Removal From Dorr Thickener

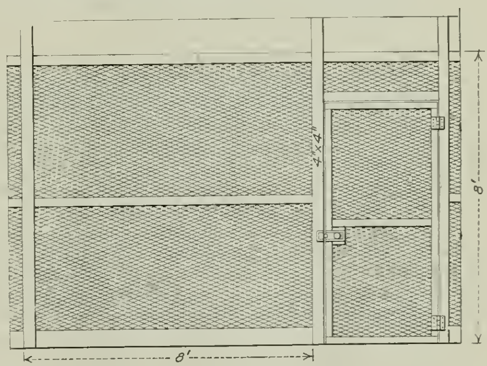
By Claude T. Rice

At the Gold Hunter plant at Mullan, Idaho, great trouble was experienced with the flotation froth in the Dorr thickener feeding the Oliver filter. The froth refused to "die," but would build up on top of the thickener and overflow, no matter how thick it became. Numerous expedients were tried without overcoming the difficulty in a satisfactory manner, until it was decided to scrape the froth off the top of the thickener. The apparatus was erected on top of another Dorr thickener that dewaters pulp for the flotation machines, so that a special arrangement of piping was necessary to carry the shaft down through the bottom without leakage. This was accomplished by bolting a flange to the bottom of the tank and then screwing into it a pipe that rises above the water level. The feed is delivered through a larger casting that extends down to carry the scraper arms discharging the pulp at the bottom of the tank. This casting is carried by spider arms at its top from the shaft itself.

In order to scrape the froth from the top of the tank as fast as it forms, two sweep arms were bolted to the top of the rotating casting. Two 4 in. by 3 ft. drags were attached to the end of these by means of eyebolts, which fasten into rods extending down from the arms. This allows the drags to swing and slide up the two skids that are placed to raise them over the top of the froth-discharge box. The top of the discharge box is an inch higher than the water level of the thickener. In order to drive the froth to the inside of the tank, a baffle board was extended to within three feet of the edge on the discharge side and then jogged three feet to join the discharge box itself. In this way an entrapment bay was formed where the froth accumulates and finally is pushed up over the lid of the discharge box. The refractory froth was much richer in lead than that which settled easily.

Expanded-Metal Partitions

Partitions are often found necessary in a milling, smelting, or hydrometallurgical plant to separate sections of the building for special purposes. In many instances it is found impracticable to arrange for exterior lighting or ventilation, and the use of expanded metal has been found suitable as a wall material.



DETAIL OF EXPANDED-METAL PARTITION

In precious-metal extraction plants provision must often be made against theft, and it is advisable to inclose sections of the building where there are amalgam plates, clean-up pans, mercury traps, or zinc precipitation boxes. In such conditions an arrangement which permits security, ease of inspection, ventilation and lighting will be appreciated.

The accompanying cut shows the details of an expanded metal partition and is taken from a pamphlet recently issued by the Expanded Metal Engineering Co., of 8 West 40th St., New York City.

Volatilization of Gold

The following conclusions have been drawn from a study of the subject of the volatilization of gold by Sir Thomas Kirke Rose, and are found at the conclusion of a paper on the subject which was presented at a meeting of the Institution of Mining and Metallurgy on Mar. 20, 1919:

1. True volatilization of gold is so small as to be

negligible at the temperatures of industrial melting furnaces, say 1000 to 1300°. It is difficult to measure with accuracy the infinitesimal amounts volatilized at these temperatures.

2. It is probable that the nature of the atmosphere, provided that it is maintained unchanged, has no effect on volatilization. Even in a strong draught, the amount volatilized remains exceedingly small.

3. Certain gold alloys when molten take up oxygen from atmospheres containing it, and will afterward spirt or effervesce in a reducing atmosphere until the oxygen has been removed. Similarly, hydrogen, and in a less degree carbon monoxide, are occluded by such molten alloys, and the metal then spirts in an oxidizing atmosphere. In spirting, showers of globules of the alloys of all sizes are thrown up, and the smaller ones, especially those of less than 0.001 mm. diameter, are carried away by any draught, however slight, and are difficult to recover. They can be collected by such a filter as cotton wool.

4. The action is observable in all the alloys of gold with silver or copper. Even parted gold containing 1 part per 1000 of silver is affected, though to a far less degree than coinage alloys, gold-silver parting alloys, and similar materials. Fine silver and its alloys with copper also spirt freely.

5. It is this action which causes the unrecovered losses in melting such alloys in crucibles without a cover of slag.

Flotation of Mixed Copper Ores

United States patent No. 1,288,121, granted Dec. 17, 1918, relates especially to the extraction of copper from mixed ores containing copper both as sulphide and as cuprite, with or without native copper and with or without the presence of copper in the form of other oxidized minerals, such as carbonates or silicates.

It has been proposed to recover the copper from such ores by subjecting the pulp to the action of dilute sulphuric acid, to dissolve oxidized copper, precipitating the copper, in metallic form, by a reducing agent, and then recovering the precipitated copper by flotation, together with undissolved copper sulphide. Harry W. Morse, the inventor of the process, which has been assigned to the Chino Copper Co., has discovered that when cuprite is present in the ore, a portion of the copper contained therein separates as metallic copper and may be recovered in the flotating operation, together with the precipitated copper and the copper sulphide.

The finely divided ore is treated with sulphuric acid in dilute water solution. This dissolves the carbonates, silicates, and similar soluble copper minerals. At the same time any cuprite which is present in the ore is decomposed according to the following reaction:

$$Cu_2O + H_2SO_4 = CuSO_4 + Cu + H_2O$$

One-half of the copper in the cuprite goes into solution as copper sulphate and one-half separates as metallic copper, remaining in the pulp. After treatment with the dilute sulphuric acid, the entire pulp is subjected to agitation in the presence of metallic iron, and copper is precipitated from solution as cement copper in the pulp. Fig. 1 is a flow sheet for the first method, hereinafter described, and Fig. 2 is a flow sheet for the second method.

First Method: Sulphides and metallic copper may be recovered by frothing flotation during the reaction with sulphuric acid of the oxidized minerals of the ore. To effect this, a flotation oil or flotation agents are added to the ore pulp, either before or after the addition of acid, or simultaneously with such addition, and the reaction with the oxidized minerals is produced in cells similar to those used in flotation operation, the cells serving as agitators to promote solution of material such as carbonates and silicates, and reaction with the cuprite as described above. These cells also permit simultaneous leaching with acid and flotation of sulphide minerals, together with any metallic copper which may have been present in the ore or produced from cuprite.

After leaving the first set of flotation cells, in which simultaneous leaching and flotation are being carried out, the entire pulp is passed through an agitating machine or precipitator, in which it is brought into contact with metallic iron in the form of shot or scrap or otherwise finely divided. In this step the copper in solution is precipitated as metallic (cement) copper. The entire pulp passing from the precipitator is then again subjected to flotation in a second flotation cell or set of cells in which cement copper which has been produced by the action of the iron, any remaining metallic copper from the ore or resulting from the decomposition of the cuprite by acid, as shown by the above reaction, and any remaining sulphide minerals, are recovered by frothing flotation.

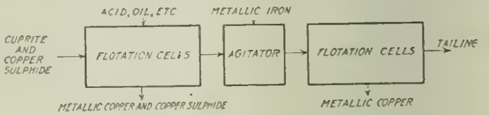


FIG. 1

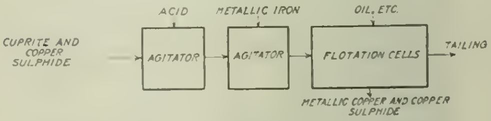


FIG. 2

FLOW SHEETS OF COPPER-ORE TREATMENT

Second Method: Leaching as described may be carried out in any convenient agitating device, such as a mechanical or air agitator or in cells similar to those used in flotation operation, without, however, removing any mineral concentrate at this stage of the process. The pulp is then passed over scrap iron or shot iron in a machine adapted to agitate the mixture and precipitate copper from solution as finely divided (cement) copper. The entire pulp, containing sulphides and metallic copper, is then subjected to flotation, using, for example, any suitable flotation agent, such as oil, and any suitable flotation machine. The natural sulphides are recovered in this way, together with any metallic copper which may have been present in the ore and any metallic copper which has been produced by decomposition of the cuprite or precipitation from solution on metallic iron.

The advantage of this process in the case of ores containing cuprite lies in the economy of acid used for leaching and in the economy of iron used for precipitation. On a pure cuprite ore, only half the copper is dissolved as copper sulphate and precipitated by iron. The other half of the copper is produced in metallic form during the leaching operation and is recovered during flotation without additional expense for flotation agents, power for operating machinery, or labor for repairs or attendance.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Department of Public Works Proposed

Without a dissenting vote the representatives of 74 engineering societies have endorsed the proposed establishment of a Department of Public Works in the Federal Government. It is the intention to include in this proposed department the two bureaus in which the mining industry is most interested—the Geological Survey and the Bureau of Mines. The conference at which this action was taken was held in Chicago on Apr. 23, 24, and 25, and was attended by the correspondent of the *Journal.*

The conference unanimously voted to attempt the grouping of all the engineering bureaus under one of the existing Cabinet officers, rather than to add a secretary to the President's Cabinet. Although no department was specified formally, it was the general understanding among the delegates that it is the Interior Department which is to be remodeled. The non-engineering bureaus already in that department will be detached. The Interior Department is composed, as it is, largely of engineering bureaus, employing more engineers than any other organization in the world. The idea is to group with them bureaus from other departments whose activities are chiefly of an engineering nature.

The meeting was called by the Engineering Council. J. Parke Channing, its chairman, in opening the conference, said in part:

> "Our Government has become the greatest industrial plant in all history—investigating, surveying, building, and operating. Its various functions are being conducted with practical independence, one with another, and with so little coördination and with so complete a lack of common purpose that practically the only occasions when the various elements become conscious of each other is when they overlap.
>
> "There are 12 Federal organizations engaged in making surveys. More than a score are conducting chemical investigations. In the *Congressional Directory*, 29 bureaus and agencies of Government engaged in construction of one or another kind are listed. Four Government departments are engaged in fuel tests."

Philip N. Moore, former president of the American Institute of Mining Engineers, in the course of his remarks at the conference, said:

> "For a generation, the dream of the civilian engineers of this country has been that one great department of our executive government, under the trained control of an experienced engineer, might have charge of all the non-military engineering tasks of the nation.
>
> "Owing to increased specializing, the engineer has multiplied societies and has not built up any organization with sufficient political potence to achieve in legislation the ideals of the profession.
>
> "Of the merits of some plan that shall coördinate, under one head, the vast engineering activities of the United States Government, which now function through a dozen or more bureaus, directed by six secretaries, there probably will be, in this meeting, few opponents. That opponents will be found elsewhere, fortified in power, we who favor the idea will soon realize.
>
> "Reconstruction is a common thought and word. Engineers have borne a great and honorable part in the war. Never before have their services been recognized so publicly and generally. Never before has there been so keen a realization of the complexity and lack of system in the engineering bureaus of the Government. Bureaus which in the past have competed with one another, and aimed at new activities and accompanying appropriations, now approve a more logical system."

As a result of the conference, active steps are to begin at once looking to the consummation of the proposals endorsed at the meeting.

War-Minerals Relief

On May 1, the war-minerals claims on the docket of the Relief Commission totaled over $4,000,000. Claims known to be pending on that date run the total of the relief asked to close to $6,000,000. The claims now on the docket are divided as follows:

Alabama—Pyrites, 1 claim, $200,000.

Arizona—Manganese, 5 claims, $45,000; and tungsten, 2 claims, $12,000.

Arkansas—Manganese, 20 claims, $350,000.

California—Chrome, 60 claims, $300,000; pyrites, 1 claim, $7000; manganese, 23 claims, $175,000; tungsten, 6 claims, $360,000.

Colorado—Manganese, 3 claims, $4000; tungsten, 5 claims, $15,000; and pyrites, 2 claims, $10,000.

Delaware—Chrome, 1 claim, $20,000.

Georgia—Manganese, 6 claims, $20,000; pyrites, 6 claims, $1,450,000.

Idaho—Manganese, 1 claim, $20,000; pyrites, 1 claim, $5000.

Maryland—Chrome, 1 claim, $55,000.

Minnesota—Manganese, 2 claims, $275,000.

Missouri—Pyrites, 1 claim, $5000.

Montana—Chrome, 2 claims, $20,000; manganese, 5 claims, $10,000.

Nevada—Manganese, 5 claims, $3000; tungsten, 5 claims, $95,000.

New Mexico—Manganese, 2 claims, $65,000.

New York—Pyrites, 1 claim, $500.

North Carolina—Manganese, 1 claim, $300.

Ohio—Pyrites, 1 claim, $200,000.

Oregon—Chrome, 30 claims, $40,000; manganese, 5 claims, $20,000.

Pennsylvania—Chrome, 1 claim, $30,000; manganese, 1 claim, $500.

Tennessee—Manganese, 6 claims, $30,000.

South Carolina—Manganese, 2 claims, $115,000.

Utah—Manganese, 5 claims, $20,000; pyrites, 1 claim, $2500; tungsten, 1 claim, $7000.

Virginia—Manganese, 2 claims, $40,000; pyrites, 1 claim, $3000.

Washington—Chrome, 2 claims, $20,000; manganese, 1 claim, $10,000.

The figures given are in round numbers. The engineers of the commission, under the direction of J. E. Spurr, are now engaged in examinations in connection with the Arkansas claims. The accounts of the claimants are being checked by a force of accountants under the direction of C. B. Holmes.

The second hearing in the claim of the Chestatee Pyrites and Chemical Co. has been postponed until May 16.

Sale of Picric-Acid Plant

Bids on the U. S. Government picric-acid plant at Brunswick, Ga., will be opened on May 20. The plant consists of a 2000-acre tract on which are all the necessary buildings for its operation, including a power plant and dwellings for officers and workmen, some partly completed. Bids for the plant must necessarily be for the entire Government property, including land, buildings, materials, and equipment. The bids will be opened on May 20 at the Cincinnati District Salvage Board.

The plant is at the present time open for inspection, and prospective bidders will be given all the facilities for inspecting the property for sale by applying to the Cincinnati Salvage Board at Cincinnati, Ohio.

New General Import License

The War Trade Board announces that a new general import license, to be known as General Import License PBF No. 37, has been issued covering the importation into the United States from all countries of the world except Germany (including the Rhine Provinces), Luxemburg, Hungary, and those parts of Russia under Bolshevik control, of all commodities with the exception of a number, including the following, the importation of which continues to be controlled by reason of existing agreements:

> Pig tin, tin ore, tin concentrates and all metal alloys containing tin, including tin drosses, tin oxides, solder drosses, type metals, anti-friction metals, waste metals, and other miscellaneous metals containing tin.
>
> Nitrate of soda and nitrate of potash.
>
> Emery and emery ore, except that mined in Canada.

Withdrawal of "Black Lists"

Acting concurrently with the competent authorities of the associated governments, the War Trade Board announces that, on Apr. 29, 1919, all enemy trading lists heretofore issued or compiled by the War Trade Board will be withdrawn. On and after Apr. 29, 1919, all disabilities heretofore attached to trade and communication with persons included in such lists shall cease to operate, and all persons in the United States will be authorized, subject to the other rules and regulations of the War Trade Board and except as hereinafter provided, to trade and communicate with all persons outside of the United States with whom trade and communication is prohibited by the Trading With the Enemy Act.

This action does not modify or affect in any respect the present restrictions against trade and communication between the United States and Germany or Hungary, nor does it authorize trade with respect to any property which heretofore, pursuant to the provisions of the Trading With the Enemy Act as amended, has been reported to the Alien Property Custodian, or should have been so reported to him, or any property which heretofore, pursuant to the provisions of said act, the Alien Property Custodian has seized or has required to be conveyed, transferred, assigned, delivered, or paid over to him.

Engineering and Education

Encouraged by the nation-wide interest in the movement to incorporate in all engineering courses a greater amount of business training, the Bureau of Education has called a general conference on the subject to be held in Washington, June 23 and 24. It is expected that representatives of all technical schools in the country providing such courses will attend, as well as large numbers of other persons who are interested in the subject. The sessions will consider the questions of: (1) Business training for the engineer; (2) engineering training for commercial enterprises; (3) significance of the war experience for engineering education; (4) training of the engineer for overseas engineering projects.

Curricula suggestions will be submitted to the conference as follows:

> *First*, That a minimum number of hours in business training, to be determined by the committee, be required in all engineering courses. In respect to this suggestion it was recommended, at the Washington Committee Conference, that from 12 to 18 semester hours be required in all engineering courses on the following subjects: General economics, cost accounting, business organization, and business law.
>
> *Second*, That a curriculum providing for a minimum of 15 to 30 units in business economics be incorporated in all engineering courses and offered on an elective basis. In respect to this suggestion the Washington Committee Conference recommended that electives be encouraged in connection with all engineering courses in the following subjects: Labor and employment problems, statistics, corporation management and finance, political science, marketing, including advertising and salesmanship; psychology, scientific management, and transportation. It was further recommended that economic phases of engineering subjects be emphasized wherever possible in engineering instruction.
>
> *Third*, That a curriculum in commercial or industrial engineering, permitting full and proper emphasis upon engineering subjects, be offered in the School of Commerce, with degree to be given in that school.
>
> *Fourth*, That a five-year combined engineering and commercial course be prepared.

It was recommended at the Washington Committee Conference that no action be taken at this time on the latter two suggestions.

**A Rolling Fancy Gathers No Victory Notes
Buy Yours Today.**

The Mining and Metallurgical Society Of America

At the meeting of the New York Section of the Mining and Metallurgical Society of America held on Apr. 30, three interesting papers were presented. Dr. Thomas Darlington spoke upon the subject of fatigue, and, after indicating the physiological cause for fatigue, showed the practical side of the subject in relation to industry. Cleanliness, well-selected food, proper living conditions, and knowledge of how to live are the important factors that enable a worker to accomplish his stint easily and cheerfully. Efficiency of the worker is just as much a matter of proper health as of good superintendence. Tactful direction and suggestion having for their object the betterment of the worker's living conditions are as necessary in the successful handling of labor as is intelligent supervision.

J. M. Larkin, of the Bethlehem Steel Co., discussed the plans of his company for the prevention of labor disputes and for the securing of a better understanding between the workers and the managerial force. The system used is similar to the Rockefeller plan first initiated by the Colorado Fuel and Iron Co. Under the system representatives elected by the workers confer with the shop managers on all questions which arise between the company and the workmen.

P. G. Beckett, of the Phelps Dodge Corporation, was the next speaker, and briefly described the system instituted by his company at its Arizona properties. A. H. Rogers, H. H. Knox, W. R. Ingalls, and Dr. Darlington took part in the discussion. The meeting was presided over by Benjamin F. Tillson, in the absence of George C. Stone.

Chronology of Mining for April

Apr. 1—Agreement between Government and copper producers became effective, calling for purchase by producers of 5,000,000 lb. copper per month for 10 months and 10,000,000 lb. per month for the next five months. Report received of strike of smelter men in some zinc plants in Oklahoma, owing to wage reduction.

Apr. 2—Meeting of representatives of potash companies to form the National Potash Association, in Denver.

Apr. 3—Committee of zinc producers met Director of Sales in the War Department to consider liquidation of stock of spelter held by the Government.

Apr. 4—Announcement made of reduction of $1 a day in wages of metal miners, effective May 1, by Iron Silver Mining Co., operating in Leadville district, and at Yak mines of American Smelting and Refining Co., affecting about 1000 men.

Apr. 6—First meeting of board consisting of the Governor of Idaho, the Inspector of Mines, and others interested, to effect organization of new State Bureau of Mines and Geology.

Apr. 7—Sales of German-owned stock of Compañia de Minerales y Metales, S. A., and American Metal Co. by Alien Property Custodian.

Apr. 12—War Department issued statement regarding disposal of its surplus stocks of lead.—Opening of navigation for iron-ore shipments on the Lakes, being the earliest date in 41 years.

Apr. 15—Initial hearing before War-Minerals Relief Commission.

Apr. 18—U. S. Shipping Board approved rates of shipment for ore, grain, and coal on the Great Lakes for the coming season.

Apr. 19—Announcement of important strike in C. and C. shaft of Consolidated Virginia on the Comstock Lode.

Apr. 20—Miners at many large properties in Leadville district walked out, some of the operators previously having pulled the pumps.

Apr. 21—Fire destroyed buildings at Sunnyside mine, at Eureka, Colo., causing damage of $225,000.—Reports received of filing of complaint by 11 large mining companies against high freight rates put into effect by the Railroad Administration.

Apr. 22—Miners' committee and Leadville operators agree on a minimum wage of $4 per day.

Apr. 23—Anaconda Copper Mining Co. reported to be operating 11 properties out of 31 either owned or controlled by the company, production being about 55% of normal.

Apr. 24—Cave-in occurred at Granby Mine, at Phoenix, B. C.

Apr. 29—Explosion in Majestic Coal Mining Co.'s mine, 22 miles from Birmingham, Ala., killed 17 miners, injuring seven others.

Licensing of Engineers

Denver Correspondence

Licensing of engineers in the State of Colorado has been provided for by the passage of Senate Bill No. 339, which creates a State Board of Engineer Examiners. The passage of this bill was a complete surprise to fully 90% of the engineers of the state. The supporters of the measure claim that they made every effort to advise the engineering profession of the state, and gain their support. On the other hand, many engineers never heard of the bill until notice of its passage appeared in the newspapers, and some express the belief that the supporters of the measure deliberately refrained from publicity so as to avoid adverse influence.

Conservative engineers are generally of the opinion that such a law can serve no good purpose and is likely to be harmful to developments in the state. It is pointed out that many engineers from other states come to Colorado temporarily to render professional service, and that such a law as the one recently enacted will cause such visiting engineers exasperating inconvenience and delay on account of the usual red tape in connection with such a measure. This is particularly true in the case of mining and metallurgical engineers. It appears that every engineer who desires to carry on professional practice in the state must secure a license within 90 days from the passage of the law.

To secure this license he must apply for either an engineer's or a surveyor's license, appear before an examining board, and pass an examination. A surveyor's examination is a simple matter, but how such a board can properly examine a great variety of specialists to determine whether they are competent to serve their clients' interests is not explained in the bill.

The examining board is to consist of five members, including the State Engineer, who becomes a member ex officio. The four members to be appointed by the Governor are to serve without pay. Presumably, these members of the examining board should represent as many engineering professions as possible, and be competent, broad-minded men, with considerable judgment and discretion.

However, it is a well-known practice in making political appointments to make the selections so that the appointees will be geographically distributed, without regard to technical qualifications. Various engineering and technical societies representing different engineering professions in Colorado have held meetings for the purpose of selecting men who would be desirable as members of the Board of Engineer Examiners as provided in the law. These proposals will be placed before the Governor with a view to assisting him in making a choice of suitable examiners, in case he desires to avail himself of such suggestions.

Engineers in Colorado whose abilities are beyond question are inclined to regard the bill as an example of freak legislation that is more likely to be a nuisance than a benefit. Others are disposed to view the matter with some alarm, as suggestive of some subtle movement toward unionism of professional men. The supporters of the bill claim that its object is to eliminate impostors.

French Imports of Metals and Ores

The following figures of imports of metals and ores during the last three years are given in *L'Echo des Mines et de la Metallurgie* of Mar. 23, 1919:

	1916 Metric Tons	1917 Metric Tons	1918 Metric Tons
Metals:			
Crude copper	153,091	188,886	152,645
Copper bars	6.554	28,992	7,541
Copper sheets	13.364	31,260	6,595
Lead, argentiferous	9,195	3,676	7,382
Lead, ordinary	54,544	54,170	44,059
Tin	10,226	12,641	10,127
Spelter	63,206	72,909	45,587
Nickel	1,760	1,871	823
Aluminum	739	1,350	7.219
Mercury	568	490	852
Ores:			
Copper	1,591	4,030	427
Lead	40,750	36,027	24,128
Tin	445	333	50
Zinc	56.727	36,430	61,356
Nickel	8,915	5,152	3,289
Antimony	10,697	13,665	2,015
Manganese	58,658	77,356	59,296
Pyrites	79.234	49,162	32,101

During the last two years the copper imported into France came principally from the United States, only about 20,000 tons being received from England, Japan and other countries.

Of the pig lead, Spain supplied 53,000, 41,000, and 37,000 tons in 1916, 1917, and 1918, respectively.

Practically all of the tin came from England and the Dutch East Indies. The big increase in aluminum imports in 1918, which metal came mainly from Norway and the United States, was due in the main to aviation requirements.

Walter Douglas on the Copper Situation

ARIZONA CORRESPONDENCE

After a short visit to California, Walter Douglas, president of the Phelps Dodge Corporation, has been making a close inspection of the company's properties in the Southwest, including the Moctezuma, near Nacozari, Sonora. He has been quoted as expressing belief that a brisk demand for copper will spring up by the end of the year. In the meantime, the strictest economy must be maintained around the mines, as some companies are losing money on every pound of copper produced, having to borrow to meet their current expenses. Mr. Douglas made reference to the reserves of his own company as comprising large sums in Liberty bonds, which should not be disposed of now, and which ultimately will be worth more than was paid for them. He said that the main object of the company now is "to make the depression as little felt as possible in the camps which are dependent wholly upon company operation for their living, and also to provide work for our old employees who are coming home from the war."

The return of many employees who went to the war has created a serious employment problem of late for the Copper Queen and Calumet & Arizona companies, in consideration of their desire to cut work and production down to the lowest logical limit. Employees have been placed in five classes, to which assignments are made with the assistance of an elected employees' welfare committee of nine. First considered are old employees, with dependents. Soldiers, sailors and marines are next. Class 3 generally embraces men without dependents who have been over two years with either of the companies, as well as older employees who are not citizens. Class 4 mainly covers men of 18-months' employment, with dependents, and the last class the newer employees without dependents.

Warns of Oil-Stock Fakes

Assistant District Attorney Theodore L. Waugh, of New York County, who has been investigating sales of oil stock on the curb, has issued a warning against buying stock from curb brokers not members of the Curb Market Association and further advised that no stock should be bought unless it was on the approved curb list. Anyone buying stock should compel the broker who sells the same to sign his name to the circular setting forth his claims to the stock, by which means the District Attorney's office will have a basis for criminal action if the stock proves to be that of a fake concern. The District Attorney is being assisted by Fred B. Sturges, secretary of the Curb Market Association.

Vocational Education and the Disabled Soldier

There are 14 district offices of the Federal Board for Vocational Education, established in as many different cities of the country, to facilitate contact with disabled soldiers, sailors, and marines; and to date the average number of cases handled by each office is 1972. Of the large number of applications made to the Federal Board for training, only 65 have been definitely disapproved, whereas 3841 have been recommended for training by the district boards, and of this number 2704 have been approved by the Federal Board.

These district offices are organized to facilitate getting in touch with disabled men; and it is not even necessary for a disabled man to call in person at the branch office. If he is at a distance and will notify the office of his district that he is disabled and prevented, either by lack of funds or otherwise, from coming in person, the board will send a vocational adviser to see him and make the preliminary investigation at his home, and, if it is necessary for him to appear before the local "Case Board," his expenses are of course defrayed.

Following are the branch offices of the Federal Board: Room 433 Tremont Bldg., Boston, Mass.; Room 711, 280 Broadway, New York; 1000 Penn Square Bldg., Philadelphia, Penn.; 606 F St., N. W., Washington, D. C.; 823 Forsyth Bldg., Atlanta, Ga.; 822 Maison Blanche Annex, New Orleans, La.; 1212-14 Mercantile Library Bldg., St. Louis, Mo.; Room 742 Metropolitan Bank Bldg., Minneapolis, Minn.; 909 Seventeenth St., Denver, Colo.; 997 Monadnock Bldg., San Francisco, Calif; Room 539 Central Bldg., Seattle, Wash.; and 810 Western Indemnity Bldg., Dallas, Texas.

The International Labor Commission And the Peace Treaty*

The nine clauses proposed by the commission on international labor legislation for insertion in the peace treaty as adopted by the Peace Conference in plenary session at Paris were made public at Washington on Apr. 29 by the State Department.

Among the principles incorporated are a standard eight-hour day, a weekly day of rest, the abolition of child labor, equality of pay for men and women, and workmen's "right of association for all lawful purposes."

The text of the clauses, as adopted, follows:

"The high contracting parties, recognizing that the well-being, physical, moral and intellectual, of industrial wage earners is of supreme international importance, have framed a permanent machinery associated with that of the League of Nations to further this great end. They recognize that difference of climate, habits and customs, of economic opportunity and industrial tradition make strict uniformity in the conditions of labor difficult of immediate attainment. But, holding as they do, that labor 'remedies' (probably error in transmission) be regarded merely as an article of commerce, they think that there are methods and principles for the 'ratification' (probably error in transmission) of labor conditions, which all industrial communities should endeavor to apply so far as their special circumstances will permit.

"Among these methods and principles, the following seem to the high contracting parties to be of special and urgent importance:

"First—The guiding principle above enunciated that labor should not be regarded merely as a commodity or article of commerce.

"Second—The right of association for all lawful purposes by the employed as well as by the employers.

"Third—The payment to the employed of a wage adequate to maintain a reasonable standard of life as this is understood in their time and country.

"Fourth—The adoption of an eight-hour day or a 48-hour week as the standard to be aimed at where it has not already been obtained.

"Fifth—The adoption of a weekly rest of at least 24 hours, which should include Sunday whenever practicable.

"Sixth—The abolition of child labor and the imposition of such limitations on the labor of young persons as shall permit the continuation of their education and assure their proper physical development.

"Seventh—The principle that men and women should receive equal remuneration for work of equal value.

"Eighth—The standard set by law in each country with respect to the condition of labor should have due regard to the equitable economic treatment of all workers lawfully resident therein.

"Ninth—Each state should make provision for a system of inspection, in which women should take part, in order to insure the enforcement of the laws and regulations for the protection of the employed.

"Without claiming that these methods and principles are either complete or final, the high contracting parties are of opinion that they are well fitted to guide the policy of the League of Nations, and that if adopted by the industrial communities which are members of the league, and safeguarded in practice by an adequate system of such inspection, they will confer lasting benefits upon the wage earners of the world."

Mining in Australia

MELBOURNE CORRESPONDENCE

Wallaroo & Moonta Mining and Smelting Co., Ltd., had an output for the year 1918 which amounted to 9290 tons refined copper, including 1454 tons electrolytic and 2266 tons of Mount Cuthbert Co. blister. The cost per ton of copper, f.o.b. ocean steamer, was £92 15s. 11d. Speaking at the annual meeting of shareholders in Adelaide on Mar. 26, the chairman of directors, Sir Lancelot Stirling, after referring to the slump in the price of copper, said the position of the company was a difficult one. If shipping were available to enable the company to realize on its product it would receive, if the market remained steady, about £70 per ton f.o.b. at Sydney, though the cost of production to the same point was about £90 per ton.

It was evident that no matter how important the company, as a big employer of labor, regarded its obligations to the nation to retain the men in full work, it could not for long carry such a financial burden. The position was further complicated by the fact that the lack of shipping prevented the company from realizing on its product, and it therefore became a question of finding the money with which to pay the men. The British government again coming to the assistance of the industry by providing some means whereby copper can be shipped, and the costs and the market price brought closer together, would alone prevent the cessation of operations. Continuing, the chairman said that if anything did mature it could not mean profit to the company, but by preventing heavy losses it would enable it, at any rate, to keep part of the men at work. Shareholders should also realize the fact that apart from the liability still to be met under the war-time profits tax, the cost of keeping the mines in order for future work would not be less than £72,000 per year. The attitude of a section of the company's employees had been disappointing. The company had treated the men with full consideration in regard to their earnings, and they had participated largely in the result of the high copper market. The directors were disappointed now that some were not satisfied to accept the lower rates in the sliding scale when the value of copper dropped. The company was now concerned in an appeal by some of the men to the arbitration court, and it was possible that the long-established system of wages and bonus allowance might have to be abolished.

If you have not bought a Victory Note, do it today!

---

*From the New York *Tribune*, Apr. 30, 1919.

Editorials

Prosperity—Let's Go

IN A MEMORABLE speech made recently at St. Louis before the Seventh Annual Convention of the United States Chamber of Commerce, Secretary Glass of the Treasury Department stated:

"The American people should supplement the patriotism of war by the patriotism of peace, and just as the American soldiers on the field battled to notable conquest for liberty, so American business men, in different ways and through different instrumentalities, should now give expression to their patriotism by promptly and cheerfully meeting the obligations of citizenship. The foremost obligation of which I can think is the duty of every American citizen, whether of humble or high station, to guard jealously the honor of the nation; to regard its commitments as his own, and willingly contribute his labor and his substance for complete payment of our debt in the spirit of the National Prosperity Campaign, whose efforts for the stimulation of business and confidence have been spread broadcast throughout the country over the slogan of LET'S GO.

"We should start right away; we should break in upon this unnatural, abnormal suspension of commercial activities; for there is a world to be rebuilt, and why should we stand timidly by and question as to our opportunity?

"The spirit of confidence which made all the previous Liberty Loans successful assures the success of this present Victory Loan; that spirit which has brought our nation through the recent struggle has at the same time made the United States supreme in a financial sense.

"Has not a record of that sort any lesson for us? Should it not give us heart and spirit to go forward upon a field of prosperity such as never passed before the vision of any business community on this earth in all of its history?

"I say, should not this record banish fear and stir the spirit of business adventure and carry us confidently and swiftly along toward the goal of national supremacy in the wider field of commercial activity?

"LET'S GO."

Maintenance and Repair

THE mining companies are doing their full share to minimize the seriousness of the problem of unemployment by keeping their men employed to as great extent as is possible. In spite of a pronounced curtailment of production, many men are being kept at work, development operations are being pushed, and ore reserves being built up. Keeping men at work and extending development are sound policies. Making repairs to surface and underground plants and keeping mechanical equipment in good condition are other timely and effective means of reinstituting conditions that will in the near future be of marked advantage to the mining industry. Before the war, maintenance and repair were essential parts of the operating program, and good management dictated the upkeep of all mechanical appurtenances. During the rush for production caused by war needs, both maintenance and repair were relegated to the background, to await a time when mechanics and repair men would be available.

Now is the time to catch up. Every piece of machinery should be overhauled and put into the best mechanical condition. Section by section, ore-dressing plants should be completely overhauled. At the smelteries, furnaces should be overhauled and worn-out equipment replaced. There is much that can be done to restore plant equipment to pre-war efficiency.

Col. Arthur Woods, special assistant to the Secretary of War in the work of obtaining positions for discharged service men, predicts a labor shortage before the end of this year. If this be, indeed, the prospective conditions, there is all the more reason for taking advantage of the present opportunity. The same policy of the resumption of maintenance and repair work in all lines of industry, as well as in mining, will go far toward enlivening the demand for materials, machinery, and supplies. The renewal of industrial activity on a one-hundred per cent. basis is confidently to be looked for in the near future. Being ready for that resumption will bring a decided advantage to those who are far-sighted enough to prepare for it now.

Mexico

DURING the month of April the news from Mexico, though more or less conflicting, gave the impression that the government was making some progress in restoring order in at least some parts of that country.

If it is correct, as reported from Mexico City on Apr. 11, that Emiliano Zapata has been killed, there has been removed from the side of the Mexican government a thorn that for years has been the cause of constant irritation. Zapata was a man possessing the gift of leadership, and, an Indian himself, may have been entirely sincere in his early efforts to return the large estates of the south to the Indians. This, however, resulted only in laying waste a large area of prosperous country and placing those whom he pretended to help in a worse plight than they had ever been before. The old town of Cuernavaca, the delight of those who have a love for Mexico and things Mexican, is said to be in ruins. Nowhere in all the south could be found such a church; richly colored with the paint of time and its walls covered with a wild profusion of lavender-tinted creepers. Its paintings are destroyed, as are also the historic and picturesque gardens which drew many travelers to this quaint old town.

Throughout the country peace and order have been replaced by a feeling of unrest. This is contagious, and, without knowing just why, the traveler feels it too. In the old days he would invariably lean back in the seat of his Pullman and go to sleep between stations, merely waking up when the train stopped to watch the whole of Don Pancho's family who had come down from the ranch in coach and on muleback, with their hundred and one packages and contingent of family servants. Today the traveler is awake and experiences a feeling of relief every time a bridge is passed, or a railway cut, still marked with the remains of a train that was wrecked or burned, is left behind. No family parties are going to the city, and the laughing, happy, noisy throng that filled and overran the second-class coaches is replaced by a few warm and tired and hungry-looking peones, who, there is reason to fear, may not be on entirely peaceful missions.

One may hear of no disorder or he may hear only a rumor of disorders in some remote district, but a different atmosphere prevails, and old Mexico has not come back, even where perfect order prevails. The traveler on muleback reaches the old stopping-place at sundown, but it is not familiar. The old church which he recalls as a sentinel, waking only once a year when the padre came around to baptize the last crop of children and celebrate the year's marriages, is still there, but somehow it looks like a ghost. The feeling that it will never wake again persists. The sun goes down, and the traveler turns in, not with the sole thought of getting a good night's rest, but wondering, as they say in Spanish, "if he will wake up dead."

It is, indeed, a most encouraging prospect if the main cause of disorder in Morelos has been removed. Would we could say the same of Chihuahua, where Villa and his lieutenants still continue to take under their protection foreign citizens, whom they look after carefully until substantial bills for board and lodging have been rendered and paid. This is such a profitable business that it may have been a reason for the formation in Texas of a band of Villa recruits, who, however, got no further than the border and are now in a position where about twenty of them may have to pay Uncle Sam a considerable bill before they are permitted to pass from his care.

Possibly there are no greater number of hold-ups daily in Mexico than in New York City, but the fact that foreigners are so frequently the objects of violence creates the impression of general disorder. One of the latest atrocities noted was the murder of Edward L. Dufourcq, a well-known and highly esteemed mining engineer of New York. Though the details of this outrage have not reached us, and although the murder cannot be attributed to the Carranza government, that government is directly responsible for the fact that Dufourcq's murderers were allowed to operate and escape and to continue as a menace in the State of Pueblo.

Can it be that the present Mexican government does not appreciate the harm that is done to the whole country by permitting such a state of affairs, or is the government simply incapable of putting a stop to the constantly recurring atrocities? We imagine that the experience of the Minister of Finance on his recent visit to this country in search of financial support may have thrown some light on the situation, as did also the reported refusal of the peace delegates to receive a diplomatic representative from Mexico. Both instances must have been forceful reminders to that country that considerable housecleaning must be done before extended outside assistance can be regarded as feasible. If it is true that Limantour has been asked to return to Mexico City, this may be taken as tangible evidence that the Carranza government realizes its difficulties and is going to a logical and proper source for advice and assistance.

Along the Texas-Mexico border visitors from the south have recently been less fortunate in their raids, and United States troops that have crossed in pursuit have been fairly successful in their objectives, so successful that a number of Villa adherents and former Carranza soldiers have crossed the Rio Grande for the last time. That a better feeling on either side of the Rio Grande now exists is evidenced by the recent meeting of Mexican and Texas governors at Nuevo Laredo on Apr. 7 for the purpose of exchanging expressions of good will. This may mean no practical improvement in the interior of the country, but it helps a little toward a better understanding.

The American Smelting and Refining Co. and the United States Smelting, Refining and Mining Co. both report increasing business. The report of the Mexican national receipts for 1918, now available, shows a respectable total from duties and taxes, with a prospect of a further increase from these sources during the present year. It is pointed out that this increase of receipts may foreshadow some returns to those who hold the bonds of the Mexican railways, but this appears extremely doubtful, in view of the vast amount of repair work required upon the roads and the expense of keeping them open if they are to be operated at all.

The Mexican Congress has just convened, and it is the sincere hope of Americans who have interests in Mexico that energetic steps will be taken to restore order in the troublesome mining districts and insure equitable treatment of foreign mining and business interests. When the Congress of the United States meets, various phases of the peace program will press for solution, and, though most attention will be focused on affairs across the Atlantic, there will still be the Mexican problem, which cannot much longer be denied the attention that it demands.

Foreign Trade and the Mining Industry

THE stimulation of foreign trade is of more than passing interest to the mining industry. It is evident that any increase in the market for manufactured articles, particularly those in which metal is an essential constituent, such as hardware, mining and agricultural machinery, electrical and power equipment, will materially increase the demand for the basic metals. A comprehensive business policy and legislative program for the development of the foreign trade of the United States is greatly to be desired, and would have the strong support of all mining interests. Active steps are now being taken by the National Foreign Trade Council toward establishing such a policy and program. At its convention recently held in Chicago the significant recommendations which are summarized herewith were presented:

> The earliest possible completion of the Government's present shipbuilding program.
>
> The Government should immediately remove all restrictions now placed on American shipbuilding and permit the free construction of vessels for sale to foreign interests.
>
> There is imperative need of a revision of our shipping, navigation, classification, and measurement laws so that American vessels may be placed on a more equitable basis of competitive operative costs in foreign trade.
>
> Opposition to any continuance of Government operation of the United States merchant marine.

It is urged that the Government-owned vessels be allocated to suitable trades and trading routes for operation by any qualified competent American shipping enterprise, under conditions of sale or charter that will permit of their sending the American flag to any port of the world on a fair trading competitive basis.

Establishment of necessary coal and fuel-oil depots on all the great foreign trading routes, so that American shipping shall not be dependent upon foreign-owned facilities for such vital service.

Adequate telegraphic facilities with all foreign countries for the benefit of American exporters.

Establishment of free zones at the principal American ports where products from all countries may be assembled, classified, manufactured and reshipped.

Enactment of laws providing a bargaining tariff for the protection of American commercial interests in foreign countries.

Extension of the international parcel-post service.

The program merits the prompt attention of Congress at its next session. The domestic trade of the United States is enormous, but it requires the addition of a relatively large foreign trade to insure the consumption of our basic products at remunerative prices. That our foreign trade will increase rapidly goes without saying, but we are not so sanguine that it will take care of itself. We may well say that nothing takes care of itself particularly well. The nation has been engrossed with domestic affairs hitherto, but the war has broadened our interests, and it is greatly to be desired that we give to the development of foreign trade the attention which it deserves.

Copper Slags

THE slags formed in the smelting of copper ores and in the converting of copper mattes have always been of interest to the copper metallurgist. To the pioneer metallurgist, as well as to his successor, the chemical composition of the slag first commanded attention. Undoubtedly some of the first slags that would run properly, and not crust up the hearth of the blast furnace, were obtained by cut-and-try methods. Effective smelting mixtures were obtained by the increase or decrease of the proportions of the ore and the limestone flux. Practical smelters were men who were gifted with a considerable degree of native shrewdness, and who were quick to detect variations in the physical character of the slags as they issued from the blast furnace. By prompt adjustment of the charges, trouble was avoided in time, and the work proceeded without serious delay.

As smelting operations increased in magnitude, more and more use was made of the chemist, until it became the ruling practice to analyze the constituents of the charge and the fluxes, and to make calculations of the furnace charge that would give slags of certain compositions. More and more information was obtained of the characteristics of certain slags, and further information obtained of the effect of specific ore constituents. Finally the accumulated information was sufficient to make the smelting practice an approximately exact process. The practical smelter was then replaced by the trained metallurgist.

Scientific investigation kept pace with the increase in the size of smelting operations. The classic experiments of Hoffman and of Fulton gave information about formation temperatures and the relation between chemical composition and physical characteristics. The development of slags that were metallurgically efficient—that is, that would run freely, that would form at temperatures within certain limits and that would permit of economical ore mixtures—followed simultaneously with the scientific investigations. In the smelting plants the metallurgists made progress in obtaining slags of lower and lower copper content. The demand made upon them was to reduce the metal losses in smelting to the lowest possible figures. In blast-furnace smelting, larger and larger forehearths were demanded, until a practical limit to the settling out of matte in suspension was reached. In reverberatory smelting, larger and still larger reverberatories were used, with the objectives of securing cleaner slags and higher fuel efficiencies. Probably the limit of effective settling in both blast and reverberatory smelting has been reached.

The modern metallurgist refuses to be satisfied; and no sooner does there appear a culminating point in practice than new methods of investigation are seized upon, and the prevailing practice is subjected to critical examination. An investigation of this kind is presented in the current issue. Progress results from the thorough study of specific problems, and it is for this reason that the article of C. G. Maier and G. D. Van Arsdale will be welcomed by copper metallurgists. By an ingenious combination of chemical and physical methods of investigation, these two research chemists have determined for certain slags that oxidized copper compounds are not present, and that there is almost a fixed amount of dissolved copper in all of the blast-furnace and reverberatory-furnace slags examined. This copper is not in the form of matte, as might readily be supposed, but in that of sulphide copper. The practicable point is the demonstration of the limit to which settling practice can go in reducing the copper content of slags. Another important conclusion is that copper in excess of the dissolved copper is retained in suspension by flotative action, caused by the liberation of gas formed by the action of ferric oxide. As the investigators suggest, this indicates the desirability of reducing or eliminating the amount of ferric iron in the slag.

Although the amount of copper that could be saved by preventing this flotative action ranges from two to four pounds per ton of slag, under adequate settling conditions, and would perhaps, in some cases, be considered negligible, in other circumstances it might represent an important saving that could be effected by slight variations in the preliminary treatment of the charge, and without great increase in cost.

Available Shipping

THE matter of available shipping for raw and manufactured articles of American production is today of more than passing interest to the producer and to the manufacturer. Even though a foreign demand exists, it will be useless, while few ships are available for export business, to produce beyond the capacity of the American market to absorb.

There is some satisfaction in the information given out by John H. Rosseter, director of operations, U. S. Shipping Board, that within the next 30 days ample tonnage will be available for export trade.

If it is a fact that certain industries are being held back through inability to ship, there is in this news warrant for hope of material relief; but for the American people as a whole the more significant statement by Mr. Rosseter is that "The shipping board has provided not less than 1,390,000 dead-weight tons of steamers for European relief during the period of three months."

The trade that America needs particularly to have restored is that with European nations. This is the trade that affects every branch of our own industrial life, and the restoration of this trade depends upon such restoration of European conditions as will again permit of an exchange of goods. The first step in this restoration is admittedly that of bringing normal health to the populations of the devastated countries through supplying them with food, and the second step is to provide them with raw materials.

Individual sacrifices have been made and contracts have been lost through inability to secure carriers from the United States, and there will undoubtedly be other similar cases, despite the promise that has been made. In making these sacrifices, however, we can take comfort in the thought that the Shipping Board, in sending every ton of food possible to Europe and bringing our men home with the greatest possible dispatch, is acting in the best interest of the American people as a whole.

BY THE WAY

It is interesting to note in Henry M. Stanley's account of his famous expedition in 1871-1872 to rescue David Livingstone, the African explorer, reference to the now well-known Katanga copper mine. He says: "Rua, at a place called Katanga, is rich in copper. The mines of this place have been worked for ages. In the bed of the stream gold has been found, washed down in pencil-shaped pieces or in particles as large as a split pea. Two Arabs have gone thither to prospect for the metal, but as they are ignorant of the art of gold mining it is scarcely possible they will succeed."

In a recent issue of *The Youth's Companion* a writer gives an account of the vicissitudes of the life of a prospector. Wishing to register a claim location without delay, he set out by a direct route over the mountain. Miscalculating the time it would take to urge his patient burro over the range, darkness came before he had reached the regular trail, and knowing that the safest way was to trust to the animal's instinct, he plodded long behind, with a firm grasp on Jack's tail. Suddenly the burro swerved to one side and stopped, leaving his master standing on nothing. In a few moments came the realization that a prospective millionaire was suspended in an old mine shaft, with nothing but the tail to save him from a plunge to unknown depths, the chances of rescue in that unfrequented spot being slight. No command, request, entreaty, or curse would make that burro budge; and each struggle to climb caused the animal to kick. Finally a kick in the jaw almost ended matters, but a frantic wave of the arm to ward off the next kick brought the hand in contact with a bush. After testing the strength of this new support, a careful transfer was made. But, horrors! While the spirit was more than willing to climb out of the pit, the body was weakened by the long strain. Drops of cold perspiration began to collect and trickle down, conjuring up awlful visions of a mangled corpse lying below with the mine seepage dripping upon it. After what seemed hours of agony, there came the will to end it all by letting go and dropping to oblivion. But the hands, now cramped, refused to open. Then came the phantasm of a dried and shriveled mummy, swayed by the wind at the edge of the pit's mouth. Finally, as with a maniacal shriek one last effort was made to regain the surface, the bush gave way, and down plunged the victim, seeming to float on air for a space and then landing in a confused heap at the bottom of the excavation. Unconsciousness came so quickly that there was no torture of pain such as would naturally be inferred where there seemed every chance of being mashed to a pulp. After a time a ray of moonlight and a return of the senses brought an appreciation of the fact that the supposed abandoned mine was merely an "assessment hole" and that the fall measured exactly six inches. In a few moments the burro was compelled to desist from his meal of bunch grass and resume his function as a saddle animal.

"Did'st thee make h'out one o' these 'ere tax h'income returns?" said Cap'n Dick. "Dam-me, m'son, I call un some bloody beauty you, an' a man mus' be pretty near a scholar to get 'en right. One thing certain, for sure, 'e mus' be smarter than Jan Broad. Jan, 'e'd gone to night school, an', min' you, 'e did'nt 'esitate baout tellin' people. One day Jimmy Kevern asked 'im, ''Ere naow, Jan, thee be so bloody smart with this 'ere night school, 'ow much is 'leven poun' o' 'errin' at 'leven cents a poun'?' 'Simple nuff', sez Jan, 'Give us a bit o' pencil an' scrap o' paper an' I'll fixun.' So Jimmy, 'e gives un a pencil an paper, an' Jan 'e sits daown to work un h'out. Firs' 'e covers one side o' tha paper with figgers an' then 'e turns un h'over an' writes daown h'other side. 'Dam-me,' sez e, 'can't seem to figger'n h'out no'ow. W'ot was tha bloody problem, any'ow?' 'Simple nuff,' sez Jimmy, ''Ow much is 'leven poun' o' 'errin at 'leven cents a poun'?' 'Oh, dam-me,' sez Jan, 'No wonner could'nt figger'n h'out. 'Ere wuz I figger'n mackerel h'all tha time!'"

D. E. A. C.

An amusing anecdote is going the rounds in connection with the search for petroleum in Derbyshire, England. It is reported that Lord Cowdray is beginning to bore in various places what are known to the drilling profession as wildcat wells. His agent found promising indications in one locality (presumably Foxstones), and forwarded a bottle containing a sample of the first crude petroleum from the prospect. Being in somewhat of a hurry, Lord Cowdray handed the bottle to one of his servants. The man started out with the bottle and a note, but stopped to visit his family on the way. He suddenly remembered his errand; and, picking up from a shelf what he thought was the same bottle, hurried out to deliver it. In the morning Cowdray received from the chemist a telegram to the effect that congratulations were in order in view of the greatest find of the century, adding "You have struck paregoric."

By the Way—Have you bought your Victory Note?

Personals

Tom L. Gibson is making mine examinations in the Kingman, Ariz., district.

Frederick Burbidge recently made an inspection trip of properties in Oklahoma.

Albert Burch recently examined gold properties in El Dorado County, California.

E. O. Daue has just returned to Philadelphia from a professional trip to Georgia.

A. J. Robin has accepted a position with the Mazapil Copper Co. at Saltillo, Coahuila

Charles A. Burdick has changed his address to 1834 Equitable Bldg. New York City.

S. H. Ball left for the Southwest on Apr 10. He expects to be absent for about one month.

J. K. MacGowan has been elected a director of the Chile Copper Co. in place of F. R. Foraker

Stanly A. Easton was elected a delegate-at-large at the annual convention of the Idaho Mining Association.

Edwin J. Collins, mining engineer of Duluth, has returned from a 10-weeks' trip through the west and southwest.

N. L. Wimmler is returning to the Orient, and his temporary address will be care of American Consulate, Bangkok, Siam

George B. Holderer will be in Cuba for the next few months, with headquarters at the Horter Bldg., Obispo 7, Habana, Cuba.

William Loeb, Jr., has been elected a director of the Federal Smelting and Refining Co., succeeding William J. Hall, resigned.

S. F. Shaw has returned to Charcas from a visit of inspection to the Bonanza, Asientos, and Zacatecas units of the American Smelting and Refining Co.

Kenneth J. Duncan, representative of the Whiteside Minnesota mining interests, has returned from Minneapolis, where he underwent a serious operation.

Henry M. Adkinson has returned to Salt Lake after an absence of three months in New York, Washington, and Chicago, where he was engaged in professional work.

Walter Douglas, president of the Phelps Dodge Corporation, is making an inspection of the company's properties in the southwest, being recently at Douglas, Ariz

F. G. Lasier, who served as a captain of engineers in Washington until receiving his discharge recently, will resume his consulting work, with Detroit as his headquarters.

A. W. Allen has resigned from the editorial staff of the "Journal" to become chief engineer for the Penyon Syndicate. Mr. Allen expects to leave New York for Chile about the middle of June.

J. E. Spurr, executive of the War-Minerals Investigation, will be in charge of the physical examinations for the War-Minerals Relief Commission. A part of his field force is already at work.

W. A. McCurdy, formerly assistant general superintendent in the Vermillion district for the Oliver Iron Mining Co., succeeds **G. H. Dormer** as assistant general superintendent at Virginia, Minn

W. P. Chinn, assistant general manager; **W. H. Gallagher**, mechanical engineer, and **W. A. Rose**, chief mining engineer, all of the Pickands-Mather Co., attended the annual meeting of the company, held at Cleveland.

A. S. Howie is expected to return to Lima, Peru, soon He was formerly superintendent of the Natividad mines at Morococha, and went to England in 1917, obtaining a commission in the Royal Engineers.

W. H. Overpeck, superintendent for the Oliver Iron Mining Co in the Buhl district, has been transferred to the Hibbing district with the same company He is succeeded by **G. H. Dormer**, recently of the Virginia district

Frank J. Tone has been elected president of the Carborundum Co. of Niagara Falls succeeding the late Frank W Haskell **George R. Rayner** succeeds B B Mellon as vice president **F. H Manley** retains the position of treasurer

Richard Coombs has resigned his position as mining captain of the Hancock Consolidated Mining Co., having been with the company for 13 years Mr Coombs was one of the "safety-first" leaders in the copper-mining industry

George A. Chapman, of New York consulting engineer for the Minerals Separation, Ltd., is in the Lake Superior district in connection with the operation of the corporation's contracts with Calumet & Hecla and other interests.

Carl Wirth, formerly of the Research Corporation, who served in France as a second lieutenant with the 52d Regiment, has accepted the position of foreman in the smeltery department of the chrome plant of the U. S. Smelting, Refining and Mining Co.

James P. Graves, of Boston, has been in Salt Lake City, from which place he made inspection trips to the Bingham properties of the Bingham Mines Co. and the Eagle & Blue Bell and Victoria, of Tintic, also controlled by the Bingham Mines Company.

J. P. Bonardi, assistant chemist with the U. S. Bureau of Mines, who has spent several months in Seattle experimenting on flotation problems in conjunction with **Will H. Coghill**, has returned to Golden, Colo., to resume his duties at the experiment station there.

George Reading, chairman, **Alexander McNabb**, and **Sir David Paulin** of Edinburgh, Scotland, of the board of directors of the Arizona Copper Co., Ltd., accompanied by general manager **Norman Carmichael**, are visiting other Southwestern mining camps, after inspection of their company's mines and plants at Clifton, Morenci, and Metcalf.

A. E. Drucker has severed his connection with Howard, Morinni & Co., Inc., and opened an office on May 1 at 30 Church St., New York, where he will again take up the practice of a consulting metallurgical engineer. Mr. Drucker has organized the Drucker Smelting Corporation, of which he is president and treasurer. The purpose of the company is the recovery of metals from foundry residues.

Ira B. Jerolemon, geologist for the Calumet & Arizona Co. at Warren, who has been doing important work correlating the functions of artillery and airplane forces, has been recently released from Army service. Among other Arizona mining men recently discharged from the service are the following: Lieut.-Col. John C. Lowe, efficiency foreman of the Old Dominion mines at Globe, commissioned a lieutenant and promoted for good work at the front with the engineers; Lieut -Col. H. H. Stout, superintendent of the Copper Queen smeltery at Douglas, for two years in the Ordnance Department and lately returned from overseas. Of the United Verde staff at Jerome, Clarence V. Hopkins, chief engineer, was one of the last engineer captains commissioned, and H DeWitt Smith, superintendent, assigned to aviation service at Dayton, Ohio, was turned back on arrival.

LIEUT. WILLIAM H. STUART

The American Red Cross wishes to ascertain the whereabouts of Lieut. William H. Stuart, son of Duncan C Stuart, of 12 Maple St., Oneonta, N. Y., and will appreciate any information that can be secured relative to him. Lieutenant Stuart is 27 yrs. old He arrived from overseas service on Jan. 13, and went to Washington, where he was given his discharge He returned to New York, and was last seen in that city Jan. 18, at 7 30 P M He is a graduate of Colgate, Class 1914, and took two years' post-graduate work at Brooklyn Polytechnic Institute. He is 5 ft 8 in tall, has dark brown hair and blue eyes and a ruddy complexion He has a brown mole on the left side of his nose He had three gold service chevrons on his sleeve, indicating 18 months' service overseas, if in uniform. When last seen Lieutenant Stuart was wearing spiral puttees, and not the customary leather ones for officers. Information relative to him may also be sent to D C Stuart 13 Maple St Oneonta, N Y or to Thomas Blizard, Chief of Police, Oneonta, New York

Obituary

G. Lavignino, who had been engaged in mining operations at Bingham, Utah, for over [illegible]5 years, died on Mar [illegible]1 in Los Angeles, at the age of 70 years

Daniel H. Merritt, for many years active in the railroad and mining industries of the Lake Superior district, died at Marquette Mich., on Apr 28 aged 86 years After a first visit to the district in 1855 he returned to Marquette three years later and was identified with the old Iron Mountain R.R. and later with the Marqu[illegible]ton and Ontonagan R.R., of which he was general manager. In 1868 he became connected with what is now the Lake Shore Engine Works at Marquette, Mich., and remained as its head until 1889. During his connection with this plant Mr Merritt built the first stationary engine in the Lake Superior region.

Barry H. Jones, a director and secretary of the Bethlehem Steel Co., died on Apr. 3, being suddenly stricken while in the midst of his work. He was within six days of being 45 years old, and in years of service was one of the oldest of that coterie of men known as "the Bethlehem Boys." He was graduated from Lehigh University in 1894, as a bachelor of science in metallurgy. The following year he received the degree of engineer of mines for post-graduate work performed while acting as instructor at Lehigh. He entered the employ of the Bethlehem Steel Co. in 1899, which was about the time of its organization. He rose rapidly, and, because of his great ability in accounting and financial matters, he was made comptroller and auditor in 1902, and later in 1906 was elected a director, and the secretary and treasurer. He resigned as treasurer in 1917.

Societies

Engineers' Society of Western Pennsylvania, civic section, held the bimonthly meeting on May 6, when S. H. McKee presented a paper on "Central Boiler Feed Water Service for Plants."

American Institute of Mining and Metallurgical Engineers, Colorado section, held a meeting at the Denver Athletic Club, May 1, 1919. Following an informal dinner, Col. Thomas B. Burbridge addressed the section on "Travels Through Mining Districts in the Orient." The meeting was well attended.

Colorado Scientific Society held its 336th regular meeting at the Shirley Hotel, Denver, on May 3, 1919. The speaker was Prof. O. A. Randolph, who addressed the meeting on the subject: "The Production and Uses of X-Rays, With Special Reference to Crystal Structure." About 40 members and guests were present. The lecture was illustrated by lantern slides and laboratory experiments.

American Zinc Institute will hold the annual meeting at Hotel Statler, St. Louis, Mo., June 9, at 10 a.m. The postponement of this meeting from May 12 was occasioned by the crowded condition of the Statler's calendar of events. William F Rossman, Pierce Bldg. St. Louis, is the chairman of the committee of arrangements. It is suggested that the matter of hotel accommodations at St Louis be given early attention Two days (Monday and Tuesday) will probably be devoted to the business of the Institute, including the election of directors, and the proceedings should prove of great interest to everyone engaged either directly or indirectly in the zinc industry

The American Institute of Mining and Metallurgical Engineers will hold its annual convention in Chicago, Sept. 22 to 26. This meeting promises to be one of decided importance to the industry, as subjects of vital concern to modern metallurgy will be discussed In addition to the technical talks, an elaborate social programme is being arranged, and excursions by the Institute as a body are planned to many points of interest in the vicinity, including the steel mills at Gary, the oil refineries at Whiting metallurgical plants at East Chicago and North Chicago, and to the La Salle district, where the cement, coal, and zinc industries are represented New York section, held a meeting on May 7 at the Machinery Club. The program was an address by Col O. B. Perry, on the organization and campaign of the 27th Engineers in France

Industrial News

Metal Export Company of America, New York, desires to announce removal to 220 Fifth Ave on May 1 Telephone, Madison Square, 4794

Greene, Tweed & Co., 109 Duane St., New York, has just issued a catalog which has the additional value of being a guidebook to the use of packings The company will be glad to send a copy upon request to anyone interested in the difficult subject of piston rod packings

John Herman, assayer and chemist, has removed his business to 339 South Los Angeles St., Los Angeles, Calif. Announcement is also made that a 40-ton custom grinding plant is being operated at Vernon, a suburb of Los Angeles, and a plant will soon be installed to follow the Herman mill for making carload tests. The crushing plant is provided with railroad facilities.

Eagle-Picher Lead Co., Chicago, announces that H. G. Clopper, general sales manager of the New Jersey Zinc Co., has resigned from that company to accept a vice presidency in the Eagle-Picher Lead Co., and that he will actively begin work with this company on June 1 of this year. Mr. Clopper will make his headquarters at the general offices of this corporation in Chicago.

Joseph Dixon Crucible Co., of Jersey City, N. J., manufacturers of lead pencils, crayons, erasers, silica, graphite paint, crucibles, graphite greases, and graphite automobile lubricants, have announced the removal of their Philadelphia sales office from 1020 Arch St. to Rooms 801 and 802 of the Finance Bldg., South Penn Square, Philadelphia, May 1st. The Philadelphia sales district comprises Pennsylvania, Southern New Jersey, Delaware, Maryland, the District of Columbia, Virginia, and West Virginia. W. G. Stringer is in charge of the Philadelphia organization.

Anniston Steel Co., Anniston, Ala., has secured the services of N. W. Tarleton in the salvage division of the sales department. Mr. Tarleton was connected with the Southern Manganese Corporation of Anniston for the last two years as purchasing agent and traffic manager. He will now be in charge of the sale of all the equipment recently acquired by the steel company from the Illinois Car and Equipment Co., consisting of iron- and wood-working machinery of all kinds, engines, boilers, and other miscellaneous equipment the value of which has been estimated at slightly under $200,000. A catalog giving full information on the equipment to be sold is now in the hands of the printer, and will be distributed to the trade as soon as it comes from the press.

Pioneer Rubber Mills is the name under which the Bowers Rubber Works, of San Francisco, is now operating. The change in name became effective Apr. 1, but the management and policy of the company continue as under the old name. The Pioneer Rubber Mills will continue all the brands, such as Skookum Piston Rod Packing, Copper Queen Belting, Victor Fire Hose, that the Bowers Rubber Works has established. The Pioneer Rubber Mills maintains factory sales offices in Portland, Tacoma, Seattle, Los Angeles, Salt Lake, and Denver, and has distributors all over the United States. George N. Towne is vice-president and general manager, and D. D. Tripp is vice-president in charge of sales. The general offices are at 68 Sacramento St., San Francisco.

"How Business With Foreign Countries Is Financed" is the title of a pamphlet just issued by the Guaranty Trust Co., of New York, for the benefit of exporters and importers and others having business or financial relations with foreign countries. The brochure contains 28 reproductions of specimen forms of drafts, letters of credit, bills of lading, invoices, and other documents generally used in connection with the financing of exports and imports. Explanatory notes accompany each illustration, and features in the documents of particular importance are noted. The use of the documents is also explained when that seems necessary. Special attention is given to those which bear directly upon the development of dollar exchange. The pamphlet is printed in attractive type upon coated paper and is carefully indexed. At the end there is a table of currencies of various countries and their value in United States dollars.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal' at 25c. each. British patents are supplied at 40c. each.

Aluminum. Apparatus for Carrying Out Processes of Winning Metals. Victor M. Weaver, Harrisburg, Penn., assignor to Weaver Co. (U. S. No. 1,296,575; Mar. 4, 1919.)

Anodes. Process for Making Anodes of Solid Manganese Peroxide. Max Huth, Berlin-Charlottenburg, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. (U. S. No. 1,296,188; Mar. 4, 1919.)

Cement-Making Process. Woolsey McA. Johnson, Hartford, Conn. (U. S. No. 1,297,297; Mar. 11, 1919.)

Concentrator. Arthur Baring-Gould, Placerville, Calif. (U. S. No. 1,296,737; Mar. 11, 1919.)

Copper. Process of Extracting Copper From Ores., Etc. Newton Evans, Los Angeles, Calif., assignor of one-third to Carl F. Schader and one-third to William H. Heady, Los Angeles, Calif. (U. S. No. 1,297,670; Mar. 18, 1919.)

Crushing. Grinding Mill. Jacob K. Griffith, Pittston, Penn., assignor to A. J. Griffith, Pittston, Penn. (U. S. No. 1,295,482; Feb. 25, 1919.)

Crushing. Mill. Thomas J. Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co., Harrison Square, Mass. (U. S. No. 1,296,134; Mar. 4, 1919.)

Crushing. Rock Crusher and Pulverizer. Charles O. Michaelsen, Minneapolis, Minn., assignor, by mesne assignments, to Michaelsen Machinery Co. (U. S. No. 1,297,385; Mar. 18, 1919.)

Drill. Core Drill. Frank Miller, New York, N. Y. (U. S. No. 1,297,889; Mar. 18, 1919.)

Drill. Rotary Boring Drill. Robert E. Carmichael, Damon, Tex. (U. S. No. 1,295,969; Mar. 4, 1919.)

Drill Holder. John M. Calderwood, Spanish Fork, Utah. (U. S. No. 1,296,918; Mar. 11, 1919.)

Drilling. Oil-Well-Drilling Drive. Victor York, Brea, Calif. (U. S. No. 1,297,289; Mar. 11, 1919.)

Drilling. Well-Drilling Tool. John Maier, Detroit, Mich. U. S. No. 1,297,708; Mar. 18, 1919.)

Electric-Arc Furnace. Jens Lassen la Cour, Christiania, Norway, assignor to Norsk Hydroelektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,296,194; Mar. 4, 1919.)

Electric Furnace and Method of Operating the Same. Jervis R. Harbeck, New York, N. Y., and Edward G. Norton, Chicago, Ill. (U. S. No. 1,295,309; Feb. 25, 1919.)

Electric Furnace for Smelting Ores. Albert E. Bookwalter, Coeur d'Alene, Idaho. (U. S. No. 1,297,641; Mar. 18, 1919.)

Flotation. Apparatus for the Concentration of Ores. James M. Hyde, Palo Alto, Calif. (U. S. No. 1,296,190; Mar. 4, 1919.)

Furnace. Open-Hearth Furnace. Marinus Hvid, Chicago, Ill. (U. S. No. 1,296,189; Mar. 4, 1919.

Galvanized Sheet and Plates, Process of Finishing. Robert Skemp, Scottdale, Penn., assignor to American Sheet and Tin Plate Co., Pittsburgh, Penn. (U. S. No. 1,297,265; Mar. 11, 1919.)

Editorial Correspondence

BUTTE, MONT.—May 3

Anaconda Copper Mining Co., has instituted a contract system for the mining of ore as a measure designed to promote efficiency. Heretofore the contracts were given only for development work. However, since signing of the armistice, the efficiency of the miner has increased from 20 to 33⅓%, and the company is now mining 1⅛ tons per man. Anaconda is continuing operations at approximately 60% of normal, with a slight increase in the zinc ore tonnage. One of the most recent notable ore developments was the uncovering of ore on the 3200 ft. level of the Steward mine showing a width of 25 ft. and averaging about 5% copper and about an ounce of silver for each per cent. of copper. This width was found in the eastern part of the property; westerly, the drift on this level has been pushed 800 ft., showing eight to nine feet of ore for the entire distance. The Steward shaft, being sunk to the 3800 ft. point, is now down 3400 feet.

DENVER, COLO.—May 3

The Sunnyside Mine, at Eureka, in San Juan County, was recently the scene of a fire which destroyed the mine buildings with the exception of the transformer house. The loss is estimated at $250,000. Over 200 miners were without shelter, and lost their personal belongings. The bunk houses destroyed were steam-heated, electric lighted, and equipped with hot and cold running water. They were among the best mining bunk houses in the West. The cause of the fire has not been determined.

The Globe Smeltery at Denver is to be abandoned. The American Smelting and Refining Co. purposes handling at its Pueblo plant all Colorado ores which would come to this plant. Denver will lose the benefits of the payroll, and other incidental advantages of such an industry. The Globe smeltery is an old, out-of-date plant which has received few improvements. Its methods are in many respects obsolete. On the other hand, the Pueblo plant is modern, and has kept pace with improvements in smelting practice. Ore shippers, particularly those in the northern part of the state, are wondering if the change will have any effect upon the cost of selling their products, and whether the advantages to be gained by the smelting company will be permitted to offset the disadvantages to the shipper of the longer freight haul.

Junking Railroads is becoming general in Colorado. The most recent proposal is to junk the D. B. & W. R.R., known as the "Switzerland Trail." Such action would be of serious consequence to mine operators in Boulder County. This mountain railroad is absolutely essential to the proper conduct of the mining business in certain territory west of Boulder, and the mining business of this territory is of great importance to the trade of the city of Boulder. Mine operators of the district claim that motor-truck transportation of ore, coal and heavy freight in this region is not feasible and commercially practicable except in a few instances. It is claimed that if the road is discontinued the mines of the region will close, and with the junking of the railroad will follow the junking of mining plants and the abandonment of mining properties in which investments have been made which aggregate many times the amount invested in the railroad. It is claimed that this road brings in much of the ore which is delivered to the sampling works recently established at Boulder. The Yellow Pine Mining and Reduction Co., the Logan Metals Co., the Humboldt Mining Co., and many others have been active in filing protests with the Public Utilities Commission against the proposed junking of the railroad. The City Council of Boulder, and citizens of the camps served by the road, have taken up the issue and will make every effort to save the road for Boulder County.

HOUGHTON, MICH.—May 3

Copper Shipments by Express are not unusual from the Michigan smelteries, notwithstanding the generally depressed condition of the metal market and the surplus of copper in warehouses. These shipments are small lots. One went out from Hubbell yesterday, 1900 lb., to the American Brass Co.'s plant at Kenosha, Wis. This indicates the conditions of stocks carried by such plants.

Depression in the Copper Industry is marked in the Lake Superior district. More mines are considering suspension and others are figuring on further curtailment. Such properties as the Mass Consolidated, Victoria, and White Pine, in Ontonagon County, are continuing to operate. They are running at a loss, and though their total output of copper makes practically no appreciable difference to the surplus on hand, it causes a continuous and sustained drain on the treasury.

Among the Calumet & Hecla subsidiaries, the White Pine is not the only producer which is operating at a loss. The Centennial, La Salle, and the Old Osceola branch of the Osceola Consolidated are today operating without profit. The same is true of the Superior. The margin is slim at the Allouez and the Isle Royale.

The Quincy, Copper Range, Mohawk, and Wolverine are independent producers which are going ahead full time in an effort to keep their working forces from joining the exodus to Flint, Detroit, and other automobile centers, which just now are augmenting their working forces by importations from the Michigan copper and iron industries. During the last week eight iron mines closed down in northern Michigan.

Two plans are generally discussed in the Michigan copper district to bring about alleviation of the distressing situation in which the copper producers now find themselves. One is to ask for a Government subsidy to copper mines, on the same plan that the wheat farmers now enjoy a subsidy. The other is to start a national advertising campaign to bring about more general use of copper. "Buy a Bar of Copper" may become a slogan as common as "Buy a Bale of Cotton" was a few years before the war.

(By Telegraph—May 5)

Production Reduced 50% and 2000 employees of Calumet & Hecla and subsidiaries are laid off by an order which was issued today. The properties affected are the Ahmeek, Allouez, Isle Royale, Osceola, and Lake Superior Smelting Co. All other men will work full time.

BISBEE, ARIZ.—May 3

Copper Camps of Cochise County show little change in the last 30 days. At Johnson two of the smaller properties are doing development work, the Arizona United, Copper Chief, and Mammouth Lease having closed down Feb. 1. It costs these companies about 18c. per lb. to mine copper, so the properties will undoubtedly remain closed until the price goes above that figure. At Gleeson, Courtland, Tombstone, and the other small camps where it costs the companies as much or more to produce copper than at Johnson, operation has been discontinued with the exception of that conducted by lessees, all of whom are taking out a small amount of ore. At Bisbee the situation looks better, the companies hiring a few machine men each day.

Settlement of Deportation Suits, according to the attorneys of the deported men, was attempted by the companies, which, the report states, offered to settle with men in the district so deported, on the following basis: Single men, $500; married men without children, $1000; married men with children, $1250. Deported men will take a vote on this offer, but it is reported that they are not inclined to accept. In this connection, the indictments which had been found in the Bisbee deportation cases, involving about 25 individuals, including capitalists, mine operators and public officials, were quashed by Judge William W. Morrow, of San Francisco, in a decision filed on Dec. 2 in the U. S. District Court. The indictments charged conspiracy to deprive citizens of the United States of their constitutional rights and involved the deportation of 1186 striking copper mine workers and their alleged sympathizers.

Readjustment of Rates on copper-ore shipments from Arizona mines to reduction works in this state and other sections was asked of the Interstate Commerce Commission today by the Calumet and Arizona Mining Co. and the Phelps Dodge Corporation. It was claimed that such readjustment was necessary to meet the competition of the Anaconda and other copper companies. The rate relationship of those rates, it was stated, was disturbed by the advance of 25% in freight rates put in effect by the Railroad Administration.

Announcement that the Interstate Commerce Commission has refused the request of Director-General Hines to reopen the Michigan rate case was made recently. The Director-General requested the reopening on the ground that the whole structure of railroad rates was in danger of concerted action against the charges on the part of the shippers. A decision already has been handed down in these cases, the commission said, and no additional proof or data have since been submitted to warrant the reopening of the cases for further argument and consideration.

ST. LOUIS, MO.—Apr. 29

The Southeast Missouri Lead Belt has greatly restricted the output of lead, on account of the low price of pig lead in St. Louis, which today is selling at 4¾ to 5c. per lb., which is abnormally low in view of the continued high price for labor and supplies. The excessively high wages of the war boom have been reduced only 20%, which reduction was accepted by the miners without trouble. The St. Joe Co., the heaviest producer, has entirely closed down its large Leadwood mill and mine, but is operating its Bonne Terre and River Mines plant on full time. Its smeltery at Herculaneum has been closed down for some time, as it is being remodeled and will probably not start again until autumn. In the interim, St. Joe smelting is being done by the Collinsville and Alton smelteries, in Illinois. To reduce the cost of living, the St. Joe Co. has reopened its mine store at Bonne Terre, where it is selling groceries at a marked reduction below prices asked by local storekeepers. The new tailing stacker at Bonne Terre is now in successful operation, with a saving of approximately $100 per day over the large crew that was formerly required when it was the practice to haul these tailings away in railroad cars to nearby dumps.

The Federal Lead Co. is operating only two of its eight shafts, and has closed down the new No. 4, 3000-ton mill. Only a few diamond drills are operating, whereas usually at this time of the year at least 40 to 50 should be at work on the summer campaign development work. The Hungarian miners are largely leaving the district rather than take out naturalization papers now required, and many of them had been employed for some time without attempting to take out their papers.

PIOCHE, NEV.—May 1

Activity in the Pioche District has been revived owing to the high price of silver, and has been under way since the first of the year. Recently a decided impetus was given by a notable strike in the Harney group of claims, in the eastern end of the district, by two lessees, Stindt and Donohue. About $20,000 worth of ore has already been shipped to the smelters. About the middle of April, Stindt and Donohue sold their lease to Melville Gillett, of Smethport, Penn., and G. Henry Stetson, of Philadelphia, Penn., for the sum of $75,000. The purchasers, who have also taken options on adjoining property, are preparing to install equipment to conduct extensive development work. The fact that the vein was previously unknown, owing to its outcrop being covered by soil, has stimulated interest in adjacent areas of undeveloped ground which lie within the mineral-bearing belt, and several leases have been let for the exploration of these areas.

The current price of silver now renders possible the exploitation of bodies of low-grade ore in producers that could not be profitably mined previously. One of these properties, the Providence Mines Co., has recently been purchased, for the sum of $10,000, by the Mascot Mining Co., of which the control is held by John Cook, of Pioche, and H. W. Rand, of Los Angeles. This property is fully equipped for operation and development. Large bodies of low-grade ore are known to exist in several of the principal producers of former days, now owned by the Amalgamated Pioche M. & S. Corporation. These orebodies, in accordance with the past policy of the company, will probably be leased.

A considerable proportion of the silver and lead in the Pioche ores occures in an oxidized form, and under the ore-dressing methods formerly practiced, of amalgamation and table concentration, rarely more than 50% or 60% of the metal contents could be recovered. The success attending the operations of the Prince Consolidated M. & S. Co. in treating old mill tailings at the Bullionville mill by flotation with the use of sulphidizing reagents has demonstrated that a high precentage of recovery on oxidized ores can be attained by this process; and a movement is under way, by residents of the district, to lease the concentrating mill of the Amalgamated Pioche M. & S. Corporation, which is equipped with Overstrom tables and Callow flotation cells, for use as a custom mill, for the treatment of the low-grade ores of the district.

In the southern part of the district, the Prince Consolidated M. & S. Co. and the Virginia-Louise Mining Co. are making regular shipments of about 25 cars and 10 cars, respectively, per week, to the Salt Lake smelters. The ore produced by these properties is a low-grade silver-lead ore, which, because of the fact that it contains between 30% and 40% iron and manganese in excess of the insoluble content, is a desirable smeltery flux. The two properties are contiguous, and are mining the same orebodies, which are of the bedded type, and are of large areal extent and thickness. During the last year a new orebody, known as the "Davidson," has been discovered, which is of exceptional purity and large size, having a thickness of 60 ft. in places.

BIRMINGHAM, ALA.—May 3

Gradual Reduction in the Iron Business in this district, noticeable since the beginning of the year, was still further marked when on Apr. 28 practically the entire mining division of the large companies went on an eight-hour basis. This means a large cut in wages and will particularly affect the small wage earners. The change affects the entire district more, probably, than any one event since the taking over of the Tennessee Coal, Iron and Railroad Co. by the Steel Corporation. The Sloss-Sheffield Steel and Iron Co. has been running on an eight-hour day, five days a week basis for some time, and this schedule will probably be followed by some of the other companies, at least at their smaller plants.

The Republic Iron and Steel Co. has closed all but one of its mines at Spaulding, this being run five days a week on an eight-hour basis. The ore from these mines has been going into stock, and with only the one mine in operation it is probable its output, too, will be added to the stock. This company's brown ore mines at Houston have been closed, but all construction now in progress will be finished, particularly the new washer now nearing completion. The company's No. 3 mine, at the Raimund group (R. F. D. No. 3, Bessemer, Ala.), is now being mined for hard ore only. The soft ore forming the largest proportion of this mine's production is not in demand at the company's furnaces at Thomas, and, as the hard-ore production is not great, it would not be surprising to see this mine closed entirely. The Nos. 1 and 2 mines of the Raimund group will probably continue to operate, as their entire product will be needed to supply the company's one furnace in operation (Thomas, Ala.). Two stacks of the group of three at Thomas are now idle, and though there is no indication of the third going out of blast, should it do so it will probably mean the closing of the company's Raimund and Spaulding groups of mines. Only four mines of the Tennessee Coal, Iron and Railroad Co.'s Wenonah group are working, two being run one day and two the next. All night work in the company's mining division has been discontinued, with the exception of that at the No. 6 mine in the Muscoda group.

It is rumored that the Woodward Iron Co. will begin operations soon. This is borne out by reports from a number of the other large companies that labor now leaving them in a majority of cases is returning to some of the Woodward plants and mines.

JOHANNESBURG, SOUTH AFRICA—Mar. 30

Rand Mining Industry was discussed at the annual meeting of the Transvaal Chamber of Mines, held on Mar. 24. Sir E. A. Wallers spoke on the relations of capital and labor in regard to fewer hours and the process of underground mining, and showed that the actual time for native laborers required in drilling rock which must be broken in order to maintain operations was surprisingly short. However, he said a decrease in dividends would occur unless the decreased hours and increased wages were accompanied by greater efficiency. Taking the Rand industry as a whole, it was now paying 2½% on the capital invested. No mine had closed down. The dividends amounted to only £5,144,077 last year, compared with £8,730,436 in 1914, and of the latter figure £6,357,933 was declared by mines other than those on the Far East Rand. In 1918 these same mines declared dividends of only £1,[illegible],430, a decidedly small return on the capital invested. Working profits had decreased from 9s. to 6s. per ton, whereas total costs had increased from £21,943,692 in 1914 to £26,848,547 in 1918.

There was an insufficiency of native workers throughout the year. The refusal of Parliament to sanction the experimental introduction of 1000 tropical natives for work in the mines after being inoculated was not to the best advantage. The limited point in earning to which the natives were able to rise was the cause of dissatisfaction. A number of piecework systems was in use, and information was being collected as to such methods of payment, with the intention of extending them where possible, having proper regard for the position of white workmen. Despite the increase of the native death rate resultant from the influenza epidemic, the mortality from pneumonia among natives was at the rate of 3.72 per 1000, compared with 3.36 for 1917, which was the lowest on record. The accident death rate was only 2.68.

The Mining News

ARIZONA

Cochise County

TOMBSTONE MINES of Phelps Dodge Corporation operating only under leases; 150 men thus employed, profitably.

Gila County

GILA MONSTER (Globe)—New corporation formed to operate Mack Morris, Richmond and other old mines of Richmond Basin, nine miles north of Globe. District was notable silver producer in early 80's. New vein cut in Richmond at 70 ft.

Mohave County

FAY (Kingman)—Option taken by H. A. Hamme, who is remodeling small mill for run on ore from narrow vein carrying gold.

GOLD DUST (Oatman) — Exploring on 500 level, directed by H. E. Davis, geologist, to strike vein faulted below 300 level. About $500,000 spent on development.

MUSHRUSH (Oatman)—Taken over by United American Co., composed largely of stockholders in United Eastern. Lies just south of Tom Reed ground. Deep shaft to be sunk, with expectation of picking up Tom Reed lead, already being worked close to southern line. Hoist and compressor already in place.

Santa Cruz County

LAYMAN SYNDICATE (Patagonia)—Organized by James Layman and R. E. Moore, of Jerome, to take over Pierce-Gardner and Blue Nose properties. Former has shipped since December 27 carloads silver-lead ore. Orebody is about 12 ft. wide.

Yavapai County

UNITED ARIZONA (Cordes) — Completed shaft to 800 ft.; will sink winze on vein 200 ft. deeper. Commercial ore said to be developed.

DUNDEE ARIZONA (Jerome)—W. E. Defty, consulting engineer, of Phoenix, making plans for small leaching plant for surface carbonate ores estimated at 50,000 tons, sampling above 3% copper. Sinking 600-ft. shaft will be resumed; country now drained by Extension tunnel. Owns about only level land in Jerome, and laying off a townsite on which $150,000 school will be placed.

VERDE COMBINATION (Jerome)—On 1300 level two drifts cut 6-ft. ledge of schist carrying chalcopyrite. Drifts started along ledge.

SILVER BELT (Prescott)—New shaft driven 160 ft.; high-grade galena-silver ore struck in 9-ft. vein.

CALIFORNIA

Calaveras County

PARNELL (Angels Camp)—To install machinery and work gravel claim through shaft formerly sunk to bedrock. Jim Lee and associates have lease.

INDIAN CREEK (San Andreas)—Electric power, air compressor, rock crusher, and stamps and concentrator tested and ready for operation. Mines in this district idle for about eight years. Walter Osselin and Frank Cuneo operating.

Eldorado County

ELDORADO LIME (Latrobe)—Shipping five cars lime daily.

FRUIT RIDGE DISTRICT (Placerville)—W. W. Bender and Ray Danaher developed claim; installed machinery costing $5000, which will be increased immediately.

Humboldt County

HORSE MOUNTAIN COPPER (Eureka)—Examination under option held by Pittsburgh men to begin early in May. Mine developed and some copper concentrates produced. Concentrating plant, sawmill and other surface improvements and development work have cost about $250,000. Improvements include 12 miles of good road. Property produced large amount chrome ore.

Inyo County

KEARSARGE (Independence)—Optioned by Independence Mining and Milling Co. after idleness of 47 years. Was a producer of high-grade ore over 50 years ago. Discovered in 1864; a 10-stamp mill installed in 1866 at cost of $40,000. Was variously managed by Almarin B. Paul, Isaac L. Requa and D. P. Pierce. Mr. Paul said to have quit because one consignment of bullion he shipped assayed only 12½c. per oz. But other ore ran as high as $950 per ton in silver. P. C. Montgomery is manager of company just formed under laws of Minnesota.

Nupa County

WHITEROCK MAGNESITE (St. Helena)—Operations resumed after idleness of several months. Motor trucks haul product to railroad.

Nevada County

MOUNTAINEER (Nevada City)—Action brought in Superior Court by Peter Bender, of Morgan Hill, Santa Clara County, to recover $118,338 on note executed in April, 1915. Situated on Deer Creek, second largest mining holdings in district.

Plumas County

ONION PLACER (Greenville)—To resume operation. Heavy snows insure abundance of water. Joseph Baccala and William Roedde, owners.

TRASK & COFFER (Taylorsville)—Compressor installed in Moonlight Canyon. Development discloses large deposits copper ore carrying gold and silver.

COLORADO

Boulder County

SLIDE (Gold Hill)—Milling ore opened on 800, 900 and 1000 levels. Mill running three shifts on ore from these levels, and from Slide dump. Concentrates shipped to local sampling works at Boulder.

BLACK ROSE (Jamestown)—Acquired by W. F. Dopp and associates; will begin development.

COLORADO PITCHBLEND (Jamsetown)—Employ 15 men in development. Golden Age mill, recently remodeled, treating 125 tons per day. Reported fluorspar product averaging 94% calcium fluoride; iron-lead concentrate treated by flotation.

NUGGET (Rowena) — Purchased by Omaha men; will develop soon.

PRUSSIAN (Rowena)—S. A. Tarbett & Co. developed milling ore. Prussian mill operating with flotation unit.

TIPPECANOE (Rowena)—Acquired by E. P. Copeland and associates, of Boulder. Cleaning tunnel and other workings preparatory to development.

Dolores County

RESOLUTE MINING CO. (Rico)—To operate new 100-ton concentrating plant. Expect to purchase all equipment soon. J. A. Houghton, 54 De Menil Bldg., St. Louis, Mo., president.

Gilpin County

IRON CITY MILL (Black Hawk)—John Mollard and associates, of Idaho Springs, secured three-year lease. Mill will be remodeled and flotation equipment installed. Plant will be designed to treat ores from the Becky Sharp, Lillian, and other mines in Russell Gulch, partly to save transportation charges on milling products. John Scibird, formerly superintendent at Argo mill, near Idaho Springs, will be in charge of mill.

IDAHO

Shoshone County

NABOB (Beeler) — Framework of new mill on Pine Creek completed. Most of machinery on ground and being installed.

CARBONATE HILL (Mullan) — Work started after suspension, owing to war conditions. Shaft down over 400 ft. Will crosscut vein at 400 level. Old workings show lead and zinc in 100-ft. vein, and some encountered in sinking shaft. Shaft sunk from lower tunnel. Modern hoisting plant in underground chamber. Will employ 25 men.

NATIONAL (Mullan)—Management announces mill will start after suspension of two months. Enough ore broken to run three months. New oreshoot of better grade, recently found on 800 level, will be developed.

HERCULES AND TAMARACK (Wallace)—Resumed operations after four months' suspension. Each working one shift until repairs at Northport smeltery are completed, to permit handling maximum product. Considerable difficulty experienced in getting the limited forces required.

MICHIGAN

Copper District

MOHAWK (Mohawk) — Openings in lower levels No. 6 shaft not in as good rock as those of 4 and 5. This is similar to past occurrences. No. 6, 15th level, in 470 ft. south and 490 ft. north. South opening at 14th level in 401 ft., north 500 ft. North drift at 12th level in 135 ft. and south 117.

SENECA (Mohawk)—Crosscut struck vein 35 ft. from shaft; in 21 ft. and no hanging wall yet in sight. Crosscut is 8 x 9 ft. not exactly at right angles, owing to rake of shaft.

COPPER RANGE (Painesdale)—Baltic's deepest shaft is No. 3, at 3500 ft.; newest openings show copper rock averaging 32 lb., after selection. Continues shaft sinking. No. 4 shaft down 3000 ft., No. 2, down 2900 ft. During 1918 the Baltic drifted a total of 11,991 ft., including work on west lode, subdrifting 164 ft., crosscutting 965 ft., and raising 663 ft. Total tonnage hoisted was 422,035. Stamped 293,601; waste, 128,484, or 30 per cent.

Gogebic Range

NORRIE-AURORA (Ironwood) — Drill-sharpening shop, 40 x 40 ft., completed. Has four oil forges, sharpening machines, puncher, oil temper tank, and drill racks.

Menominee Range

DUNN (Crystal Falls)—Shut down completely; only pumps running.

ODGERS (Crystal Falls)—Shut down completely; only pumps running. Thus all McKinney Steel Co. mines in Iron County are down, the Tobin (Crystal Falls) and Tully (Stambaugh) having closed in January. Between 400 and 500 men have been let out at these properties, and others in county are curtailing operations.

WEST CHAPIN (Iron Mountain)—Planning to erect charcoal blast furnace. Ore low in phosphorus, but low in iron also; has not been a shipper.

MINNESOTA

Cnynna Range

MANGAN No. 1 (Ironton)—Closed down pending betterment of ore market; 10,000 tons manganiferous ore in stockpile.

PENNINGTON (Ironton)—Open pit of Tod-Stambaugh shipping.

JOAN No. 4 (Trommald)—Marcus L. Fay property closed down, as unable to pump water required when surrounding mines closed.

Mesabi Range

CLARK (Chisholm)—Rushing operations to exhaust ore before expiration of lease, which occurs this year. Estimated 500,000 tons still available.

SHENANGO (Chisholm) — Shut down May 1, releasing about 100 miners. One of oldest properties on range, in continuous operation since original shaft sunk, in 1901. Operated by Shenango Furnace Co. which will ship some ore from open-pit portion.

LEONIDAS (Eveleth)—Washing plant being installed by Oliver Iron Mining Co. nearing completion; all material on ground. A feature is a 35-ft. log washer and 60 x 48-in. jaw crusher.

MORRIS (Hibbing)—New crushing and screening plant in operation Apr. 16.

BRAY (Keewatin)—Closed down May 1, account uncertain ore market. Operated by Republic Iron and Steel Co.

STATE MINES (Mesabi District)—Shipments to Apr. 26 totaled 107,351 tons, divided as follows: Pool, 1350; Hill Annex, 3895; Philbin, 6055; Wanless, 8832; Leonidas, 16,605; Shiras, 24,150; Missabe Mountain, 46,464.

LA RUE (Nashwauk)—Will not start washing ore until about June 1.

YORK (Nashwauk) — Began shipping Apr. 28. Crosby, same district, began shipping May 1.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn, via Divide)—Two raises from Idanha fissure on 1000 level showing high-grade ore up to as high as driven, approximately 200 ft, tops of raises being connected by drifting, with ore exposed all the way. Ore carries gold, silver, lead, copper, and zinc. Blocking out ore preparatory to shipment when Montana Southern Ry., now under construction, has reached Elkhorn. Railway a subsidiary of company. Samuel Hall, superintendent.

Jefferson County

PLACER MINING in Montana City has begun on a bar bordering Prickly Pear Creek.

FREE COINAGE (Clancy) — Amalgamated Silver Mines Co. shipped four carloads during April.

LEGAL TENDER (Clancy) — Sacking high-grade silver ore for shipment.

ELKHORN QUEEN (Elkhorn) — Prospecting below 550 level.

Lewis and Clark County

POWELL COUNTY (Bald Butte)—Hydraulic and ground sluice work begun in Uncle Ben Gulch.

HELENA MINE (Helena)—New contact lead in south 400-ft. drift; higher-grade ore.

HELENA PLACERS (Helena)—Sinking 60-ft. shaft in Last Chance Gulch begun on West Main St.

Missoula County

POTOMAC COPPER (Potomac)—Ten teams building road to connect with Potomac highway, where connection is had with railroad. Two compressors purchased, compressor plant under way, preparatory to starting 1200-ft tunnel under "Copper Cliff" outcropping of quartzite carrying chalcocite and averaging about 2% copper. Irving W. Higgins, superintendent.

Powell County

MONARCH MINING (Elliston)—Installation of compressor plant under way; cutting mine timbers and mill construction proceeding. Employs 25 men. Development by tunnels. Frank Eichelberger, manager.

Silver Bow County

CRYSTAL COPPER (Butte)—Crosscutting and drifting on north and south veins on 500 ft. level. Second north fissure expected to be cut. Carload of ore will be shipped this week. W. D. Gibson, superintendent.

GREAT BUTTE COPPER (Butte)—Crosscutting and drifting on 2000-ft level on several fissures thus far failed to disclose ore and further financing of operations is in progress. F. W. Bacorn, superintendent.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments during week ended Apr. 24 were: Prince Consolidated, 25 cars; Virginia-Louise, 7 cars; Harney (Stindt and Donohue lease), 2 cars; Consolidated Nevada-Utah, 1 car.

HARNEY (Pioche)—Stindt and Donohue lease. Headframe being erected and hoisting engine installed. Peter Buol in charge. Big Five lease. Struck extension of rich orebody recently discovered in adjoining Stindt & Donohue lease.

Nye County

Tonopah shipments for week ended Apr. 19 amounted to 7,099 tons, of estimated gross milling value of $120,683. Shippers were: Tonopah Belmont, 2052 tons; Tonopah Milling, 1100, Tonopah Extension, 1955, West End, 863; Jim Butler, 1[illegible]5; Montana, 277, Tonopah Divide, 120; MacNamara, 210, Midway, 31, Rescue, 63; and miscellaneous, 10 tons.

ALTO DIVIDE (Divide)—Large compressor in operation supplying air to Alto and East Divide being under same control and adjoining. Joseph Mayer, manager, J. K. Turner, consulting engineer.

BROUGHER DIVIDE (Divide)—Installing larger machinery delayed work on 500 level. Southeast drift on this level, near center of vein, advanced 140 ft, large part of distance in good milling ore exposing some ore of shipping grade. Crosscut showed 22 ft of milling ore. Another drift started northwest on Brougher vein.

DIVIDE CONSOLIDATED (Divide) — Two compartment shaft sunk and timbered 50 ft; second largest hoisting and air plant in district installed, including 10-drill compressor. Sinking resumed. Richard Finn, superintendent.

DIVIDE EXTENSION (Divide)—Shaft nearing 350-ft. point, and will crosscut through vein in this ground from adjoining Brougher. Vein here said to be in the area affected by block faulting, which brought lower breccia nearer surface, as in adjoining Divide mine. Good silver assays obtained from surface workings on knoll or blow-out 600 ft. north of main shaft.

EAST DIVIDE (Divide)—Using air drills, and shaft down 380 ft. Station will be cut for lateral work at 400-ft. point. Shaft cut silver ore stringers.

GOLD ZONE (Divide)—Machinery for larger surface plant arriving; shaft will be sunk from 500 to 800-ft. point at once. Seams of ore cut in southeast drift on 500 level; northeast crosscut on this level, from shaft, penetrated separate vein or fracture zone, trending more to east and showing seams several inches wide.

SUTHERLAND DIVIDE (Goldfield) — Owns 135 acres, five miles from Tonopah in Divide district. Installed plant and started development; power turned on Apr. 24; working two shifts in 400-ft. shaft sunk in days of Tonopah boom, now in good condition. Will explore 300 level and sink shaft 200 ft. deeper for lateral extensions.

TONOPAH DIVIDE (Divide)—Fourth, or 465 level, hanging wall drift advanced southeast 250 ft., near point under high-grade sill on third level, where chamber 20 x 50 ft., 10 ft. high, produced ore showing high contents. Lower drift continues in ore, some being high grade. Raises from second and third levels connected with drifts above, all in high-grade ore. Shaft sunk to 565 level, where station cut, and south crosscut will be started to vein soon. Now awaiting completion of foundations for 1200-cu.ft. compressor, purchased from Goldfield Merger Mines, and large double-drum hoisting engine. Latter will be installed when next level opened. Time lost in these improvements will be recovered with increased air supply. Shipments to MacNamara mill, at Tonopah, are 60 tons daily. Mill construction will be considered when water level is reached.

TONOPAH DIVIDEND (Divide)—Shaft being sunk below 300 level; electrically driven hoisting engine being placed at shaft collar, replacing gasoline engine. Equipment includes electrically driven compressor. E. P. Cullinan in charge.

NEW MEXICO

Grant County

CHARLES FOWLES, Lordsburg, owner and superintendent of silver-lead mine at Old Hachita, will purchase new pumping plant, including power equipment to handle 250 gal. per minute.

APACHE MOUNTAIN (Hachita) — Anderson Apache Copper Mining Co. reopened silver-lead properties four miles south of Hachita. Shipped one car ore to El Paso smeltery in April. Robert Anderson superintendent.

OLD HACHITA (Hachita)—O. O. and E. Mattox and Charles I. Auer took over Tom Wright interests and acquired additional ground. Shipped one car silver-lead ore to El Paso smeltery last month, and will ship another soon.

BOSTON HECLA (Lordsburg)—Situated three miles southwest of Lordsburg, in charge of R. E. Van Druff. Open for contract to sink a two-compartment shaft 260 ft below 40 ft. level. Raw timber so far secured.

UTAH

Juab County

TINTIC SHIPMENTS, week ended Apr. 25, amounted to 134 cars.

CHIEF CONSOLIDATED (Eureka)—Report to Board of Equalization of net proceeds for 1918, $773,737, which multiplied by three is $2,321,211 as basis for taxation. Machinery and improvements, $113,210. Gross yield from 66,019 tons of ore produced, $2,956,601, from which deductions of $1,055,780, cost of extraction, reduction, transportation, and construction. Metal content, 4100 oz. gold, 2,354,798 oz. silver, 7,906,831 lb. lead, 4137 lb. copper, and 11,597 lb. zinc.

IRON KING (Eureka)—In east Tintic property. Purchased compressor and hoisting plant. Has iron ore suitable for fluxing which it may market on completion of Goshen Valley R.R. Also seeking to develop other ores. Near Tintic Standard.

TINTIC DRAIN TUNNEL (Eureka)—Now completed for 2500 ft. Again in softer ground and timbering necessary.

Salt Lake County

COLUMBUS-RENALL (Alta) — Gross yields 1918 amounts to $153,568; net proceeds, $41,485. Machinery, $14,932.

OHIO COPPER (Bingham)—Report to State Board of Equalization for 1918 shows production of 3,442,647 lb. copper; gross yield $861,926, and deductions, $894,701, making deficit, $32,744. Extraction, $219,934; reduction expense, $584,070; transportation, $90,696.

UTAH CONSOLIDATED (Bingham) — Gross yield for 1918 equals $2,827,571; deductions, $2,571,060, leaving net proceeds $256,511. Machinery valued at $241,010; buildings and tramway at $87,400.

WASHINGTON

Whatcom County

CANADA OIL AND VENTURE CO. (Vancouver, B. C.)—Has let contract to Diamond Drill Contracting Co., 419 1st St., Spokane, Wash., to continue a hole now 2640 ft. deep to 3500 ft. Object is to prospect for oil or gas. Hole is at Enterprise station on Great Northern Ry., 2½ miles north of Ferndale, Wash.; was started about five years ago.

CANADA

British Columbia

INTERNATIONAL MINING CONVENTION will be held at Nelson, June 19-20-21. Government aiding project, subscribing $2500.

Ontario

IN BOSTON CREEK SECTION the mines are negotiating with Northern Ontario Light and Power Co. for electric power. Power line passes practically through the camp, and only substation and distributing lines required.

ADANAC (Cobalt) — Has made another discovery of high-grade ore in new vein.

CROWN RESERVE (Cobalt)—Installed underground electric haulage system; only one of its kind in Cobalt.

T. & H. B. (Cobalt)—Surrendering charter as result of formation of operating company known as Hudson Bay Mining Co. The T. & H. B. was first company to take holdings in Cobalt and first to pay a dividend, which was 200%. Was capitalized at $25,000 and only 7,761 shares of $1 par issued. Stock at one time difficult to dispose of at 10c. a share, ultimately sold at $375. First mining work done was to sink shaft. First 65 ft. of sinking returning $55,000 worth of ore.

GOLD REEF (Porcupine) — To be reopened.

MEXICO

Estado de Sonora

CACHARAMBA (Alamos) — Owned by Plata Fina Mining and Development Co. Has completed 3000 ft. of development work, blocking out $50,000 medium-grade silver-copper ore. Completed truck road to Navajo, 35 miles. Will start shipments in 60 days. T. P. Brinegar, superintendent.

PIEDRAS VERDES (Alamos) — Has 2500 acres low-grade copper ore, 25 miles from Alamos, under option to New York parties.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—April clean-up, $400,000. Clean-up for March as follows: Tabowie Mill, 11,064 tons, yielding $32,675, Taracol, 10,258 tons, yielding $19,773, Taracol cyanide plant, $50,750.

Begun mailing bullion to Tokio, care of Dai Ichi Ginko, Ltd. Tanaka Choten taken contract, accepting company assay. The D. I. G. in Tokio collects value from purchasers before delivery of gold. Receiving 5.18 yen per momme for pure gold and 24 yen per momme for silver contents. Gold value is advance of 3.6% over par value of 5.00 yen per momme. Tanaka Choten deposited 10,000 yen as guarantee to accept gold at this rate for six months.

Epidemic of foot and mouth disease among the bulls practically over; quarantine lifted in latter part of March. Suritong dam should be completed by July if present labor force can be maintained, and no unusually bad weather hampers the work; expect farmer element to return to farms in few weeks, but hope to replace them with Chinese, who are coming in daily. Water was turned through tunnel on Mar. 22, lowering river several feet, helping work of excavating and stripping to bedrock. Chorrie reservoir down to 6½ ft., and unless some rain falls, hydro-electric power will fail soon. No evidence here of political outbreaks by natives which occurred in other parts.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	May	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
1	4.6650	101⅛	48$\frac{13}{16}$	5	4.6725	101⅛	48$\frac{11}{16}$
2	4.6700	101⅛	48$\frac{11}{16}$	6	4.6800	101⅛	48$\frac{9}{16}$
3	4.6700	101⅛	48$\frac{11}{16}$	7	4.6813	101¾	48½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
1	15.35	†72½	4.72½ @4.77½	4.55 @4.60	5.95
2	15.35	†72½	4.72½ @4.77½	4.55 @4.60	5.95
3	15.35	†72½	4.72½ @4.77½	4.52½ @4.57½	5.92½
5	15.35	†72½	4.75 @4.80	4.47½ @4.57½	5.90 @5.92½
6	15.35	†72½	4.75 @4.85	4.50 @4.60	5.90
7	15.35	†72½	4.75 @4.85	4.50 @4.60	5.90

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

May	Copper: Standard Spot	Copper: Standard 3 M.	Copper: Electrolytic	Tin: Spot	Tin: 3 M	Lead: Spot	Lead: 3 M.	Zinc: Spot
1	76	76¼	80½	226¾	226	24½	24	35¼
2	75¼	75¾	80½	226¼	225¾	24½	24	35¼
3	...	...	...	...	...	...	...	...
5	75¾	76	80	226¾	227	24½	24	35
6	76½	76½	80	227¾	228	24	24¼	34½
7	76 35	76½	80	228½	228¼	24½	24 35	34¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—May 7, 1919

Copper was distinctly firm this week, and practically none was to be had except at the terms of the big producers. Lead was soft during the early part of the week, but was firmer toward the close. Zinc broke through the 6c. price and declined from day to day.

Important events of the week were the removal of all import licenses except with respect to tin and some minor substances; and the removal of the restrictions on the exportation of silver, which sets the silver market free to rise if demand and supply so determine, while, on the other hand, the replacement of the silver taken from the Treasury under the terms of the Pittman Act may guarantee the market against a decline below $1 per oz., or the net equivalent thereof. However, there is no certainty as to how things are going to work out.

Transatlantic freights became easier for shipments to British ports, 1c. per lb. being quoted. The rate to French ports is 1½c. The rate from Pacific ports to Hongkong and Kobe remains at $15 per ton.

Tuesday was a holiday in New York City, but the banks were open. Some of the business houses were open and some were closed. Considerable business in the metals was transacted, and we do not therefore regard the day as a holiday.

Copper—A rather fair volume of business was done, the total being rather more than in the previous week. This was mainly for domestic account and was mainly with wire-drawers. There was scarcely any business in cakes and ingots. Any business that might be done with brass makers is overshadowed by the large supplies of scrap that are offered, a good deal of it being high-grade scrap. There was some trifling export business, among which were some small sales to Japan. This produced the curious situation of Japan offering electrolytic copper in England at prices below ours, while, on the other hand, she is buying electrolytic copper from us. The explanation is probably that the offerings in England are from copper in stock there, or afloat thereto, while refining costs in Japan have risen to such an extent that it may have become cheaper to buy from us. It is not expected, however, that the Japanese demand will amount to much.

Domestic copper manufacturers report slack business. The copper that they are taking is mainly for maintenance work. The railways and public service corporations are not buying at all. Among the wire-drawers there is very keen competition, which sometimes leads to the sacrifice of the profit on copper that was purchased more cheaply a couple of months ago.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17¼@17½c. per lb. f.o.b. mill, carload lots.

Tin—American smelters decline to sell for future delivery, which indicates that some kind of protection has been promised. In the meanwhile, it is said that the stock of the U. S. Steel Products Co. is being allocated very slowly, and it may be the middle of June before it is disposed of.

Lead—Injudicious actions with respect to the sale of some of the Government lead continued to trouble the market. During the early part of the week the market was soft, but in the latter part there was a distinctly firmer tone, and sales were made at 4.80c., around which price several producers were willing to sell. The rally in price may have been due to speculative buying, there having been a good deal of inquiry from speculative interests. Even at the lower prices, however, the big lead manufacturers have not been tempted to buy in the open market. This might be regarded as disappointing, were it not that they were reported to be taking in lead more liberally on average-price contracts, an unusually large proportion of the lead at present going into consumption in that way. Producers report an increase in the demand from manufacturers of lead pipe and plumbers' supplies, which appears to be spreading eastward from the West. This would be a natural development in the face of the prospect for increased building. Japan inquired for lead this week and bought some.

From the standpoint of the lead producer the present situation is very uncomfortable. The three Utah smelters which six weeks ago were running 16 furnaces are today running only 10, and even that number may have to be curtailed. The Utah Apex mine, one of the large producers of Utah, has been closed. Ore supply in Colorado is so short that the Globe plant at Denver is going to be closed. Some of the Coeur d'Alene producers are maintaining a high rate, while others have curtailed operations owing to inability to continue production except at a loss. Without doubt the price under 5c. is effecting a drastic restriction of production.

The American Smelting and Refining Co maintains its price of 5c

Zinc—Some considerable business was done, a good deal of which was of speculative character. However, galvanizers bought some. There were sellers on many hands, and the price declined from day to day. This week is noteworthy as the first week since January, 1915, in which the price for spelter has been below 6c.

There was no inquiry for high-grade zinc, and it is impossible to say what the market for it would be.

Zinc dust can be bought at 1.5 the price for common spelter.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Nominal at 33c.

Antimony—This market was a little firmer, although not very much business was done. During the early part of the week antimony was still to be had at 6⅞c., and possibly that price might have been shaded. At the close we quote spot at 7c. Prompt shipments from the Orient are quoted at 6¾@7c.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—This market became distinctly firmer. We quote California virgin in New York at $77. San Francisco telegraphs $73, strong.

Silver and Platinum

Silver—The silver situation has been entirely changed by the announcement made on May 6 by the Federal Reserve Board that the existing restrictions on the export of silver were removed, thus reëstablishing an open market for silver. Inasmuch as there has been an accumulation of orders for export for which licenses could not be obtained, it is likely that there will be some advance in price until these orders are filled. The price eventually will be governed by the Indian and Chinese demand. Sellers are holding off, awaiting developments, and the market closes unsettled.

Mexican dollars at New York: May 1, 77½; May 2, 77½; May 3, 77½; May 5, 77½; May 6, 77½; May 7, 78¾.

Platinum—Refined ingot was strong at $100, with good demand for it.

Palladium—We quote $120@121.

Zinc and Lead Ore Markets

Joplin, Mo., May 3—Blende, per ton, high, $40.95; basis 60% zinc, premium, $37@36; Prime Western, $35@34; sludge and flotation, $33@30; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $37.04; calamine, $22.62; all zinc ores, $36.74.

Lead, high, $61.70; basis 80% lead, $58@56; average settling price, all grades of lead, $56.11 per ton.

Shipments the week: Blende, 9148; calamine, 199; lead, 1364 tons. Value all ores the week, $419,950.

Some sellers declined to accept the reduction of $1 per ton on Thursday, but by Friday evening most of them were selling.

Producers cannot agree among themselves as to a plan of restriction of output to a level of the market necessity, and those who comprehend the metal situation are expecting a crisis in zinc-ore prices that may close down, by necessity, a large proportion of producing plants.

Platteville, Wis., May 3—Blende, basis 60% zinc, no sales or offerings for premium grades reported; $37 base offered for high-lead blende early in the week, but no sales reported.

No sales of lead ore were reported.

Shipments reported for the week are 2007 tons blende and 694 tons sulphur ore.

For the year to date the totals are 33,751 tons blende, 1720 tons galena, and 2611 tons sulphur ore. During the week 2920 tons blende was shipped to separating plants

Other Ores

Manganese Ore—A little business was done on the basis of 50c. per unit, delivered at buyers' works, but there was no great interest even at that price.

Molybdenum Ore—No business reported.

Tungsten Ore—The market became very dull. We quote $6@7 for ordinary grades of ore.

Pyrites—Spanish pyrites is quoted at 21c. per unit for furnace ore, c.i.f. New York or any South Atlantic or North Atlantic port.

Iron Trade Review

PITTSBURGH—May 6

The iron and steel market continues to mark time. Instances of increased activity are the exception, the general trend, where there is any, being in the direction of greater dullness. Mill operations are uniformly declining, excepting the case of sheet and tin mills. With somewhat improved demand for electrical sheets, some sheet mills are slightly increasing their operations, though the tin-plate mills are approximately holding their own, operating at about 55% at a time of year when normally they are busy, even if steel demand generally is light.

The majority of the large independent steel interests are operating at slightly less than 50% of capacity, though small interests show widely varying conditions, some operating between 75 and 100% and some being closed entirely. The Steel Corporation is operating at an average of about 65%, and the steel industry as a whole is running at somewhat under 60%, against 77% in March and 87% in January. With a continuance of the trend of the last few weeks, old orders gradually being exhausted and new buying light, the mills would be operating at not over 40% in July.

Buyers of steel are indifferent. They have no price level in mind which they would accept as a basis for making heavier purchases. The everyday buyer, the jobber, and the manufacturing consumer buy in the smallest possible quantities, ordering at frequent intervals and simply paying the market price.

Obviously, the situation calls for an "open market," for, when buyers are unable to determine the prices at which they would be willing to take hold, it requires an active competitive market to give them confidence in prices. The majority of steel salesmen would like to see an open market develop, and many of them believe prices would not recede a great deal in such case, as it is not so much the price itself as the manner in which the price is developed that gives the buyer confidence. The small number of men who control the policies of the large producers apparently believe otherwise, evidently feeling either that there is no large amount of business to be brought out by low prices, or that, with competitive selling, prices would drop to a ruinously low level.

Pig Iron—Furnishing a curious commentary on the fears of leading steel producers that abandonment of the present understanding and establishment of open-market conditions would lead to sharp price declines, the pig-iron market has been an open one, according to the testimony of the merchant furnaces, for fully a month, yet in the western Pennsylvania, Valley and Lake front markets there has not been a single decline from the prices that became effective Mar. 21. Some of the furnaces would be glad to cut prices $1 or $2 a ton to secure an order for 1000 to 5000 tons, but the inquiry does not develop, sales being confined to carloads up to 100 tons, at full prices. An exception is a sale of 500 tons of standard bessemer, at $27.95, Valley, the recognized price, delivery 100 tons a month, but the circumstances of the buyer were somewhat unusual. W. P. Snyder & Co. announce average prices obtaining on sales of Valley iron in April at $27.95 for bessemer, and $25.75 for basic, these being the regular quotations. We quote the market steady to quiet at former prices: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75; f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—There is no inquiry for either large or small lots. Deliveries of billets and sheet bars on regular contracts are somewhat lighter. We quote: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferromanganese—Resale 80% ferromanganese is now available at $110@115 delivered, or $5 decline in the week, producers continuing to quote $150. Resale 18% spiegeleisen is $33@35, delivered.

Coke—The spot furnace coke market is again a shade stiffer, at $3.70@3.75 per net ton at ovens, Connellsville region, the stiffness being due not to increased demand, as demand is light, but to closer adjustment of production to contract requirements. Contract settlements for May deliveries are generally at $4. Spot foundry coke is $5.25@6, depending on brand.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	....	37.940	48.980	......
June	76.971	99.500	....	39.065	48.875	......
July	79.010	99.625	....	40.110	48.813	......
Aug.	85.407	100.292	....	43.418	49.077	......
Sept.	100.740	101.125	....	50.920	49.500	......
Oct.	87.332	101.125	....	44.324	49.500	......
Nov.	85.891	101.125	....	43.584	48.969	......
Dec.	85.960	101.125	....	43.052	48.492	......
Year	81.417	96.772	....	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500	.....	110.000	.....	125.000	.....
June	23.500	.....	110.000	.....	125.000	.....
July	25.904	.....	119.913	.....	134.913	.....
Aug.	26.000	.....	122.000	.....	137.000	.....
Sept.	26.000	.....	122.000	.....	137.000	.....
Oct.	26.000	.....	122.000	.....	137.000	.....
Nov.	26.000	.....	122.000	.....	137.000	.....
Dec.	(a)	.....	118.447	.....	133.167	.....
Year	24.628	.....	115.530	.....	130.507	.....

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.905	225.275
May	(a)	.....	364.217	.....
June	(a)	.....	331.925	.....
July	(a)	.....	360.347	.....
August	(a)	.....	380.900	.....
September	(a)	.....	343.905	.....
October	(a)	.....	335.543	.....
November	(a)	.....	323.550	.....
December	(a)	.....	267.736	.....
Av. year	(a)	.....	330.138	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818		6.704		29.00	
June	7.611		7.511		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.681	6.922	54.000	58.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	6.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.60	33.95	31.40	33.95	29.12
April	36.15	29.35	32.95	27.15	33.95	28.15
May	36.20		33.00		34.00	
June	36.30		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.46	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	May 5
Alaska Gold M.	3½
Alaska Juneau	2
Am.Sm.&Ref.,com.	73½
Am.Sm. & Ref., pf.	106
Am.Sm.Sec., pf., A	95
Am. Zinc	17½
Am. Zinc, pf.	48½
Anaconda	63
Batopilas Min	1½
Bethlehem Steel	‡74
Butte & Superior	23½
Butte Cop. & Zinc	8
Cerro de Pasco	40¼
Chile Cop	23¾
Chino	37½
Colo. Fuel & Iron	44½
Crucible Steel	70¾
Crucible Steel, pf.	95½
Dome Mines	14
Federal M. & S.	12
Federal M. & S., pf.	39½
Great Nor., ore ctf.	45¼
Greene Cananea	40
Gulf States Steel	54½
Homestake	89
Inspiration Con	50¼
International Nickel	25½
Kennecott	32¼
Lackawanna Steel	71
Mexican Petrol	176½
Miami Copper	23¾
Nat'l Lead, com	74¾
National Lead, pf.	110
Nev. Consol	16¼
Ontario Min	7½
Ray Con	20½
Republic I.&S., com.	82½
Republic I.&S., pf.	103½
Sloss-Sheffield	63½
Tennessee C. & C.	16½
U. S. Steel, com.	99
U. S. Steel, pf.	115½
Utah Copper	77¾
Va. Iron C. & C.	60
Worthington Pump	67½

BOSTON CURB*	May 6
Boston Ely	1
Boston & Mont.	.76
Butte & Lon'n Dev.	.11
Calaveras	.50
Chief Con	3⅛
Contact	.05
Corbin	‡ .25
Cortez	.15
Crown Reserve	.35
Crystal Cop	.20
Eagle & Blue Bell	2⅛
First Nat. Cop	1½
Gadsden Cop	3¾
Houghton Copper	.20
Intermountain	‡ 05
Iron Blossom	40
Iron Cap	10
Majestic	.16
Mexican Metals	16
Mines of America	‡ 05
Mojave Tungsten	.10
Nat. Zinc & Lead	13
Nevada-Douglas	15
New Baltic	1
Oneco	20
Pacific Mines	‡ 25
Rex Cons	14
Yukon Gold	.76

SAN FRAN.*	May 5
Alta	08
Andes	‡ 26
Best & Belcher	34
Caledonia	24
Challenge Con	‡ 03
Confidence	‡ 03
Con. Virginia	‡ 95
Gould & Curry	14
Hale & Norcross	‡ 17
Jacket-Cr. Pt	14
Mexican	61
Occidental	40
Ophir	1 95
Overman	10
Savage	14
Sierra Nevada	22
Union Con	43
Utah Con	‡ 04
Belmont	3 00
Jim Butler	83
MacNamara	02
Midway	59
Mont.-Tonopah	20
North Star	09
Rescue Eula	22
West End Con	1 95
Atlanta	05
Booth	‡ 30
Comb. Frac	‡ 03
Florence	43
Jumbo Extension	14
Kewanas	05
Nevada Hills	.05
Nevada Packard	20
Round Mountain	40
Silver Pick	11
White Caps	25

COLO. SPRINGS*	May 5
Cresson Con	4 81¼
Doctor Jack Pot	04
Elkton Con	06½
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	1 80
Granite	14
Isabella	05½
Mary McKinney	07½
Portland	1 01
United Gold M.	17
Vindicator	.30

BOSTON EXCH.†	May 6
Adventure	‡ .50
Ahmeek	70
Algomah	.20
Allouez	35
Ariz. Com	12
Arnold	‡ 20
Bingham Mines	7¾
Bonanza	‡ 10
Butte-Balaklava	25
Calumet & Ariz	59½
Calumet & Hecla	375
Centennial	‡12
Copper Range	42½
Daly West	‡2½
Davis-Daly	5¼
East Butte	8
Franklin	2½
Granby	‡66½
Hancock	5
Hedley	‡12
Helvetia	1⅛
Indiana	‡ 50
Isle Royale	25
Keweenaw	‡1½
Lake	14½
La Salle	2¼
Mason Valley	‡3½
Mass	4½
Mayflower	4½
Michigan	4½
Mohawk	56
New Arcadian	1¾
New Cornelia	17½
New Idria	9
Nipissing	9½
North Butte	10
North Lake	‡ 25
Ojibway	‡1½
Old Dominion	32¾
Osceola	46½
Quincy	54¾
St. Mary's M. L.	‡ 43
Santa Fe	‡ 35
Seneca	15
Shannon	2
Shattuck-Ariz	‡11
So. Lake	‡ .75
So. Utah	‡ 12
Superior	‡5½
Superior & Bost	‡3
Trinity	2½
Tuolumne	‡ 81
U. S. Smelting	55
U. S. Smelting, pf.	49
Utah Apex	1½
Utah Con	‡7½
Utah Metal	2
Victoria	2
Winona	85
Wolverine	15½

N. Y. CURB†	May 5
Am. Tin & Tung	1½
Big Ledge	⅜
Butte & N. Y.	1
Butte Detroit	‡ 04
Caledonia	‡ 32
Calumet & Jerome	‡1
Can. Cop. Corpn.	1½
Carlisle	‡3
Cashboy	.10
Con. Ariz. Sm.	1
Con. Coppermines	‡5
Goldfield Con	18
Goldfield Merger	05
Hecla Min	5
Howe Sound	3½
Jerome Verde	1⅝
Louisiana	½
Magma	‡31
Marsh	‡ 07
McKinley-Dar-Sa	‡ 44
Milford	‡ 75
Mother Lode	45
Nixon Nevada	20
Ohio Cop	‡ 60
Rawley	‡3½
Ray Hercules	3
Richmond	‡ 50
Rochester Mines	20
St. Joseph Lead	13
Standard S. L.	⅛
Stewart	‡ 36
Success	‡ 05
Tonopah	3¼
Tonopah Divide	10½
Tonopah Ex	2½
Tribullion	‡ 35
Troy Arizona	‡ 10
United Eastern	‡4½
United Verde Ext.	38
United Zinc	‡1
Utica Mines	‡ 08

TORONTO*	Apr. 29
Adanac	17
Bailey	03
Beaver Con	45
Chambers Ferland	‡ 10
Coniagas	2 00
Hargraves	02
Kerr Lake	5 37½
La Rose	35
Lake Shore	93
Min. Corp. of Can.	2 00
Peterson Lake	06
Temiskaming	34
Wettlaufer-Lor.	[illegible]
Davidson	‡ 88
Dome Exten	37
Dome Lake	24
Hollinger	6 37½
McIntyre	1 62½
Newray	12½
Porc. Crown	25
Teck-Hughes	18
Vipond	30
West Dome	12

* Bid prices. † Closing prices. ‡ Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	3 55	4 29	4 57	5 80	4 57	5.45
No. 12	3.60	4 34	4 62	5 75	4.62	5.50
No. 14	3 65	4 39	4 67	5.90	4 67	5.55
Black						
Nos. 18 and 20	4 15	5 04	5 17	6 75	5 42	6 25
Nos. 22 and 24	4 20	5.14	5 22	6 80	5 47	6.30
No. 26	4 25	5 19	5 27	6 95	5 52	6 40
No. 28	4 35	5 29	5 37	7 05	5 62	6.45
Galvanized:						
No. 10	4.70	5 64	5 72		5 97	6.70
No. 12	4.80	5 64	5 82	7 30	6 02	6.80
No. 14	4 80	5 64	5 82	7 30	6.07	6 80
Nos. 18 and 20	5 10	5.84	6 12	7 60	6 37	7 10
Nos. 22 and 24	5 25	5 99	6 25	7 75	6 52	7.25
No. 26	5 40	5 69	6 42	7 90	6 67	7.40
No. 28	5 70	6 44	6 72	8 20	6 97	7 70

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$45 00	$65 00	$45 00	$65.00
Standard openhearth rails	47 00	67.00	47 00	67.00
Light rails, 8 to 10 lb	2 58½*	3 36*	2 83½*	3.36½*
Light rails, 12 to 14 lb	2 54*	3 09*	2 79*	3.09*
Light rails, 25 to 45 lb	2 45*	3 00*	2.70*	3 00*

*Per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger	$3 25	$3.90	$4 27	$5.04	$6 15
Track bolts	4 90	4 90	5 17	Premium	7 20
Standard section angle bars	3 00	3.25	4 22	Premium	4.60

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago
Beams, 3 to 15 in.	$2 45	$3 47	$4 195	$3 39	$3 47
Channels, 3 to 15 in.	2 45	3 47	4 195	3 39	3 47
Angles, 3 to 6 in. ¼ in. thick	2 45	3 47	4.195	3 39	3 47
Tees, 3 in. and larger	2 45	3 52	4 195	3 39	3 47
Plates	2 66	3 67	4 445	3 39	3 67

STEEL SHEET PILING—The following price is base per 100l b. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2.5	$2.25	$4–5

RIVETS—The following quotations are per 100 lb.:

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
STRUCTURAL							
¾-in. and larger	$4 20	$5 05	$6 095	$4.87	$4 94	$6 70	$6 75
CONE HEAD BOILER							
¾ in. and larger	4 30	5.15	6 195	4 97	5 04	6 80	6 75
⅝ and 11/16	4 45	5 30	6 345	5 12	5 19	6.95	6 90
½ and 9/16	4 70	5 55	6 695	6.47	5.44	7 30	7 15

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+12½%
Galvanized cast steel rigging	7½%
Bright plow steel	35%
Bright cast steel	22½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.75	$7 50	$6 50	$6 25	$8 50	$7 35
Assorted	..	7 50	6 50	6 40	8 75	7 60

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars	2 75c.	Steel bars	2 25c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0 16½	$0 18	$0 19	$0 18½	$0 16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	14c.	14c.	15c.	16c.
Hollow	21c.	25c.		25c.

STEEL AND IRON PIPE—The following discounts are for carload lots f. o. b. Pittsburgh, basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's for iron, both dated Mar. 21, 1919.

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent	Galvanized Per Cent.
BUTT WELD					
¾ to 3	57½	44	¾ to 1½	39½	23½
LAP WELD					
2	50½	38	1¼	24½	9½
2½ to 6	53½	41	1½	31½	17½
7 to 12	50½	37	2	32½	18½
13 and 14	41	.	2½ to 6	34½	21½
15	38½	..	7 to 12	31½	18½
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛, ¼ and ⅜	46½	29	⅛, ¼ and ⅜	28½	11½
½	51½	39	½	33½	20½
¾ to 1½	55½	43	¾ to 1½	39½	24½
2 to 3	56½	44			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	48½	37	1¼	25½	10½
2½ to 4	51½	40	1½	31½	17½
4½ to 6	50½	39	2	33½	20½
7 to 8	46½	33	2½ to 4	35½	23½
9 to 12	41½	28	4½ to 6	34½	22½
			7 to 8	26½	14½
			9 to 12	21½	9½

From warehouses at the places named the following discounts bold for steel pipe

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	47%	46½%	71½%
3½ to 6 in. lap welded	42%	42½%	53½%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	31%	31%	44%
3½ to 6 in. lap welded	27%	27½%	41%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 10%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0.25	$1.00	$1.90	$1.40	$1 28	$1.05
Hot pressed hexagon	.25	1.00	1.90	1.20	1 08	.85
Cold punched square	2 25	1.00	1 90	.75	1.30	1.50
Cold punched hexagon	2.25	1.00	1 90	.75	1 30	1.50

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	40%
Chicago	50%	50%
Cleveland	50–30%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	40%	50%	45-5%
Larger and longer up to 1 in. by 30 in.	50%	40%	40%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York	$2 00	Cleveland	$2 00	Chicago	$2 25

For cast-iron washers the base price per 100 lb. is as follows:

New York	$5 00	Cleveland	$4 00	Chicago	$4 00

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f. o. b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$52 00	$52 50	$53 00	$53 50
Tar pitch (in 400-lb. bbl.)	19 00	16 00	20 00	17 00
Asphalt pitch (in barrels)	36 00	36 00	41 50	41.50
Asphalt felt	67 50	67 50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.35	$1.60	$1 70	$1.95	$2 05	$2 30
No. 2 grade	1.20	1.45	1.50	1.75	1 80	2 05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.80 per roll in carload lots and $2.05 for smaller quantities.

Shingles, red and green slate finish, cost $5.00 per square in carloads, $5.25 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$0 056	$0 11	$0 162
Seattle	09	175	30
Los Angeles*	082	154	236
New Orleans	12	15	20

* F. o. b. factory, 4, 8 and 10 inch

LUMBER—Price per M in carload lots

	8 x 8-In. x 20 Ft. and Under				12 x 12-In. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$46 50	$45.00	$45 00	$46 00	$52 00	$46 00
Cincinnati	37 00		36 00		41 00	......
Kansas City	40 50	43 50	41 50	$39 50	45.50	43 50
Seattle	17 50	17 50	17 50	17.50	17 50	17 50
New Orleans	31 50 (No. 1)				36 50	
St. Paul	46.00	50 00	46 00	46 00		53 00
Denver	44 00	36 50	36 50		49 00	39 00
Atlanta	35 50	..	......	......	40 50	.. ..

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	Y.P.	Fir
Boston	$50.00	$45 00	$40 00	$45.00	$48 50
Cincinnati	50 50	40 00	40 00	48 50	44 50
Kansas City	50 00	57 75	55 75	53 50	63 00
Seattle	17 50	17.50	17.50	17 50	17 50
New Orleans	34 and $41 for No. 1 and No. 2			31 50 (No. 1)	
St. Paul	50 50	40.00	40 00	48 50	45 50
Denver	45 00	35 50	35 50	38 00	32 00
Atlanta	20 00	....	....	33.00	
Los Angeles		31 00	30 00	..	

* Los Angeles: Base price of fir is $32; of hemlock, $34, redwood, $35

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 25	$4 00	$4 37	$5 00	$4 75
Cut	3 45	6 50	6 50	5 75	

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags

	Current	One Month Ago	One Year Ago with Bags
New York	$2 30	$2 45	$2 55
Jersey City	2 27	2 62	2 50
Boston	2 57	2 57	2 87
Chicago	2 00	2 05	2 36
Pittsburgh	2 05	2 15	2 71
Cleveland	2 22	2.32	2 84
Denver	2 67	2 67	3 20

Note—Charge for bags is generally 15c. each, 60c. per bbl.

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$17 50	$14 50	$2 90	$2 65
Kansas City	21.00	.	.....	2 20*
Chicago	18 00	17 50	1 80*	1 10*
St. Louis	22 00	18 00		1 75*
Boston	22 50	18 25	3 65	3 30
Dallas	2 25*	1 25*		
San Francisco	19 00			2 00†
St. Paul	‡23 00	19 50	1 60*	1 50*
New Orleans			...	1.65*
Atlanta		18 50	.. .	1 50*
Los Angeles		.	3 05†	2 80*
Denver	.	26 25		2 50*

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton.
Note—Refund of 10c. per barrel

LINSEED OIL—These prices are per gallon

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel...	$1 63	$1 55	$1 71	$1 65	$1 80	$1 65
5-gal. cans	1 76	1 65	1 81	1 80	2 00	1 75

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound

	Red				White	
	Current		1 Year Ago		Current	1 Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13 00	14 50	11 25	11 00	13 00	10 50
25- and 50-lb. kegs	13 25	14 75	11 50	11 25	13 25	10 75
12½-lb. keg	13 50	15 00	11 75	11.50	13 50	11 00
5-lb. cans	15 00	16 50	13 25	13 00	15 00	13 00
1-lb. cans	16 00	17 50	13 25	13 00	16 00	13 00

MINING AND MILLING SUPPLIES

HOSE

Fire	50-Ft. Lengths
Underwriters' 2½-in.	75c. per ft.
Common, 2½-in.	30%

Air	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0 55	$0 40	$0 30

Steam—Discounts from List

First grade [illegible] Second grade 35% Third grade 40%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	45%	40%
St. Louis	45%	50%
Chicago	45%	40%
Birmingham	35%	35%
Denver	35-5%	30%

RAWHIDE LACING—50c. for cut; 45c. per sq. ft. for ordinary

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft.; ⅝-in., 6; ¾-in., 4½; 1-in., 3⅓; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0 26	Denver	$0 29½
New York	28	Kansas City	29
Cincinnati	29	New Orleans	28½
Chicago	26½	Seattle	27½
St. Paul	28	St. Louis	27
San Francisco	26	Atlanta	28

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1 60
Duck and rubber for piston packing	1 00
Flax, regular	1 20
Flax, waterproofed	1 60
Compressed asbestos sheet	1 00
Wire insertion asbestos sheet	1 20
Rubber sheet	60
Rubber sheet, wire insertion	80
Rubber sheet, duck insertion	50
Rubber sheet, cloth insertion	30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1 20
Asbestos wick, ½- and 1-lb. balls	85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120 00 at Chester, Penn.
Chrome cement	net ton	65 00 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30 at Clearfield, Penn.
Clay brick, 2nd quality	net ton	38–48 at Clearfield, Penn.
Magnesite, dead burned	net ton	37 50 at Chewalah, Penn.
Magnesite brick, 9 x 4½ x 2½ in.	net ton	90 00 at Chester, Penn.
Silica brick	net ton	45–55 at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.

Birmingham—Fire clay, $40–$45; silica, $40–$50; magnesite, $90; chrome, $120

Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1 48	1 33
San Francisco	Douglas Fir—Green	1 35	96
San Francisco	Douglas Fir—Creosoted	2 70	1 92

Prices per tie at Missouri mills: St. Louis prices about 25c. higher

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0 70	No. 1	$0 55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	75
No. 4	.98		
7x9x8 white oak	..		1 05
7x9x8 red oak, No. 4	80	No. 5	87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels.

	New York	Chicago In Bbl.	Chicago Carloads	Denver In Bbl. Lots
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0 68	$0 71	$0 69	$ 0 81
Pure destructively distilled pine oil	68	68†	.66†	53-.68
Pine tar oil, sp. gr. 1.02=1.035	45	36	34	40-.47
Crude turpentine	51	68	66	50-.63
*Hardwood creosote, sp. gr. 0.96–0.99	24			50-.57

* F. o. b. Cadillac, Mich. † Very scarce.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11 00 to 13 00	13 00	16 50	12 00 to 16.50
Colored mixed	8 50 to 12 00	10 00	13 00	11 50 to 14 00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58 00
Chicago	48 00	50 00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25-lb. keg for black powder.

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York		$0 27½	$0 30		$2 40
Boston	$0 22½	.24½	26¾	$0 31	2 40
Cincinnati	19½	21¼	23¼		2 35
Kansas City	19	23¾	26¾	30	2 45
New Orleans	23¾ (50%)	22¾	.24¾	..	.
Seattle	.	18½	21	......	
Chicago	18½	21¾	25	...	
St. Paul	19	23¾	26¾		2 45
St. Louis	19	23½	25¾	30	2 35
Denver	17½	22	.24½	28½	2 60
Dallas	189	.225	228	342	
Los Angeles	19	.24	.27		2.75

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb.; Denver, 42c.; Chicago, 31½c.; St. Louis, 31c.

SODIUM SULPHIDE—In New York the price per pound is 4½c. for concentrated, 2c. for crystals. The St. Louis price is 6c. for concentrated, 5½c. for fused, 3½c. for crystals. The Chicago price is 6c. for concentrated, 3½c. for crystals. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 12c. per lb.; Chicago, 13c.; Denver, 11c. f. o. b. Pueblo; St. Louis, 12c.; less than car lots 13c.

ALUMINUM DUST—Chicago price is 1.30 per lb.; Denver, 40c.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drum Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101 00	$1 52
Southeastern portion U. S. A.	115 50	110 50	1 63
Texas (except El Paso)	124 00	119 00	1 74
El Paso, Texas	126 00	121.00	1 77
Denver, Colo.	124 00	119 00	1 74
West Coast	129 00	124 00	1 81

Engineering and Mining Journal

May 17, 1919

Volume 107 *Number* 20

GOLD MOUNTAIN, IN THE TONOPAH DIVIDE DISTRICT OF NEVADA

The Divide District

BY JAY A. CARPENTER*

Attention was first attracted to the Divide district of Nevada by the presence of free gold, but the lack of high-grade gold ore prevented extensive exploration at the time of discovery. Recent developments have disclosed the presence of silver ore, which shows increasing richness with depth. At present the district is undergoing experiences similar to those met by earlier Nevada mining-camp booms. There is, of course, the speculative element which has characterized every rapid development in the mining industry, but sufficient stable exploration is being done to promote the future activity of the camp.

THE Divide district, near Tonopah, Nev., has suddenly sprung into prominence owing to the fact that within a few months one large mine has been developed from a prospect, and the investing public is being told that further development will bring forth many more productive properties. The district is advantageously situated and is reached by the main highway connecting Tonopah and Goldfield, being only six miles south of Tonopah, yet lying within Esmeralda County, of which Goldfield is the county seat. Before Goldfield was discovered the Divide district had its boom and was located for miles by Tonopah prospectors. Because of the persistent showing of free gold over a large area, it was known as the Gold Mountain district. Considerable surface work was done, but high-grade ore was not disclosed, and the discovery of Goldfield lured away both prospector and capital.

Geologically speaking, the district is one of nearly horizontal flows of rhyolites, breccia, and basalt. Erosion has left many small mountains, most of which are overlain by a later rhyolite flow, though a few are capped with basalt. There is little to indicate that any of these mountains are rhyolitic necks. The tufa, or lake-bed formation, frequently appears. The most prevalent breccia is a light colored, rhyolite ground-mass variety containing small, sharp fragments of other rhyolites, tufa, and siliceous pebbles. Another breccia is vitreous, and is filled with large andesitic fragments.

---

*Consulting engineer, Tonopah, Nevada.

Certain slopes have the appearance of weathered andesite, and granite outcrops to the west of the district. Across these formations numerous wide zones of fissuring and silicification, the so-called dikes of the district, can be traced for long distances. This fissuring usually has a persistent northwest strike, and both the rhyolites and the breccia are thus fissured and silicified. These zones show heavy oxidation of the original iron content, and the characteristic red color can be traced by the eye. Oxidation has evidently extended to considerable depth, and the rhyolites outside of the zones of silicification are much weathered. The breccia has withstood the weathering, and often stands out in bare, rounded hills.

There are surface indications of faulting, and the workings of one property in the tufa or lake-bed formation show a marked step faulting. The term fault is also applied to the lines of fissuring where the fissuring has been intense enough to shatter the rhyolite into thin plates and there has not been the usual cementing silicification. These fissures are practically vertical, and displacement is, therefore, not easy to detect.

The gold makes its appearance as free mineral in the fissuring in the silicified rhyolite. The body of silver ore that is now attracting attention to this district occurs along the same characteristic fissures, but in the breccia formation, and shows little silicification, but marked kaolinization.

OPERATIONS IN DISTRICT SLIGHT FOLLOWING BOOM

Following the decline of the district in 1903, only two properties continued to be worked spasmodically for the next 15 years. One of these, a silver mine known as the Hasbrouck, produced a dense quartz, almost a chalcedony, and the other, known as the Gold Mountain, mined a silicified rhyolite carrying free gold and a large percentage of iron oxides. Both ores were treated at the West End mill, in Tonopah, after 1913, and the Hasbrouck is about to resume shipments. In addition to these two properties, several prospectors held their claims with remarkable persistency, and finally two of them took a lease on the Gold Mountain property.

PRELIMINARY WORK AT TONOPAH DIVIDE SUCCESSFUL

The favorable showing made by the two men on this fissure vein in the rhyolite near the mountain top encouraged the principal owner, Cal Brougher, to incorporate the Tonopah Divide Mining Co., for the purpose of sinking a shaft on the hillside below and crosscutting to the vein. Although Mr. Brougher has been identified with the Belmont, Midway, and other mines of Tonopah since the discovery of the camp, the stock went begging, and he financed the undertaking practically through his own resources. The shaft was sunk just below a prominent northwest outcrop of rhyolite breccia. At the 165-ft. level a crosscut, driven toward the gold vein, at a short distance cut a well-defined wall in the breccia, with a change in hardness and color. Assays were made of this material, and the silver content, as shown by the returns, was such that it was deemed advisable to sample each round, and the results soon confirmed the fact that a remarkable discovery had been made.

The find occurred in war times, Tonopah was accustomed to large bodies of silver ore, and the new discovery was considered a freak because it was not found in a regular quartz vein in trachyte,and for the further reason that mineralization occurred in "mud seams" in the worthless breccia. However, George Wingfield, of Goldfield Consolidated fame, who had sold out his interest in the property two years before, on geological advice, did not hesitate to plunge in for a half interest with Mr. Brougher. At 265 ft. the breccia was again crosscut, and subsequent drifting cut a larger and higher-grade orebody than that on the 165-ft. level. On the surface an old cut in the breccia, unnoticed for years, was sampled, and assayed several ounces of silver to the ton. The original prospector had relied on the gold pan instead of the fusion furnace, and had missed a fortune.

TREATMENT TESTS ON ORE FROM 165 LEVEL UNSATISFACTORY

Samples of the ore from the 165-ft. level were submitted to the Tonopah mills, but the tests showed high cyanide consumption and low extraction, which fact was attributed to the combination of the silver with oxidized molybdenum minerals. The molybdenum content was sufficiently large to warrant considerable work on a process to save it as well as the silver.

Development on the 365-ft. level disclosed a larger and richer orebody than that on the 265-ft. level. The drift to the southeast from the shaft crosscut disclosed mill ore for 400 ft., with the face still in ore, and crosscuts at 50-ft. intervals showed a width of from 10 ft. to 60 ft. of ore. As on the levels above, the ore was found to follow a series of vertical northwest fissures or faults, and at certain points both well-defined hanging and foot walls are found, but they are not continuous. A set of fissures cutting across the others at rather an acute angle is of considerable importance, for the ore at the contact shows enrichment and grows impoverished when distant from them. The richest ore is a blue-black clay, heavy with fine silver minerals.

EXTRACTION PROCESS SIMPLIFIED WITH DECREASE IN MOLYBDENUM CONTENT

Silver sulphides and native silver, finely divided, appear with the silver chloride on the 365-ft. level. The ore is soft, and the silver minerals are finely divided, so that the beautiful specimens that characterized the Tonopah ores are lacking. On this level the molybdenum practically disappears, and the ore gives excellent results to straight cyanide treatment. It is much easier to crush and grind than Tonopah ore, and extracts more rapidly, but requires a much greater settling and filtering area.

The improvement with depth of each succeeding level attracted capital to the adjoining properties along the strike of the breccia outcrop at the Divide shaft. The Gold Zone, the Brougher Divide, the Divide Extension, the Tonopah Dividend, and the Divide Consolidated were amply financed. The breccia on the surface at the Divide mine contains little of value, and the ore from the levels below is oxidized and carries mostly horn silver. Consequently, the idea is prevalent that the surface has been leached and that depth by shaft sinking must be obtained before the formation is prospected.

Work on the 465-ft. level of the Divide mine has been in progress only a short time, but the remarkable showing on this and on the 365-ft. level, considering the development work done, has caused great excitement in the Divide district. The assay value of the ore on the 465-ft. level in the hanging-wall drift to the southeast, as given to the public and to the newspapers, has greatly exceeded that reported as coming from the 365-ft. level. The first 110-ft. is said to have averaged $60 a ton, and after that extremely high assays have been reported up to 2604 oz. of silver per ton for the sample from one round. This drift has been driven over 250 ft., but crosscutting has not been done. Development work is hindered by the small installation now used, but larger equipment is being installed and the shaft is ready for the cutting of the 565-ft. station.

The feature of the development work to date is the fact that such a large proportion of it has consisted of operation in actual ore. The main mineral values to be found are silver, but the gold content is not negligible, as the ratio of silver to gold is about 250 to 1 by weight. Probably several million dollars in silver will be produced from the area opened up by the present development work, and the limits of the mineralized fissure zone, either in extent or depth, are as yet unknown.

Future of District Dependent on Development

The Brougher, the Divide Extension, and the Gold Zone on their lower levels have cut fair ore in development work in the breccia. Both extravagant and modest claims are made as to the quantity and grade of ore found, but the fact has been established that with development work these properties have an opportunity to become producers. Tonopah had but one property at which the ore-bearing trachyte formation outcropped on the surface, and only the distinctly quartz veins in the formation carried silver. The surface on the now famous Belmont mine is covered by a barren-looking white rhyolite; that of the Montana, West End, and Extension was covered with a badly weathered barren andesite. Yet companies were formed and money was raised in the hope that the trachyte underlaid the other formations and with the less probable expectation that it also contained rich quartz veins. In the Divide district today the breccia formation can be found for miles in nearly all directions, and with it are wide zones of faulting, fissuring, silicification, and oxidation, with the same approximate N. 45° W. strike of the Divide ore zone. What a chance for the locator, the promoter, and the mine maker!

Propitious Circumstances Favor Divide Boom

A boom was inevitable. Here was a new silver mine of great promise in a district that offered equal opportunities for miles around. It was close to one of the leading silver-producing camps in the United States that spelled wealth and stability. The war was over, and the "war babies" were off the market. Silver was the king of metals at more than $1 an ounce, with all the other metals under the cloud of reconstruction. The cool but plunging Wingfield, of Goldfield Consolidated fame and wealth, not content with the rich windfall of the Divide mine, played the wheel of fortune by investing in neighboring properties and buying and financing newly discovered prospects and mines.

With every train came men that have figured in every boom in Nevada for the last 20 years. The daily papers were forced to crowd out national news to give place to notices of prominent men purchasing valuable groups of claims, and incorporating the ——— Divide Mining Co. Ford cars vibrated up Main St. filled in the back with 4 x 4-ft. posts to be used as location corners. The Mizpah Hotel lobby was jammed with locators, curb dealers, engineers, promoters, and moneyed men. Allotments of a quarter million treasury stock were oversubscribed in a day by local money, and much of the stock was sold a week later for double the price paid, and it was listed on the exchange. This easy money is being reinvested in new promotions, and the process is as yet like the uninterrupted course of a growing snowball. The demand for claims resulted in the stiffening of prices until a favored group about a mile from the Divide mine brought $50,000, and groups of claims within three miles of the Divide, with only location notices up and corners staked, were held at $5000. The feverish excitement still exists, and will continue as long as the limits of the Divide orebody remain unknown and the adjoining properties continue to report improved showings. This boom phase of the new district's development will probably result in the establishment of fictitious values, and the loss of money to many investors, most of whom are more interested in the stock quotations than in the properties themselves.

The redeeming feature of the boom is that, of the 200 companies incorporated, nearly all are providing themselves with a treasury fund of $15,000 to $25,000 for development work. There has been no lavish expenditure for fine offices and autos, and there are no high-salaried officers. The purpose of every company seems to be to get to work. Operations are in charge of reliable and responsible men, and good shaft-sinking equipments are being installed. Competent shaftmen and hoistmen are already hard to obtain, and several hundred good workmen from the quiet copper camps will find employment here this summer.

Promotive Activities Conducive to Thorough Exploration

The large sums of money spent on development will thoroughly explore the possibilities of the district. Much unnecessary work will be done on ground that does not justify the expenditure or effort, but, at the same time, the work will determine to what extent the pronounced fissuring and silicification of the breccia and rhyolites have been accompanied by the mineralization of these same formations. Until the Divide mine found the ore, investors and engineers were skeptical of the small surface showings of the district, but today claim buyers do not demand even a surface showing, and many are more interested in knowing about their neighbors than concerning themselves as to whether or not the best formation and fissuring are present.

The high price paid for claims has put heart into prospectors, for they had been discouraged by the demand of the engineers for more ore in sight and for further development work. Claims at a strike sell like hot cakes, and for the first time in years the hills of Nevada will be covered with prospectors. This time they will travel in "flivvers" and with a grubstake large enough to pay for an assay on every promising piece of quartz, breccia, or rhyolite.

Conservative investors looking over the Divide district are already giving consideration to the many evidences of ore in the surrounding camps which dollar silver has made worth development work, and, with the advent of the Divide mine, a sharp revival in the search for and development of precious metal mines in Nevada has come.

Every Nevadan, loyal to the traditions of the Comstock, remembers with a thrill the stirring days of 1902 to 1906 that brought forward Rhyolite, Manhattan, Tonopah, and Goldfield, and devoutly hopes that the Divide is just the first of the new camps that will reëstablish Nevada's prestige as the premier producer of the precious metals.

The Mauss Centrifugal Separators

By E. M. WESTON

THE Mauss centrifugal separator is made in three main types. The type used for the separation of colloids from slimes, particularly tin-ore slimes, is shown in Figs. 1 and 2. It consists essentially of two bottomless buckets or vertical cylinders revolving rapidly in a frame around an upright spindle at a rate, for treatment of tin slimes, of 700 to 800 r.p.m. Each of the buckets has also an independent slow revolution on its own axis. The use of the Mauss machine in this connection has been to bring the intractable pulp into a condition where its mineral contents can be recovered on gravity chute *16* against the outer wall of the bucket at the point furthest from the central spindle.

The centrifugal force generated by the revolution of the whole frame packs the solid matter in the pulp against the wall of the bucket, the fluid flowing over the rim or lip, in the same way as in a cream separator, carrying the colloids with it. The slow revolution of the bucket on its own axis continually carries away the clean and dry solids packed against its wall, from the point of feed, so that a fresh face is constantly exposed to the feed flow. The packed solids are carried around in the bucket until they arrive at the inner wall or the point next the central spindle. Here the centrifugal force, which at first packed them against the wall, exercises a reversed effect, and they are discharged into a mixer to be fed to the concentrator.

Colloids are the chief source of loss and trouble in the concentration of tin slimes, as they entangle the mineral particles, and it is claimed that, by the use of this centrifugal, a recovery of 66 to 80% of the tin concentrate in slimes is rendered practicable. The experimental centrifugal when working at African tin mines gave a recovery of over 60%, and treated about 25 tons per day. It was necessary to stop the machine until special steel could be procured from England. The separator will, it is hoped, soon be tried on the slimes of the Cornish tin mines.

The second separator, known as the "alkali" type, is of special interest at present, when attention is being directed to the more economical treatment of the caliche of the Chilian nitrate pampa. Two of these machines have been running for some time separating the soda from the slime of a soda lake near Pretoria which was worked by the South African Alakali Co., Ltd., and several more are on order. This type, shown in Figs. 3, 4, and 5, is essentially a centrifugal filter, differing from all previous types in that the charging of the pulp and the separate discharge of the fluids and solids take place in cycle and automatically during its uninterrupted revolution. This machine revolves at from 1500 to 2000 r.p.m. The cycle of operation is as follows:

The perforated separation drum, into which is fed the solution to be filtered, is in two parts, the division being on a horizontal plane; and when all the fluid is filtered away into an external launder, or hollow ring, the drum is lowered below the level of the launder, and then opened, while still revolving at the set number of revolutions per minute; whereupon the dry material which is left after the fluid has passed out is immediately thrown into a lower receptacle. The drum is then closed and lifted into the first position, and the solution to be filtered is again fed into it, and the process is repeated without stopping the machine. With this cycle of movement the machine can run for the whole 24 hours without stopping, being self-discharging and self-cleaning. The filtration may take a minute, according to the material to be filtered, but the throwing out of the dried material may make scarcely a second. The effect of this process is a continuous machine with intermittent action.

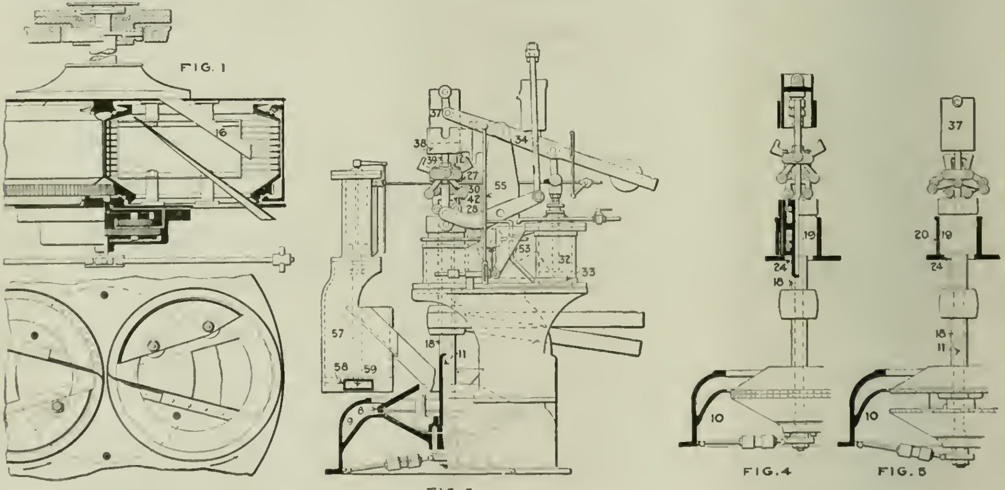


FIG. 1

FIG 2

FIG. 3

FIG. 4

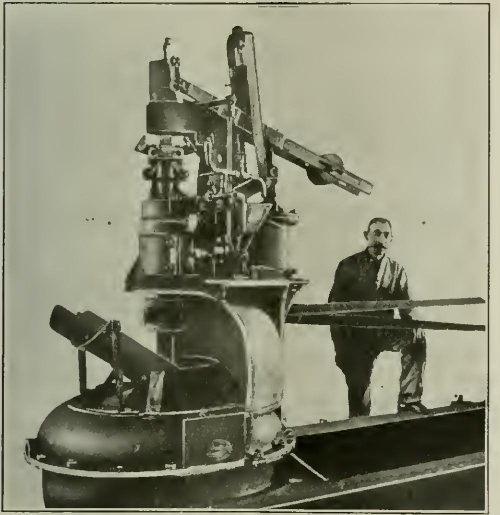
FIG. 5

DETAILS OF THE MAUSS CENTRIFUGAL SEPARATOR

Figs. 1 and 2 represent the type used in the treatment of tin-ore slimes. Figs. 3 and 4 are suitable for alkali and similar work

The shape of the drum is roughly that of a double hollow cone, and it is formed by bringing together two hollow cones, the top one apex upward and the bottom one apex downward. This shape is evidently the best for securing a quick discharge of the dry material when the drum is opened. In action, this design is found to be almost perfect. The mode of securing the above-described operation is shown clearly in the accompanying drawings, Figs. 3, 4, and 5.

Fig. 3 shows the drum while running with its perforations level with the launder or horizontal hollow ring, discharging the fluid at its periphery. The section which is cut away in the drawing shows the method of fitting the screening inside the drum. The drum has an opening at the top, into which the pulp is fed by means of a funnel. Fig. 4 shows the drum lowered below the launder still closed and Fig. 5 depicts the drum when it is opened for the discharge of the dried material.



THE MAUSS SEPARATOR

Gears are avoided in this design, and the lowering, opening, and lifting of the drum are secured by a time motion. Water is slowly poured into receptacle *53* (Fig. 3) and this tips over when full, opening a valve leading water at hydraulic pressure into cylinder *32*, lifting piston *33*. This piston actuates lever *34*, thus pushing down piston *37*, which works in a sleeve *38* and is fixed to rod *39*. This rod is rigidly fixed to the lower cone of the drum by means of the shaft *11* (movable within hollow shaft *18*), and is loosely joined to the top cone of the drum by the intermediate joint or toggle *12*, *27*, *30*, *42*, and *28*, which is fixed at the bottom with the hollow shaft *18*.

Whatever distance the piston and rod *37* and *39* are lowered or raised, the bottom cone of the drum is moved the same distance, but the movements of the top cone of the drum are varied in accord with a certain double action of the toggle. The position at the end of this movement is seen in Fig. 5, and is caused by arresting the downward movement of hollow shaft *18* by means of shoulder *24* of sleeve *20*, thus checking the downward movement of piston *19*, which is fixed to hollow shaft *18*. The movements of the drum are therefore as follows:

Stage 1—After the fluid is filtered out into the launder *9* through holes *8*, the whole drum, and the shaft *11* and hollow shaft *18* with the toggle in its closed position, are lowered by means of piston and rod *37* and *39* for a space of 2 in. Fig. 4 shows the position at the end of this movement.

Stage 2—Cylinder *19* is arrested by the shoulder *24*; the toggle opens (as in Fig. 5) and while the top cone of the drum remains stationary (except for its continued rotary motion), being a fixture with shaft *18* and piston *19*. The bottom cone of the drum continues its downward movement, being positively thrust downward by piston *37* through rod *39* and inside-shaft *11*. This downward movement of the bottom cone continues for 3 in., during which operation the dry separated material is discharged by the centrifugal action into the space *10* underneath the launder *9*.

Stage 3—On the application of the lever *34* giving an upward movement to piston *37* and rod *39*, the bottom cone of the drum is lifted 3 in. By the end of this upward movement the drum has become again closed and the toggle has reassumed the position shown in Figs. 3 and 4.

Stage 4—The upward movement of piston *37* and shaft *39* continues for a further 2 in., and in this further movement the cylinder *19* and hollow shaft *18* also move. Thus the whole drum is lifted into the position shown in Fig. 3, which completes the cycle.

The upward movement is caused by the reverse action of the hydraulic piston *33* in cylinder *32* (Fig. 3) the valve being operated in this case by the downward movement of rod *55*, which also simultaneously throws the time-motion cistern *53* back into its first position. Other details of the machine, such as the automatic feed *57* to *59*, incorporate methods which do not affect the general principle.

The machine works perfectly, and without vibration or friction. In separating alkali it produces 5 to 7 tons of crystal per day and lends itself most conveniently to the operations of fractional crystallization, such as from mixtures of solutions of common salt, soda, gypsum, and potassium salts.

The third type of machine is especially adapted, in the manufacture of sugar, to the rapid purification of the mill juice. In ordinary practice this juice has to pass through a number of appliances, clarifiers, eliminators, and filter presses, before it is clear enough for the vacuum evaporation. The processes are slow and expensive. Some are designed for the separation of heavy earthy and vegetable matters; some for the light waxes the specific gravity of which scarcely differs from that of the syrup. This separation carries out three processes in a single step.

Yukon Gold Co.

The annual statement and report of the Yukon Gold Co. shows that the adverse conditions affecting gold mining are reflected in the result of the company's operations for the year. The net operating income amounted to $45,898.70, which, when deducted from allowances for depletion and depreciation, amounting to $921,419.55, leaves a net deficit for the season of $875,520.85. Distributions amounting to $175,000 were made to stockholders in 1918.

Notes on the Housing Problem

By CHARLES F. WILLIS*

IDEALISTS and "uplifters" are working overtime to promote housing projects, proclaiming through magazines, newspapers, and by word of mouth that improvement in the housing conditions of workmen is the panacea for all labor troubles, all dissatisfaction, all labor unrest, and the solution of many of the differences between capital and labor. Without doubt adequate and suitable housing of employees is a big step forward, and in many cases a necessity, but is it not possible that the impetuous United States, which never does things by halves, which goes all the way or not at all, will let the pendulum swing so far in housing betterment that it will have to come back again? Is it not possible that housing advancement may go too fast and have a reaction?

The advocates say there is no probability of this, and maintain that home ties mean contentment, attachment to locality, and a sense of security, and that the foundation for the building of a more beautiful, more efficient and more glorious America is labor. Further, it is contended that well-paid, contented labor and proper housing create a permanent home sense which will be a determining factor in the situation. Some point to the progress of England and France in their home building program, and to its results, but they fail to show the differences existing between the conditions in those countries and the industrial situation in the United States.

No one will question the appropriateness of good homes, of well-paid labor, of well-organized industrial communities, presided over by well-balanced, home-loving heads of families. It is an ideal toward which we must strive. There are few industries in this country that would not go to the limit to provide a community in which the people would take pride in living, where they would come and stay and bring up their families; in which the men would become home owners and home lovers, and have the same interest in the community that the industry had, though perhaps on a smaller scale.

Nor will anyone question the value to industry as a whole of having all workmen living under ideal health conditions, fully satisfied with their part in industry, their wages, working conditions, their part in the management, their share of the profits, and their protection. The Arcadian condition, labor and capital in complete harmony, is an objective toward which many are striving, but the question is: Can we reach this objective in one jump, or must we take several jumps?

Writers on housing betterment have long bemoaned the fact that the United States was reluctant to take up housing, housing standards and industrial villages, and that it was years behind European countries in this particular. But the war has changed all this. New industries created new towns—not the normal growth of towns, but cities overnight. As the cities could not care for the large industries made necessary by the war, the Government went into housing projects to the extent of millions of dollars, but as a matter of necessity rather than through a deliberate purpose to improve the condition of the workingman.

It was not done without thought and consideration, and the United States had European experience as an example. Government housing was considered in the proper relation to health and home conveniences and was not of the "fly-by-night" nature of some construction contracts. Industry did likewise. New and fine cities appeared, and, as one writer expressed it, housing betterment advanced a generation in one year.

The United States moves quickly. The impetus given to good housing proposals by the war promises to bowl all obstructions out of the way, and to dot the map of the United States with housing projects. America is faddish. She takes up a movement, goes through with it like a whirlwind, and then proceeds to forget it. Ready-to-wear house advertisers are taking advantage of the fad, and it is almost impossible to go through a magazine without coming across a number of advertisements of companies which aim to promote housing projects. Welfare workers have grasped the idea as a solution to their difficulties; reformers are using it as a new fad.

Would it not be better, however, if housing betterment had a steady and consistent development rather than a boom? Would it not be more desirable if the people were educated to appreciate better homes, rather than to thrust them into houses of a far higher standard than those to which they have been accustomed? After a boom, invariably there comes a reaction. A slump in the market and a step backward start the pendulum the other way, and might effectually put a halt to much work designed for a better, bigger, and busier United States.

In England and France the industrial workers are Englishmen and Frenchmen; in America the industrial workers are everything—Americans, and 57 or more varieties of foreigners, who represent, to a great extent, all stages in the standard of living. A considerable percentage represents the lower standards of the countries from which such foreigners come. If they were of the higher class in their own countries, it is unlikely that any great number would have come. If they had been successful among their own people, they would not have looked toward new fields.

Housing and standards of living are closely allied. In England and France there is only slight difference between the standards of living of the artisans of the lowest and highest types, but America, the melting pot of the world, finds every possible standard among its workingmen. Industry would like nothing better than to see its employees all men of a high living standard; this makes for a high working standard.

Such employees demand good housing, and they get it, for if it is not to be found in one place, they will go to another. But what advantage is the housing program to the man who uses one of his rooms in which to keep his chickens, or to the family which uses the bath tub as a place in which to store coal or plant flowers? The man who appreciates a good home does not want the industry to furnish it for him; he wants it for his own, bought with his own money. He has then an interest and a pride in the community that a company-owned palace could not give.

---

*Consulting supervisor, Phelps Dodge Corporation, Bisbee, Arizona.

Improvement in the standard of living does not mean providing good houses, nor will this alone achieve the result. There are many other factors that are essential to the success of housing advancement. But what happens when these factors are all provided—when a man can buy his own home, rear his family in comfort, and partake of some of the better forms of recreation? What happens when he and his family are educated to this stage? He is not content to remain in the pick-and-shovel class, and he is not content that his son's hands shall become calloused; he is determined that his son's education shall fit him for something better.

What will happen as the people become educated to appreciate better and better standards of living, and are in a position to obtain jobs requiring intelligence rather than brawn? As they advance they must be replaced, and to do this it is necessary to draw more labor from immigration channels, each time securing a lower class and one with lower standards of living. And so the cycle is complete. Men are educated to better things, and they expect and obtain better things; but someone has to step into the places in the industry that have been made vacant.

Housing without education is futile and useless; it fails to fulfill its purpose. It is capital thrown away. The primary education that is necessary to make good housing effective is the recognition of the dignity of labor. With a class stratification among the industrial workers, there results merely a cycle of the workman educating himself to better things, and the immigrant stepping in to fill his place. It is not feasible to expect that it will be possible ever to do away with the variable standards of living. Much can be done to Americanize the foreigner, but here again is the same proposition: When he becomes Americanized, his social and industrial position is improved; another foreigner will take his place, and there is another to Americanize.

It will be possible to attain the minimum difference in living standards only when the country's immigration laws have educational clauses, and when the foreign population can begin at somewhere near American standards. This however, must be in combination with the teaching that, in this country, as in European countries, it is dignified to labor.

Then, too, no housing program can be successful until people who have been accustomed to a subnormal standard are taught housekeeping and home-making. A filthy modern house is no more of a home than a filthy shack. Much is being done to emphasize these truths through public-school vocational workers, demonstration agents of the U. S. Department of Agriculture, and many others, but the work has not progressed as rapidly as industrial housing.

Development in connection with industrial housing has advanced considerably, but the accompaniments that will make it successful, if it is to be successful, have merely progressed at a normal rate of speed. If the industrial-housing program gets too far in advance of its support, there is grave danger of reaction, or retrogression. Without doubt, it will make huge strides forward, but the communities in which it will be successful will be those in which the foreign population has been Americanized and educated simultaneously, and in which housing has had a steady and consistent growth. The boom towns will be rusted or decayed when the town that has built homes and taught people to live in them is at its zenith of prosperity.

A consideration for the welfare of workers is a popular fad just now, and, in its speed of travel, it is swinging toward philanthropy. The American workman does not want philanthropy, and the foreign workman does not appreciate it. Placing workmen in homes which they do not know how to use is philanthropy, but the education of the people to want better things, and then providing them, is good business.

Different communities are in various stages of this progress. Some are ready for good housing, and to fail to provide it would be a mistake; but many places are not so situated. It is a goal toward which all should work, for it will do much toward creating industrial and civic harmony and satisfaction.

Japan Interested in Mexican Iron

An authoritative announcement made by the Department of Communications and Public Works of the Mexican government states that it is probable that the famous Iron Mountain at Durango will soon pass into the control of a Japanese syndicate, according to *Iron Trade Review*. Representatives of large iron and steel interests of Japan recently arrived in Mexico to acquire this property, and negotiations have progressed to the point where their consummation is practically assured.

It is planned by the Japanese syndicate to mine and export large quantities of the ore to Japan. The syndicate also is considering the construction of a large iron and steel plant at some point in Mexico, probably Torreon, which is a large distributing center and within easy transportation distance of Durango. With the completion of the construction of the extension of the national railroads of Mexico from Durango to the port of Mazatlan, on the Pacific Coast, a low rate on the down-grade haul of the iron ore should be made available. Japanese ships are now making Mazatlan and other Pacific ports of Mexico regular ports of call.

The iron-bearing formation which rises 700 ft. above the surface of the level plateau just outside the city of Durango is one of the mineral marvels of Mexico. The estimated weight of the mass of ore above the surface is 600,000,000 tons, and the ore is said to be 60 to 67% pure. The deposit extends to an unknown depth below the surface.

It was chiefly to afford an outlet for this ore that the late Collis P. Huntington, who for many years directed the affairs of the Southern Pacific R.R., built what was then known as the Mexican International R.R., from Eagle Pass, Tex., to Durango. Mr. Huntington, in addition to owning extensive coal mines on the line of this road, also purchased the Iron Mountain at Durango for $500,000, gold.

Mount Bischoff Tin Mining Co.

The semi-annual report of the Mount Bischoff Tin Mining Co., covering the latter half of 1918, shows that the property owned by the company and situated in Tasmania—one of the principal low-grade tin mines of the world—produced about 1435½ long tons of 99.87% tin from 2112½ long tons of oxide, which, in turn, was obtained from concentration of 48,730 long tons of ore.

Dividends amounting to £19,500 were paid, and £7890 17s. 1d. was written off for depreciation in value of plant and property. The ore reserves at the end of the year were estimated to amount to 1,125,000 tons, with an average content of 0.29% tin.

Mining in Prehistoric Times

BY FRANCIS CHURCH LINCOLN*

An interesting account of prehistoric mining operations. Progress is traced from the flint implements, which are believed to date back half a million years or so, and which were made from a mined material. The evolution from open-pit work to underground mining is shown, and mention made of the method of shaft sinking, tunneling, and hoisting in probable operation about ten thousand years ago. The mining done by American Indians is discussed; and a short account is included of operations of which the first written records, on commemorative tablets, are available.

MINING engineers are fairly well acquainted with the evolution of mining during historic time, but few of them are familiar with the archæological discoveries which throw light on the beginnings of the mining industry. It is reasonable to assume that the industry which is concerned with the production of mineral substances was one of the first to compel the interest and labors of mankind, because mineral products are essential to the preparation or construction of implements of warfare, the chase, agriculture, building, and manufacture. But for proof it is necessary to turn to the geologist and archæologist.

The first mining was undoubtedly a casual form of placer operations, which consisted simply in the selection of suitably shaped mineral fragments from the detrital deposits of the earth's surface. The oldest known bones of man are those of the ape-man, or *Pithecanthropus erectus*, of Java, who is believed to have lived in earliest Pleistocene time, which was about 650,000 years ago. No artificially shaped stones were found associated with his bones, but it is entirely possible that he used natural stones as missiles and even as hammers. Next in age are the remains of the dawn man, or *Eoanthropus*, who lived in England in lower Middle Pleistocene time, approximately 450,000 years ago. With these bones were associated ancient types of Paleolithic flint implements,[1] proving that the dawn man was a flint miner, even if of the most primitive sort.

NEOLITHIC FLINT MINES OF EUROPE

Only when the available surface supply of a desired mineral substance was nearly exhausted is it probable that the important step of digging for buried deposits was undertaken. The further great advance from open-pit to underground work was probably made at a much later time. All three of these stages of mining are represented in the neolithic flint mines of Europe. Grand Pressigny, in Indre-et-Loire, France, was the center of a district rich in flint which could be obtained without excavation; and is known to have been the site of a great neolithic flint mining industry by the waste from an extensive workshop where flint implements were manufactured. At Meudon and Champignolles, in Oise, France, there have been discovered neolithic open pits sunk through the chalk to layers of flint by the ancient miners. Finally, at Mur-de-Barrez, in Aveyron, France, at Spiennes, near Mons, in Belgium, and at Brandon, in Norfolk, and Cissbury, in Sussex, England, underground neolithic flint mines have been found and explored.[2] Thus, during the Stone Age mining progressed from the stage of seeking suitable material on the earth's surface, through open-pit work, to rather complex underground operations.

The neolithic flint mines of England, France, and Belgium are the oldest known mines, having been worked during Upper Pleistocene geological time approximately 10,000 years ago. It was at about this time that plants were first grown for food and animals were first herded, and thus the agricultural industry was born.

Those who like to claim that mining is the most ancient of all industries will be particularly interested to learn that the remains unearthed in the underground flint mines of Cissbury were almost without exception those of wild animals, whereas at Brandon they were nearly all of domestic animals,[3] thus indicating that animal husbandry was not practiced until after mining had progressed to the underground stage.

PRIMITIVE SHAFT-SINKING AND TUNNELING.

The mining methods employed in all four of the underground flint-mining districts were similar. Circular shafts were sunk at frequent intervals through the surface soil and underlying chalk till they reached layers of good flints at depths up to 50 ft. From the bottoms of these shafts, galleries were run in all directions along the seam of flints, forming a complete network. These galleries were about 3 ft. in height and from 3 to 9 ft. in width. The tools used in this work consisted of picks, hammers, and wedges made from the antlers of the red deer, and hammers and wedges of flint. The waste from new shafts was cast into old ones and that from working galleries was stowed in abandoned workings. Grooves cut in the chalk at the sides of the shafts indicate that access was by ropes, and that flint and waste were hoisted by them. Roughly shaped cups of chalk found in the mines are thought to have served for lamps.

At Mur-de-Barrez the flint occurred as a solid stratum, instead of as a layer of nodules, and the miners kindled fires in the galleries, using the heat to break up the flint. This is the earliest known example of fire-setting, a process which until the seventeenth century A. D., when black powder was first used in mining, was the only one employed for breaking hard ground.

An archæological age has no definite chronological significance, but serves simply to indicate the degree of civilization attained by a race. The American Indians were still in the Stone Age when Columbus discovered America, and, indeed, had not attained as great a proficiency in mining as had the Europeans about 8500 years earlier. The Indians quarried a variety of substances from widely scattered workings, some of which were of considerable extent. From Mount Kineo, in

---

*Director, Mackay School of Mines, Reno, Nevada.

[1] Schuchert, Charles, "Historical Geology," (1915)

[2] Wilson, Thomas, "Arrowheads, Spearheads, and Knives of Prehistoric Times," *Ann. Rep. Smithsonian Inst.*, p. 823 (1897)

[3] Willett, Ernest Henry, "On Flint Workings at Cissbury, Sussex," *Archaeologia*, XLV, Part 2, p. 316 (1880)

Maine, they obtained porphyritic rhyolite; in Mercer County, N. J., they quarried jasper; Sugar Loaf Mountain, Maryland, provided rhyolite; soapstone came from quarries in Virginia, Maryland, and the District of Columbia; quartzite boulders were extracted from the detrital material in the vicinity of Washington, D. C.; Burke and Jefferson counties, Ga., furnished jasper and white and yellow flint; Hernando County, Fla., provided blue flint; and in Alabama mica mines have been discovered and there is an outcrop of quartz from which the Indians obtained all varieties, from rock crystal to jaspar.

In the Middle West, numerous Indian flint mines are found in Ohio and Indiana; there is a white-chert quarry near Mill Creek, Ill.; and novaculite workings are in evidence in Arkansas and Oklahoma, as are a workshop where flint articles were made from the pebbles of an ancient beach at Kenosha, Wis., and native copper pits at Keeweenaw Point, Mich. In Wyoming, there is an extensive Indian quartzite quarry in the Raw Hide Range.

The mention of copper mines might lead one to think that the Indians had reached the Bronze Age, but such was not the case, as they had not discovered that copper could be smelted, and solely mined native copper, which they treated as a malleable stone.[4]

The American Indians mined by open-pit methods. Occasionally they worked beneath a slightly overhanging ledge, or left a small pillar above them; but the nearest approach to real underground mining was made when they extracted flint from within a natural cavern at Wyandotte Cave, Indiana. In that locality a rude stone saucer containing a soft black substance was unearthed. This saucer is believed to have been used as a lamp, and recalls the chalk saucers found in the underground flint mines of Europe.

The Indians used stone hammers and chisels similar to those used by the ancient European miners, and in addition employed wooden crowbars and shovels. In the steatite quarries, they chiseled out annular holes and broke off the cores thus obtained to be worked up into utensils.[5] In Coshocton County, Ohio, traces of fire have been found in the flint mines, and it is thought that there—and also at Flint Ridge, in Licking County—fire-setting was employed by the Indians to break the flint strata, just as at Mur-de-Barrez, in France.

Oldest Mining Records on Stone Tablets

The earliest mining operations of which there is a written account were those conducted by the Egyptians of the Bronze Age in the Sinai Peninsula for turquoise.[6] Large and well-organized expeditions were sent to Sinai as early as the First Dynasty, which began about 3400 B.C., and the commemorative tablets of stone left behind by these expeditions constitute the oldest mining records. The turquoise mines of Sinai were underground mines in sandstone. Cutting was performed mainly with copper chisels, extensive chambers being hewn out of the turquoise-bearing strata with these tools. Occasionally, annular cuts about cores 3 or 4 in. in diameter were made, suggesting the Indian soapstone quarries; but in the Egyptian case the object was to break the ground and not to obtain suitably shaped lumps for manufacturing.

The remarkable quarrying operations conducted by the ancient Egyptians in their own land during the Bronze Age have long been the subject of investigation. The hard rock employed in the construction of pyramids, temples, and monoliths could not be cut with copper chisels, as could the softer rock of the turquoise mines. The tools used were likewise of copper, but were in the form of tubular drills and saws, to which hardness was imparted by the addition of emery dust or the insertion of emery fragments as teeth.

The best known and finest example of ancient Egyptian masonry is that displayed in the Great Pyramid of Cheops, which was begun about 2900 B.C. The roof of this structure is composed of 56 blocks of granite averaging 54 tons each in weight. These stones were secured from the Cataract of the Nile, where any flaws would have been exposed by the action of the water. The blocks were quarried by running grooves and sinking drill-holes 4 in. in diameter, 2 ft. apart, along them. It is thought that the force necessary to free these blocks was obtained by wetting wooden plugs, as no signs of crushing of the granite by hard wedges have been observed.

The Use of Iron in Mining Operations

The earliest known use of iron in mining was by the Athenians at Laurium.[7] The silver-lead mines of that region are first mentioned in the Greek records of about 500 B.C., when the royalties began to figure in the Athenian budget. At Laurium extensive underground mining operations were conducted with slave labor, having for their object the extraction of irregular masses of argentiferous galena lying at slate-limestone junctions. Both overhand and underhand stoping was practiced, and filling or pillars were employed to support the stopes when necessary. The tools used included hammers and gads of tempered steel, similar in design to those of the present day, together with steel picks and scrapers of antique pattern. The development workings were kept as small as possible to minimize labor and timbering. Occasionally olive-wood posts and caps were employed. Transportation of ore and waste was by pack-baskets on the backs of slaves. Lighting was effected by means of oil lamps made of terra cotta. When natural ventilation proved insufficient, furnaces were constructed and a forced draft was secured.

The mines of Laurium provided the sinews of war that gave Athens its ascendency in the ancient world. With Laurium we pass from the realms of archæology onto those of history, and thus bring the present article to a natural end.

Finding Concealed Water Pipes.—An electrical method of determining the location of pipes concealed within walls, has, according to the "South African Journal of Industries," recently been patented. The apparatus is made up of two sets of coils placed on the ends of a magnet bar. One set of coils receives alternating or vibratory current, and the other is connected to a telephone. The balance is first established so that no sound is heard in the telephone. When the device comes near the metal piping this disturbs the balance, and a sound is heard, thus indicating the locality of the pipes. The value of this invention exists in the saving effected in disturbing as little of the wall as possible when repairs to pipes are necessary.

---

[4] Whittlesey, Charles, "Ancient Mining on the Shores of Lake Superior," Smith. Con. to *Knowledge*, 13, Article IV (1863).

[5] Holmes, William Henry, "Stone Implements of the Potomac-Chesapeake Tidewater Province," 15th Ann. Rep. Bur. Ethnology (1897).

[6] Petrie, W. M. Flinders, "Researches in Sinai," New York (1906).

[7] Ardaillon, Edouard, "Les Mines du Laurion dans l'Antiquité," Paris (1897).

The Engineer and Reconstruction[*]

By W. F. STAUNTON

I WISH to record the great satisfaction with which I have read Mr. Ingalls' address of Jan. 14 last, as retiring president, on "The Economic Duties of the Engineer." The common drift of thought toward many of the ideas Mr. Ingalls expressed, among those of our profession whose practical attainments have made them leaders, in position to give publicity to their views, and therefore wielders of influence, is striking and reassuring to those who, like myself, believe that the engineer must take an increasingly active part (and quickly) in the reconstruction and operation of the social machine if our country is to maintain its place in the world. Perhaps I should go further and say, if it is to avoid disaster from trying working-scale experiments which a slight knowledge of history and the fundamentals of economics should prevent.

"The Economic Duties of the Engineer" comes as a most important addition to Channing's "Man-Power," Kemp's "The Human Side of Mining Engineering," Finlay's "Readjustment, Not Reconstruction," and, to go outside of our immediate circle, Secretary Lane's "Americanization."

To this splendid array we could all add the titles of many more articles brimming with uplifting thoughts on the great problems now before the world. We listen, or read, and agree, just as we do when we go to church; but do not most of us slide gently back into our habitual grooves and leave "George" to do the rest? I think that many, perhaps most of us, do. And yet we have before us problems compared with which those involved in going to war may prove to have been easy. There will be no flags, bands, and uniforms as stimuli, nor the exuberant appropriation of billions to accomplish results regardless of the consideration of unit costs, as compared with other countries. Economic laws, so lately suspended, will be in relentless operation. Efficiency of labor, which, owing to the prodigious market that has existed and the necessity of getting things quickly regardless of cost has declined alarmingly with us, has, on the other hand, increased abroad; a production per man of ten times the pre-war rate having been reached in some lines, according to eminent authority. A severe jolt to our complacency of superiority seems unavoidable when normal competition returns.

What, in a practical way, are we going to do about it? What, in a word, is the solution of our problem? I believe it is education; but not that sort of thing which comes to the mind of the school-trained man when the word is used—a vision of books and apparatus—but rather a knowledge of those simple, homely, historic, economic, ethic truths that man in his painful upward progress has again and again verified by the ghastly failure of experiments which this generation seems now about to repeat. Education is the keynote of Secretary Lane's "Americanization"; but even in that masterly appeal one can wish for more emphasis on the elemental principles.

The English language should be first, of course, for those ignorant of it, but, after that, as between imparting the power given by the "three R's," to be exercised in absorbing poisonous misinformation from the yellow press and reckless propaganda in general, and a knowledge of how to think clearly in the problems of everyday life, I choose the latter; but why not have both?

My observation is that not many even fairly enlightened persons that one meets can give a clear and logical explanation of capital—what it is, its origin, its benefit to all, laborers included; and why it is necessary for any material progress, whether under individualism, socialism, or any other "ism." So in regard to what is possible in the long run in the payment of wages; that the market value of the things produced sets an absolute limit to them; that no legislation or strikes can change this condition, notwithstanding that an occasional professor arises to testify that the basis of minimum wages should be made by law the cost of a comfortable living, a condition we would surely all welcome, if true. But the place man is making for himself in the universe is an artificial one, and is maintained only by his successful struggle to redirect forces tending otherwise, and it is success in this struggle and consciousness of ability to succeed that give man's intelligence its godlike potentiality, develop his strength, and support the hope of progress. So the elementary idea should be taught that the things worth having, even those altruistic in character, are only the rewards of effort of muscle and brain, and not within the power of legislatures or unions to bestow.

The conception of "freedom," too, needs clarifying. The more we hear of it lately, the less there seems to be. There is none when the laws guaranteeing a man protection from violence in the pursuit of his ordinary avocations are a dead letter and when his head may be broken with impunity or approval if he fails to join a particular organization which he does not want to join for possibly very good reasons of his own. What unjust strike could succeed if unlawful violence were made impossible? The unions and collective bargaining have come to stay; their justification is their undoubted improvement in the workers' economic status. As their potentiality for good is tremendous, so it is also for harm, to the workers themselves and society in general. The result of their unrestrained development needs no prediction. Fighting the abuse of their advancing arbitrary power, and the inevitable train of needlessly repeated experimentation, by the exercise of another arbitrary power, is unintelligent, and enlightenment by education in the fundamentals of economics and ethics is the only way in which these agencies can be effectively dealt with; preserving the good and eliminating the evil. It is not too much to hope that some day membership in good standing in a trade union will be a guaranty of proficiency and integrity, instead of a danger signal.

The practical wisdom (aside from any other reason) of a system of ethics should be made plain, and the fact that theists of all kinds, agnostics, atheists, even pagans, and probably Germans, appreciate and in their hearts and minds really believe in the essential truth of the broad principles of morality taught by Christ, and that the most rapid development of the human race, not alone in material things but also in the average of individual well-being and happiness, is coincident with the Christian era.

---

[*] Abstracted from the Mar. 31 *Bulletin* of the M. M. S. A.

I do not know how others feel, but for my part I cannot help ascribing a part at least of the unrest at the bottom of much of the present turmoil to the fading away of old religious beliefs without the substitution of other guides. With the disappearance of the blind acceptance of constituted authority, physical and moral, which we have seen everywhere, has come the dawn of an attempt to analyze the situation without the guide of an historical or economic knowledge. We can imagine a new Russian thinking: "I find myself here on this planet wholly without my consent. I see others around me with far more of the things that make life pleasant; indeed, the sole occupation of many seems to be to devise new means of enjoyment, while I slave along on a pittance. To be sure, they say that rules have been made permitting this condition, but I did not agree to these, and it even appears that these rules were made by people most of whom are now dead, and that they are perpetuated and revised by a small minority of those now here; the others not bothering themselves to express themselves one way or another. I decline to recognize these rules, and I am going to get what I want in any way I can. The game was evidently rigged by a lot of people who happened to be here first, and I don't propose to stand for it."

Perhaps not many have formulated the proposition in as raw a fashion as this, but there is little doubt of the growth of some such feeling, and nothing but education can combat it.

Fortunately the kind of education needed is elementary in the extreme, and not of a kind requiring much time or study. We can all be teachers in such a school; but in this, as in other things in this world, the same old competitive system on which everything is planned is still in operation, and we have formidable competitors. Since the growth of conscious power from organization, which has come largely within the lifetime of many of us, we have been forcibly reminded that great mental ability is quite compatible with moral obliquity, and that such mental ability can be hired for unworthy purposes. Many of the organizations we shall have to deal with are possessed of abundant financial means, and with their great memberships can, and do, accumulate formidable sums from trifling individual payments, which sums constitute an irresistible temptation to brilliant but unscrupulous minds. Also, we have the venal yellow press, where control by one vicious mind permits feeding mental poison literally to millions. These are the worms at the root. Many people have derived their whole educations among the branches and twigs of the tree of knowledge and know nothing about the roots and trunk, at which a busy little worm may be conducting operations, the effects of which they see among the leaves, and try to combat with futile local treatment.

Mr. Finlay has the happy faculty of going to the foundation of things and building thereon structures in which one cannot help feeling confidence. His "Readjustment, Not Reconstruction" is a delight to one who believes in beginning at the beginning—setting up as he does a row of axioms and building his argument firmly thereon. It is something like that which the enlightened people of the world must do to steady the tottering structure of civilization. We must get down to the foundations and make them secure; patching up the cracks afterward. Fixing foundations is preëminently an engineering job. It must be done by enlightened propaganda, elementary education, pounded into every crack and crevice that can be found, and, judging by the startling manifestations we are daily witnessing here, there and everywhere throughout the world, there is no time to lose.

In old times, ideas traveled slowly, but today they are flashed to every corner of the world. That good ones can be spread quickly, and that they will take effect with marvelous results, is shown by looking back at Hoover's work in food conservation, where a few simple, vital facts were spread like wildfire, found ready acceptance, accomplished the apparently impossible, and prevented the loss of the war, already privately conceded by Lord Rhonda on account of the assumed inevitable failure of the food supply. Something like that can be done in back-firing against the social conflagration.

This country is full of organizations. There are clubs and societies by the thousand, ostensibly for this, that, and the other thing, but most of them in eager search for a really interesting object, notwithstanding their titles. They overlap, and their members touch elbows constantly. They are mostly composed of rather enlightened people, employers of others in large and small degree, but in the aggregate enormous, their members moving about so as to increase the points of contact to an extent that would make the spreading of propaganda (if such spreading should become interesting) well-nigh perfect. They constitute a possible means of combating social heresies that could hardly be improved.

The Stanford School of Mines*

By James Perrin Smith

At the meeting of the board of trustees of Stanford University held on Mar. 28, 1919, Theodore J. Hoover was appointed professor of mining and metallurgy. This appointment marks a new period in the development of the teaching of mining and metallurgy at the university. Plans are now being formulated so that these subjects will be handled under Professor Hoover's direction, rather than in close association with geology, as has been the practice.

The aim is for mining and metallurgy to be organized as a graduate course leading to the degree of engineer of mines. Candidates for admission will be trained largely in the department of geology, chemistry, engineering, and allied subjects, and such candidates will present as qualifications for admission the degree of A. B. from Stanford or its equivalent from some other institution. There will be active coöperation with the departments of geology, chemistry, and others, and the pre-mining courses will be designed to give prospective mining engineers a broad foundation in science, language, English, economics, and history, upon which foundation will be superimposed the two years' work leading up to the degree of engineer of mines.

Special attention will be given to the mining and metallurgy of the metals, and emphasis will be continued on the branch of petroleum technology. In addition to technical education, the division of technical research, as it applies to the unsolved problems in the utilization of the natural resources of California, will receive active attention.

Theodore Hoover was born at West Branch, Iowa, in 1871. He attended Friends' Pacific Academy, at New-

---

*Excerpt from the *Stanford Illustrated Review*.

berg, Ore., and Penn College (Friends), Oskaloosa, Iowa; and was graduated from Stanford University with the degree of A. B., geology and mining, in 1901. In 1902 he was assayer for the Keystone Consolidated Mining Co., Amador City, Calif. In 1903 he was assistant manager of the Standard Consolidated Mining Co., Bodie, Calif. In 1904-5 he was manager for the Standard Consolidated Mining Co., Bodie, Calif. In 1906 he was consulting engineer for the Cosmopolitan Proprietary, Ltd., in London and Mexico. In 1907 he was general manager of the Minerals Separation, Ltd., London.

In 1910 Mr. Hoover was made consulting engineer for Minerals Separation, Ltd., London. It was during his connection with the latter company that he developed the flotation process of ore concentration and applied it successfully to the treatment of the ores at Broken Hill, New South Wales. This period also gave him the opportunity and material for his book on concentrating ores by flotation, which has run through three editions and is still an authoritative text on this art.

During 1911-19 Mr. Hoover was consulting engineer at No. 1, London Wall Buildings, London Wall, London, and Mills Building San Francisco; managing director of Zinc Corporation, Ltd., Lake View and Oroya Exploration, Ltd.; director of Star Exploration, Ltd., Oroya Links, Ltd., Oroville Dredging Co., Ltd., Pato Mines, Ltd., Nechi Mines, Ltd., Mawchi Mines, Ltd., Granville Mining Co., Ltd., Natomas Land and Dredging Trust, Ltd.; chairman of Yuammi Gold Mines, Ltd., Central American Mines, Ltd., Babilonia Gold Mines, Ltd., Carnon Valley Tin Mines, Ltd.; president Oroville Dredging, Ltd.; consulting engineer Burma Corporation, Ltd., Messina Development Co., Ltd. In all of these positions he has demonstrated executive and administrative ability, combined with financial and engineering skill. In the course of his professional work, Mr. Hoover has traveled extensively in Australia, Mexico, India, Russia, Finland, Germany, France, and Asia Minor, and has thus visited practically every mining center in those countries.

As an undergraduate Hoover began his professional career in Amador City, as assayer at the famous Keystone mine, in Amador County, and upon graduation went back to that mine on the technical staff. Thus the classic Mother Lode was his training school, as it was of his brother, H. C. Hoover, of W. A. Prichard, and many other now famous engineers.

About this time an event happened that showed Hoover's foresight. He was on a visit to his old friends at Stanford and asked the writer of this review to go over to Waddell Creek on a fishing trip. On reaching Waddell we did actually fish, but Hoover disclosed to me that the primary object was not to fish but to look over the land. He hoped some day to be able to retire from active work in his profession, and wished to find a suitable place for a country home that would be at the same time a profitable investment and a desirable place in which to live. We agreed that he had found it. Then both kept quiet about it, and nearly ten years later Hoover bought the place

In the meantime Hoover went about his business, becoming in turn manager of the various mines in different parts of the world already mentioned. As soon as it was possible, Hoover left the wearing work of foreign travel and turned back to Waddell Creek, realizing the dream of his student days, building up a model ranch and country home, where he raises his own cattle, sees the deer feeding on the hills, and catches trout out of the clear waters of Waddell Creek that caught his fancy in the old days.

Copper Country Mine Inspectors Meet

A conference of Michigan county mine inspectors and safety engineers was held at Houghton, Mich., on Apr. 23, 24, and 25, the meeting having been arranged by B. O. Pickard, representing the Bureau of Mines in the Lake Superior district, and F. W. Sperr, professor of mining at the Michigan College of Mines.

One of the principal subjects discussed was that of standardized mine-inspection reports, by means of which it will be possible to obtain a comprehensive idea of all accidents occurring in a state or a large mining district. Mr. Pickard believed that the report of the Marquette County inspector, one in use for years, is the best suited to the needs of all. It differs from the Houghton County report— for example, in that it includes accidents other than fatal ones underground and also separately reports on fatal, serious, and slight accidents on surface. The sample report submitted showed that in Marquette County mining there are nearly as many fatal accidents on surface as there are underground.

MINE INSPECTORS AND SAFETY ENGINEERS AT HOUGHTON

The Michigan mine inspectors are handicapped by the lack of state supervision, or, rather, of a central state authority to which they should report and to which they should look for guidance. It appears that the making of an annual report by a mine inspector is not compulsory as a state matter. Where the county boards of supervisors do not require it, the inspector makes no report, or one that is perfunctory and insufficient. The deficiency has been supplied in late years by the Bureau of Mines, which is a guide and aid to the inspector.

A photograph of those attending the conference is reproduced herewith. In the foreground is a group of Michigan College of Mines students, who demonstrated the use of oxygen helmets. In the center of the picture is C. E. Julihn, superintendent of the Bureau of Mines experiment station at the University of Minnesota. Others attending the meeting were: H. C. Juseen, Negaunee; G. H. Lohneis, Virginia, Minn.; Theodore Roy, Hurley, Wis., Republic Iron and Steel Co.; Byron D. Shove, Ironwood, Oliver Iron Mining Co.; John Brinkman, Keweenaw County; Gust Heikkila, Keweenaw County; J. P. Chapple, Iron Mountain, Oliver Iron Mining Co.; James Yelland, Marquette County; Frank Larson, Dickinson County; Fred B. Mitchell, Iron County; Henry J. King, Alfred James, Houghton County; Thomas Thompson, Palatka, Pickands, Mather & Co.; F. O. Bailey, Calumet & Hecla; Robert Eva, Ontonagon County.

Carranza's Oil-Lands Policy

The Mexican Congress convened on May 1, and late press dispatches indicate that President Carranza has outlined an important program. That part of Carranza's message dealing with the petroleum and mining industry is given in the following paragraphs, which are reprinted from the New York *Tribune*:

"The formation of a petroleum organic law, and one concerning combustible minerals, becomes more vital every day. Fortunately, the senators and members of the Chamber of Deputies share in the executive's desire to consolidate the sources of natural riches in accordance with law and equity. When we suggested the regulation of law and equity and asked for a revision of Article 27 of the Constitution (which nationalizes certain national resources, particularly petroleum lands), we were far from suggesting a rigid system which would entail the absorption of these properties by the state and so damage foreign business men.

"It is planned precisely to destroy any special privilege and to equalize the judicial status of Mexican citizens and subjects of other countries, without the nation claiming more preëminence than that given by national sovereignty, which rights nobody has brought up for discussion in connection with other sources of riches of which Mexico is an exceptional producer, such as mining, for example. Nothing can be discovered in the projected law, even by examining the sections which might be judged the most radical, that is not contained in previous legislation or in the statutes of colonial times (during Spanish domination). The rights of third parties which have been acquired in equitable form would be respected by the proposed law when those rights have a basis not contrary to our laws. This measure deserves the sanction of Congress.

"The participation of the state under the proposed law is less than that imposed by other nations for petroleum production. With regard to the laws for the public welfare and private well-being of the people, the executive power has had no other guide than strict equity."

Mining in Chihuahua

The State of Chihuahua is the largest in Mexico, comprising an area of 90,000 square miles and having a population of about 275,000, says a consular report. Economic conditions were better in 1918 than in either 1916 or 1917, as the reduction of bandit activity permitted the reopening of the large smeltery at Chihuahua and a number of the larger silver and lead mines at or near Chihuahua, Parral, Santa Eulalia, and Cusihuiriachic.

When the roving bandits in the state are suppressed, and mines and farms can be worked in safety, there will be unusual demands for mining machinery and supplies, agricultural implements, hardware, and railway equipment and supplies, as it is the general belief that the Chihuahua mining camps will then enter upon a period of prosperity such as they have never before experienced.

Chihuahua is considered the richest state in Mexico in mineral resources; consequently, the leading industry is the mining and smelting of silver, gold, lead, copper, zinc, and, during the last year, manganese. It was possible in 1918 to work only those mines at or near large mining camps. Several mines which had been closed for some time reopened during the year, and their output, added to the increased production later in the year of the other mines which were operating, made the total for the last six months about twice that of the first half of the year.

The estimated contents of ores and bullion declared at Chihuahua during nine months of 1918 and the entire year of 1915 were: Copper—1915, 58,943 lb.; 1918, 15,225 lb.; gold—1915, 31,691 oz.; 1918, 9604 oz.; lead 1915, 20,620,885 lb.; 1918, 35,715,232 lb.; silver—1915, 6,445,680 oz.; 1918, 4,341,376 oz.; zinc—1915, 5,639,017 pounds.

The American Smelting and Refining Co.'s smeltery was reopened in April after having been closed for two years, and continued operations throughout the year at full capacity and without interruptions, smelting about 240,000 tons of ore. Most of the mines are dependent upon it and would not be able to run were it closed. All the concrete work necessary for the mechanical handling of large quantities of ore was completed. When the present plans are finally completed this district will possess the largest lead smeltery in the world. The plant was built at a cost of about $1,000,000, U. S. currency, and the improvements and enlargements under construction call for an additional outlay of $2,000,000, almost half of which expenditure for betterments was made last year.

The San Francisco Mines of Mexico (British), situated in the Parral district, installed and began operating a flotation process mill in 1918. The Cusi Mining Co. (American), at Cusihuiriachic, started construction on a similar mill for the flotation of its lower-grade silver ores. The large Canadian power and irrigation company, Cia. Agricola y de Fuerza Electrica del Rio Conchos, extended distribution power lines from Parral to the following mining camps: San Francisco del Oro, Santa Barbara, and Minas Nuevas.

Alaska Gold Mines Co.

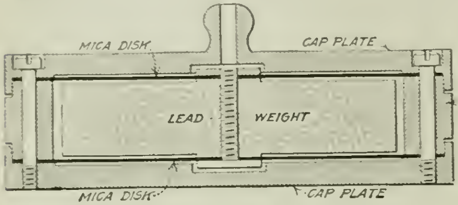
The seventh annual report of the Alaska Gold Mines Co., for the year ended Dec. 31, 1918, shows that 1,285,445 tons of ore was milled, containing gold of an average value of $1.09 per ton. The extraction amounted to 81% and the operating expenses to 96c. per ton. A net loss of 8c. per ton was, therefore, recorded. An increase in operating expenses of 19c. per ton was due to low tonnage treated during the period; there was an increase in the cost of supplies of 16.75%, of wages 12%, and a lack of skilled operators.

By the end of February, 1919, the tonnage being handled had risen to 6000 per day, and a corresponding reduction in operating costs may be anticipated during 1919. Broken ore in the stopes has been estimated at 2,000,000 tons. The tonnage in reserve, broken and unbroken, but prospected and prepared in the block of ground between No. 2 shaft and the west end of the property above No. 13 level, is estimated at 6,323,117, with a gold content valued at $1.02 per ton.

The Geophone

THE geophone, a "listening" instrument invented by the French to detect enemy sapping and underground mining operations and for ascertaining the position of enemy artillery, is now being used by the Bureau of Mines as a possible aid in establishing the location of miners who have been entombed after a disaster. The instrument was developed by United States engineers during the war, and is now used by the Bureau according to plans drawn by these engineers.

Alan Leighton, assistant chemist of the Bureau, who now has charge of these investigations, has given the following statement of general information regarding the geophone:



DETAIL OF GEOPHONE CONSTRUCTION

The instrument, though small, is essentially a seismograph. It consists of an iron ring about 3½ in. in diameter, within the center of which is suspended a lead disk which is fastened by a single bolt through two mica disks, one of which covers the top and the other the bottom of the ring. There are, in addition, two brass cap pieces, the top one having an opening in its center, to which is fastened a rubber tube, leading to a stethoscopic ear piece. The cap pieces are fastened with bolts to the iron ring and serve also to hold the mica disks in place.

If the instrument is placed on the ground, and any one is pounding or digging in the vicinity, energy is transmitted as wave motion to the earth, and the earthwaves shake the geophone case. The lead weight, on account of its mass and because it is suspended between the mica sheets, remains comparatively motionless. The result is that a compression and rarefication of the air in the instrument takes place. As the rubber tube leading to the stethoscopic ear piece is connected with this space in the geophone, this rarefication and compression is carried to the ear drum. Usually two instruments are employed, one for each ear.

When the two instruments are used, it has been found that the sound is apparently louder from the instrument nearer to its source. It is evident, then, that by moving the instruments properly a point can be found when the sound will be of the same apparent intensity in both ears. The direction of the sound is then on a perpendicular to the line connecting the centers of the two instruments either in front of or behind the observer. Further observation will show which side. Approximate direction is then accurately determined.

During the period of the war, engineers of the Mining Division of the Bureau of Mines were engaged in determining the distance through the clay, shale, coal, and the mine cover that different mining machines could be heard. Measurements were made, also, of the energy required in blows that could be heard for definite distances through clay, shale, and coal, as well as the distances at which the shock waves resulting from the discharge of various explosives could be audibly recorded.

In this connection it was found that sounds were transmitted only about half as far in clay as in shale strata, and about one quarter as far in clay as in coal. The sensitiveness of the instrument is such that pounding with a pick on the bituminous coal can be detected for a distance of 900 ft., and the direction determined, and pounding with a sledge can be heard as far as 1150 ft. These measurements were made in the Pittsburgh coal seam in the vicinity of Pittsburgh, where the coal is somewhat harder than in most other bituminous coal beds. The explosion of a 1-oz. charge of dynamite was detected a distance of over 2000 ft. through shale strata. One interesting feature of the instruments is that the sound as transmitted to the ear is markedly characteristic of the instrument producing the sound.

It is thought that the geophone will be of value to mine rescue crews who may be entering mines for exploration and for the purpose of finding miners who may have been entombed after a disaster. The tests so far made in the vicinity of Pittsburgh show that a man pounding on the coal rib with a pick, piece of timber, or a sledge can be detected and his position determined from a point 600 to 1200 ft. distant. The distance depends mainly on the character of the coal upon which the man is pounding, and intervening rooms and entries seem to have surprisingly little effect upon the distance or the determination of direction.

USING THE GEOPHONE

Pounding with a sledge can be heard from 200 to 300 ft. through the mine cover, the distance depending upon climatic conditions, as wind interferes greatly with the successful operation of the instruments. A study is also being made of the distances that pounding on rails and pipes can be heard. As rails are generally buried in the earth or dust on the entries of a mine, and because this dust damps the transmission of the sound, it is not transmitted well. The same is true of pipe lines. However, if pipe lines are not buried, but are laid on blocks and ties, pounding can be heard for great distances. So far no lines have been found long enough to show the limit of the geophones. It is known, however, that the ear can detect, without artificial aid, sounds made more than 2000 ft. distant.

In metal mines, expensive surveys sometimes have to be made, so that approaching tunnel headings may be brought together accurately. As direction can be determined so well with the geophones, it is thought that they can be utilized to advantage to guide such work. It would simply be necessary to go into each heading and determine the direction from which pounding in the other heading was coming.

Credits to Foreign Purchasers

Charles H. Sabin, president of the Guaranty Trust Co. of New York, in a statement issued on Apr. 19, calls attention to the advisability of granting more liberal credits to foreign purchasers of American products. Mr. Sabin advocates the meeting of international competition by the extension of longer credits than American business men have given heretofore, and says:

"The war forced us into the world markets on a scale not before dreamed possible. We are beginning to realize that our national prosperity is materially dependent upon the continuation of our vastly increased production, which exceeds the requirements of our own market and must continue to find an adequate outlet elsewhere. But, owing to the war, other peoples cannot pay us on practically a cash basis for the goods which they want to purchase from us, and which they sorely need. Consequently, we must allow them more time in which to meet their obligations. We must revise our point of view about foreign credits. Our banks can no longer restrict such credits to 60, 90, or 120 days, and render to manufacturers and exporters the service which the present readjustment period makes imperative.

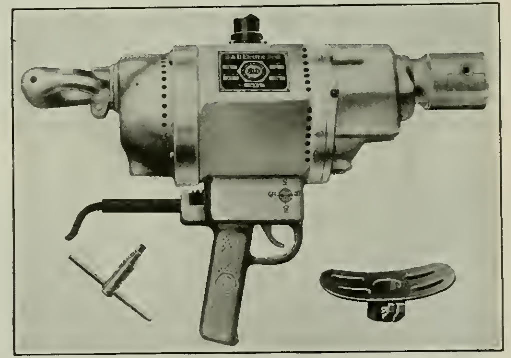
"England and Germany built up their great foreign trade prior to 1914 largely by making six months' time the selling basis for their goods. If we are to hold our own in foreign trade, we must profit by the experience of other countries and adapt ourselves to the needs of the present situation. The war has taught us many lessons; peace will teach us more. We have learned, for instance, that our existing banking system is the strongest in the world. But we must develop greater elasticity in our banking methods, particularly with regard to credits for fostering foreign trade. This is especially demanded in the selling of manufactured articles overseas, although it holds true to some extent in the selling of raw materials also.

"The recent unpegging of sterling and franc exchange has made clear to us the condition which is bound to prevail if we continue to insist upon the short-term credits which we have held to in the past. When the British and French governments withdrew their support to sterling and franc exchange, respectively, the tendency was to put the American dollar at a premium in England and France, which means that it takes more francs and shillings to equal a dollar, and, consequently, less imported goods can be purchased for an American dollar in those countries than was possible prior to the unpegging of the exchanges. This will tend to discourage the buying of American goods, and eventually will result in serious curtailment of our foreign trade unless we counteract that tendency by extending credits for a sufficient period to enable purchasers of our products abroad to pay us at a more convenient time."

A Portable Electric Drill

The outstanding feature of the ½-in. portable electric drill shown in the illustration is its method of control, the "pistol grip and trigger switch," which make it possible to handle the drill in the same manner that an automatic pistol is grasped—one pull on the trigger turns the current on and the next pull turns it off. This arrangement enables the operator to control the drill practically automatically, without having to change the position of his hands to manipulate the switch. An indicator is provided showing when the switch is on and when it is off.

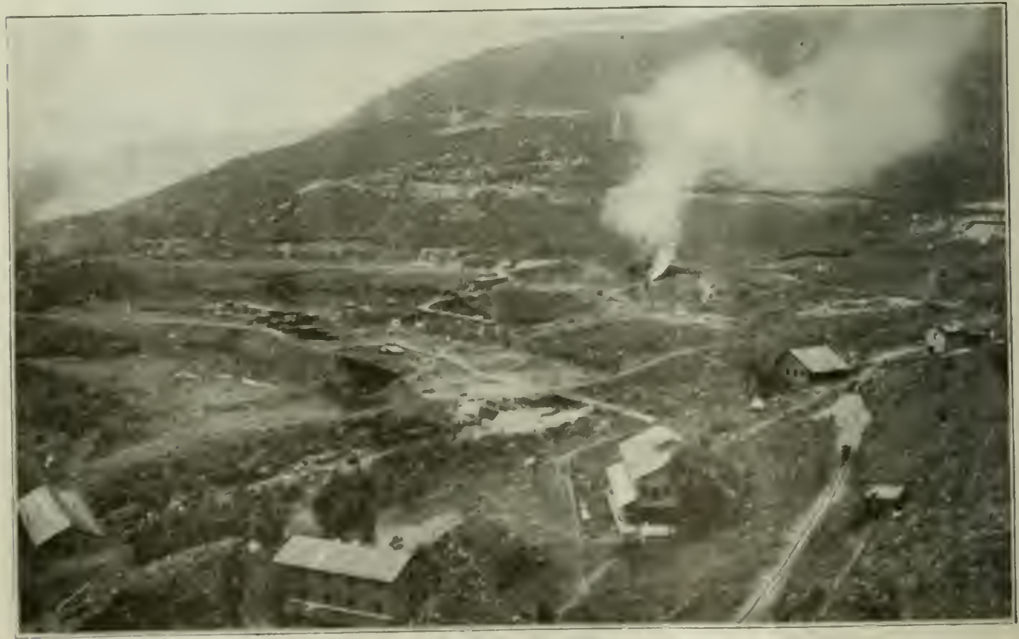
The drill is equipped with a ½-hp. motor. Its full-load current consumption is about 700 watts, and the no-load speed 600 r.p.m. The housing is of aluminum alloy, completely enclosing the motor and gears, and the total weight of the machine is 21½ lb. The electric motor is series compensated wound, interpolar type, and uses direct current or 25-, 40-, or 60-cycle alternating current, and will operate from any two wires of a three-phase circuit. Motor is air-cooled by means of a centrifugal fan mounted on the armature shaft, which draws air in at one end of the motor and expels it at the other. The gears are cut from high-carbon steel, mounted on ground shafts, and operate in grease in a separate grease-tight compartment. The drill spindle runs in a long bronze bushing against a ball thrust bearing. The commutator end cover is entirely separate from the armature shaft bearing, and is, therefore, easily removable for inspection and adjustment of brushes. This also eliminates the possibility of the armature shaft binding in the bearing, in case the end cover is accidentally distorted by dropping the drill or by exerting excess pressure on the feed screw. The drill is manufactured by the Black & Decker Manufacturing Co., Baltimore, Md.



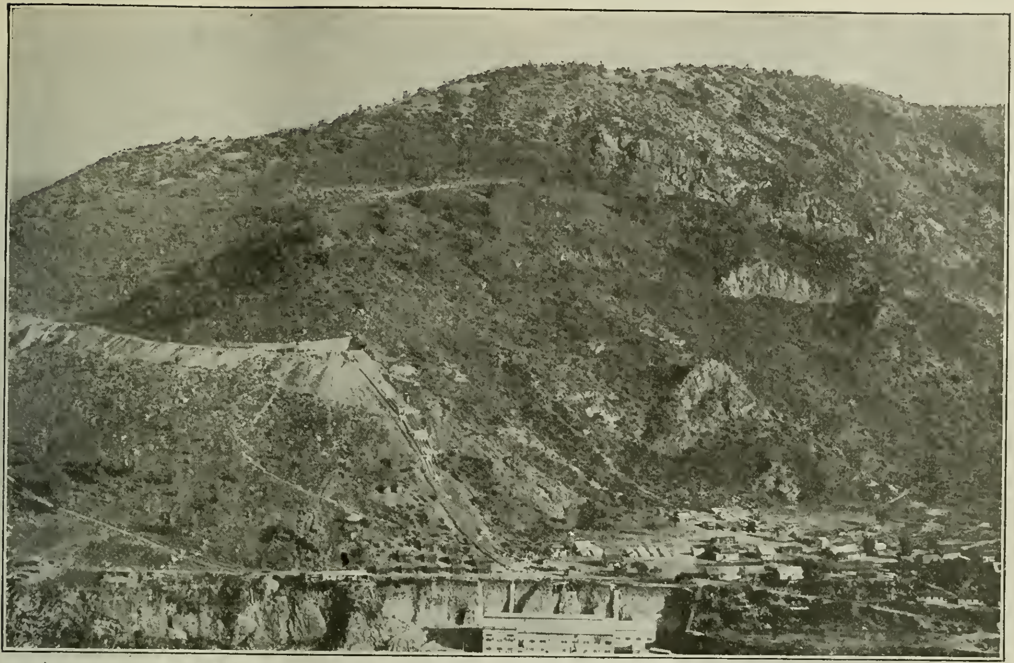
DETAIL OF PORTABLE ELECTRIC DRILL

Mining Progress in South America

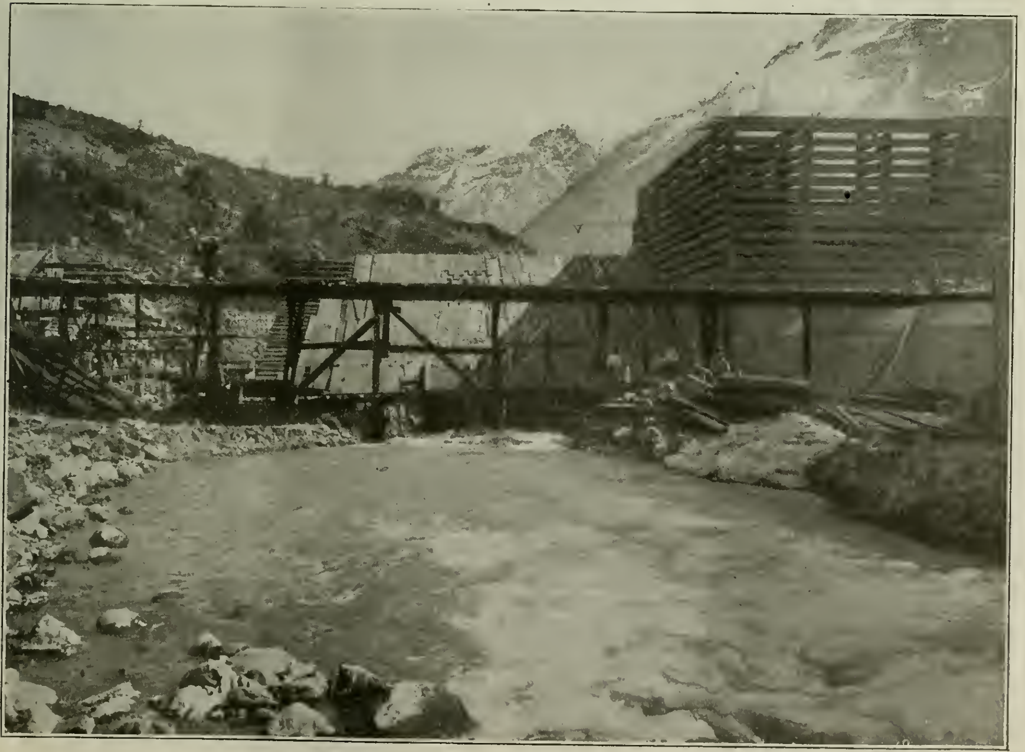
TYPICAL VIEW OF COUNTRY THROUGH WHICH BRADEN COPPER CO.'S RAILROAD PASSES



SITE OF NEW SMELTERY AT CALETONES, CHILE.



COYA CAMP AND 13,000-KW. POWER HOUSE, WHICH OPERATES UNDER 435-FT. HEAD



WOOD CRIB AND ROCK DIVERSION DAM UNDER CONSTRUCTION FOR PANGAL POWER PROJECT

Future of the Quicksilver-Mining Industry in the United States*

BY F. L. RANSOME

An appraisal of the quicksilver resources of the United States based on actual measurements and estimates of the quantity of ore available in individual deposits presents insuperable practical difficulties. The best that can be done is to reach a rough conclusion from the history of the industry and from general knowledge and impressions of its present status and of the condition of known deposits. It is also necessary to take into account the probability of the discovery of new deposits and of improvements in metallurgy.

Records show that quicksilver mining in the United States has generally declined since 1877, when the domestic production reached its peak, with 79,395 flasks. The output sank in 1914 to 16,548 flasks. Although not uniformly retrogressive, the decline was on the whole fairly regular and on this account the more ominous.

The price has not declined at the same rate as the output. In 1877, the year of maximum yield, quicksilver was worth only $37.30 a flask. In 1890 it had risen to $52.50 a flask, and in 1914 it was $49.05 a flask. Production has failed to respond to the stimulation of moderate increases in price, and the conclusion that the supply of ore has on the whole been decreasing in tenor and available quantity since 1877 appears to be warranted by the historical record. It is true that under the influence of unprecedentedly high prices during the recent war years the production rose to 36,159 flasks in 1917. This increase, however, was not accompanied by the discovery of any large new sources of supply, and that the domestic output of quicksilver must decline from the point reached in 1917 appears inevitable.

U. S. QUICKSILVER DEPOSITS ARE NOT LARGE

A wide survey of the known quicksilver deposits of the country confirms the conclusion drawn from historical and statistical data. The deposits, with few exceptions, are not large, most of them probably do not extend to great depth, and many of them are of decidedly superficial character. Even if the ore at certain localities does continue to a depth of 1000 ft. or more, some of the deeper orebodies, in consequence of their irregularity and lack of continuity, are likely to remain undiscovered. Certain mines at present the most productive have in all probability passed their period of greatest yield, although there is still a possibility that the discovery of new orebodies may restore them temporarily to something like their former activity.

There are in California a large number of old quicksilver mines which have been productive, but which have lain idle for years and which even the unprecedented prices obtainable for quicksilver during the last three years failed to revivify. Some of these are probably exhausted. Others contain orebodies or at least material that carries some quicksilver, and these mines will some day be reopened. For most of them, however, this is not likely to happen in the near future under any conditions that can now be foreseen. They will probably remain undisturbed until the higher grade and more accessible deposits of the world are exhausted.

During the last 20 years comparatively few new quicksilver deposits have been found, and only four or five of these have produced more than a few hundred flasks each. Of the total domestic production of 36,159 flasks in 1917, fewer than 600 flasks came from new mines opened during the war period, and not one of these promises to develop a production of 1000 flasks or more annually. The exploitation of the Terlingua district represents a notable modern addition to the known quicksilver resources of the country. Other regions capable of as great or greater production may be awaiting discovery, but as years pass the possibility is diminishing, and it is now hardly probable that any other locality with the potential productivity of the Terlingua district will be discovered in the country.

It appears, on the whole, that quicksilver mining in the United States must be regarded as a declining industry, in which, however, there is still opportunity for individual success, not only in working known deposits but in discovering and devoloping new ones. During the next 10 years the annual output may be expected to fall to 15,000 flasks or less. Prices, of course, will affect the output, but they cannot change the physical conditions upon which production fundamentally depends. The high prices obtainable during the war nearly tripled the annual output, but the same or even higher prices could not again produce the same result.

The price of quicksilver in the United States during the next few years will depend upon so many uncertain factors that prediction is extremely hazardous. Among the determining conditions may be mentioned changes in the uses of quicksilver, the cost of labor and supplies, the quantity and price of foreign quicksilver available, and tariff legislation. The decline of domestic production, of course, makes for higher prices. With the coming of peace there will be less quicksilver required for war purposes, although some of the modern applications that sprang from the exigencies of war are likely to persist. It is believed that the industrial consumption of quicksilver will be greater after the war than it was before, and will continue to increase until diminishing supply and rising price force the extensive employment of substitutes.

Quicksilver can undoubtedly be produced more cheaply abroad, especially in Spain, than in the United States, but it is doubtful whether this country will in the near future be deluged with foreign quicksilver to the extent feared by some domestic producers. Self-interest alone on the part of importers and foreign dealers would seem to preclude an attempt to lower the price in this country to anything near the cost of production in Spain.

QUICKSILVER INDUSTRY AND IMPORT DUTY

The plan of attempting to maintain the quicksilver-mining industry in the United States by a high duty on imported metal has many advocates among the quicksilver producers, whose representatives at a hearing held by the Tariff Commission in San Francisco in June, 1918, asked for a duty of $35 a flask in addition to the present 10% *ad valorem*. Such a duty would increase the profits of some of the larger mines, but would not transform a declining industry into a growing and self-supporting one. It is doubtful whether there is any wisdom in attempting to foster quicksilver mining by a high import duty the effect of which would be to levy a tax on all users of quicksilver for the benefit of a small group of producers, and it is still more doubtful whether the people of the United States would submit

---

*An excerpt from *Bull.* 666-FF, U. S. Geological Survey.

to this tax. It has been urged that as quicksilver is essential in warfare, the mining of quicksilver should be stimulated by tariff protection. This might be an excellent argument were American quicksilver supplies without limit, but inasmuch as they are in process of exhaustion it is difficult for one who looks at the question impartially to see why the Government should hasten the approach of that day when there shall be no more quicksilver ore to mine rather than purchase quicksilver where it can be bought cheaply, store it as an immediately available reserve supply against the next war, which it is hoped may never come, and rely as a final resource upon those mines in which some ore, that would have been taken out under suffcient governmental encouragement, may yet remain to be of service in a great emergency.

[A further contribution to this subject, in the form of a letter to the vice-chairman of the U. S. Tariff Commission, appears in another part of this issue.—EDITOR.]

Wages and Labor Conditions in Gold Mining*

A committee appointed by the Secretary of the Interior to study the gold situation in the United States, of which Hennen Jennings was chairman, submitted its report to the Secretary on Oct. 30, 1918. The report, which will soon be printed by the Bureau of Mines, contains some interesting information bearing upon the labor situation in the gold-mining industry of the United States.

The rated production of gold in the United States in the last 25 years has not kept pace with the production of coal, iron, copper, or petroleum, or the rapid growth of bank deposits. The principal cause of this relative decline in gold production is ascribed by the committee as being due to the shortage of labor. Other causes are mentioned, such as the lower efficiency of available labor, the great increase in the cost of supplies, and the higher cost of power. Depletion of certain ore deposits and the lower grade of ore mined in others have also been factors. It was reported that large gold mines in California were under operation with a supply of labor from 10 to 40% lower than the normal number employed. In the Cripple Creek district, Colorado, one of the larger companies was running at 54% of its minimum requirements for maintaining normal production and development. The number of persons employed in gold mining in the gold-producing states in 1916 was 42,942; this had declined to 34,277 in 1917.

Estimates by producers regarding the efficiency of present-day labor in the gold mines are to the effect that labor is 10 to 50% less efficient than under former conditions. These are rough approximations and no data are presented to show the present per-man per-day production as compared with that in the past.

One of the principal causes for the waning supply of labor in gold mining has been that of increasing wages in the face of a uniform price for gold, which is fixed by law. The report presents an interesting comparative tabulation of miners' wages as received in certain branches of the metal-mining industries where gold is produced either directly or as a byproduct. This table was prepared by an engineer of the California Metal Producers' Association. The wages shown are for the month of September in each of the years 1913 to 1918, inclusive.

The committee makes certain recommendations affecting the labor supply, but these were made during the period of war and have at present lost their applicability somewhat. It was recommended, for instance, that exemption from the draft and deferred classification be more generally applied to those desiring to enter the industry. The U. S. Employment Service, it was suggested, could arrange to return experienced men to the mines, and the Government could permit the return of drafted men on furlough to work at gold mines, or might detail sufficient numbers of the men from selective-draft reserves for the same work. The committee in conclusion recommends a thorough study of the mining industry with a view to improving mining conditions.

RATES OF WAGES PER DAY IN CERTAIN BRANCHES OF METAL MINING WHERE GOLD IS A PRODUCT OR BYPRODUCT, SEPTEMBER, 1913 TO 1918

	September, 1913			September, 1914			September, 1915			September, 1916			September, 1917			September, 1918		
	Machine Men	Hand Miners	Muckers	Machine Men	Hand Miners	Muckers	Machine Men	Hand Miners	Muckers	Machine Men	Hand Miners	Muckers	Machine Men	Hand Miners	Muckers	Machine Men	Hand Miners	Muckers
Copper mining:																		
Montana (Butte district)	$3.70	....	$3.70	$3.50	.....	$3.50	$3 83	.....	$3.83	$4.42	.....	$4.42	$5.00	.....	$5.00	5.25 5.75	.. ....	$5.25 5.75
Arizona:																		
Bisbee, Phelps Dodge Corporation	4.00	.....	3.75	4 00	....	3 75	4 10	...	3.85	5.32	.	5 07	5.60	...	5 35	5 50	....	5 25
Verde	3 75	$3.50	3.00	3.50 3.75	$3.25 3.50	2.75 3.00	3 50 4 00	$3.25 3.75	2.75 3.25	4.00 5.00	$3 75 4.50	3 25 4.25	5.00 5.50	$4 25 5.50	4 25 5 50	$5 15 5.90	$5.15 5.90	5 15 5.90
Utah:																		
Bingham-Utah Copper Co	3.25	2.75 3.00	2.75	3.25	2.75 3.00	2.75	3.50	3.00 3.25	3.00	3.75 4.25	3 25 3.75	3.25 3 75	4.50	4 00 4.25	4.00	4 75 5 25	4.50 5.00	4.25 4.75
General average	3.25	3.00 3 25	3.00	3.25	3.00 3.25	3.00	3.25	3 00 3.25	3.00	3.25 3.75	3.00 3.75	3 00 3.50	4.50	4.25	4.00	4 75 5.25	5.00	4.75
Nevada (Ely district)	.....	.	.....	.....	.....	.....	.....	.....	.....	.....	..	..	5.25	.....	.....	5 75	..	..
California (all districts)	3.25	.	2.50	3.25	....	2.50	3.25	.....	2.50	3.25 3.75	3.00 3.25	2.50 3.00	3.75 4.00	....	3.50	4.00 4.50	3.75 4.25	3.50 4.00
Copper and gold mining:																		
Washington	3 50	3.50	3.00	3.50	3.50	3.00	3 50	3.50	3.00	3.50	3.50	3 00	4.00	4.00	3.50	5.00	5.00	4.50
Silver and gold mining:																		
Nevada:																		
Tonopah	4 50	4 50	4 00	4.50	4.50	4.00	4 50	4.50	4.00	4.50	4.50	4.00	5 00	5 00	4.50	5 50	5.50	5 00
Comstock	4.00	4 00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00
Gold mining:																		
Nevada (Goldfield)	4 00	4 00	3.75	4.00	4.00	3.75	4.00	4.00	3.75	4.00	4.00	3.75	4.00	4.00	3.75	4 00	4.00	3.75
Montana (Kendall, Barnes, King Development Co.	3.50	.	3.50	3.50	....	3.50	3.50	.....	3.50	3.50	.....	3.05	3.50 4.00	... ..	3.50 4 00	4 00 4 50		4 00 4.50
alifornia (Mother Lode and grass Valley)	2.75 3 00	.	2.25 2.50	2.75 3.00	....	2.25 2.50	2.75 3.00	....	2 50	3.00 3.25	....	2.50 2.75	3.25 3.50	.. .	2 75 3.00	3 50 4.00	. ...	3.00 3.50

The Exportation of Gold From Brazil, states a consular report, was prohibited in 1917, and the output of the two large gold mines under British control, which formerly went to England (and in 1916 to the United States when that country was sending large supplies of war material to the Allies), has since remained in Brazil. The average annual export of gold metal amounted to approximately four tons.

---

*Extracted from *Monthly Labor Review*, April, 1919.

The American Quicksilver Industry

THE following correspondence between Murray Innes, of San Francisco, and Thomas Walker Page, vice-chairman of the U. S. Tariff Commission, and between Fletcher Hamilton, the State Mineralogist of California, and the Secretary of the Interior, will be read with interest, and will serve to draw attention to the need for prompt action if the American quicksilver industry is to be saved from collapse:

San Francisco, Calif.,
Apr. 24, 1919.

Mr. Thomas Walker Page,
Vice-Chairman, U. S. Tariff Commission,
Washington, D. C.

Dear Sir:

I have your favor of Mar. 6, inclosing copy of the second annual report of the U. S. Tariff Commission, regarding quicksilver, which is by far the most valuable and complete report published to date. You were kind enough to conclude your letter as follows:

> "May we ask you to give us the benefit of any suggestions which may occur to you for its improvement. Do not hesitate to revise the statement for our consideration in any way you think advisable."

In reply I beg to state that your report shows such a thorough grasp of the matter that I would not burden you with correspondence were it not for the wider circulation just given to what practically amounts to an epitaph of the quicksilver industry in the United States, by Prof. F. L. Ransome, which concludes as follows:

> "It has been urged that as quicksilver is essential in warfare the mining of quicksilver should be stimulated by tariff protection. This might be an excellent argument were our quicksilver supplies without limit, but, inasmuch as they are in process of exhaustion, it is difficult for one who looks at the question impartially to see why the Government should hasten the approach of that day when there shall be no more quicksilver ore to mine, rather than purchase quicksilver where it can be bought cheaply, store it as an immediately available reserve supply against the next war, *which it is hoped may never come*, and rely as a final resource upon those mines in which some ore, that would have been taken out under sufficient governmental encouragement, may yet remain to be of service in a great emergency."

Accustomed as we have become to the epidemic of internationalism at Washington, the above by Professor Ransome is most discouraging to the quicksilver miners on the Pacific Coast, who for two years were urged by letters and by pamphlets and by personal appeal by Government agents to devote their very best efforts, and such funds as they had, to the development of quicksilver mines. That they made good is proved by the Government figures as follows:

	Flasks
U. S. production in 1914	16,548
U. S. production in 1917	36,159
California production in 1914	11,303
California production in 1917	23,938

The world's production of quicksilver in 1917 is estimated by Ransome at 122,592 flasks, of which the *United States produced 36,159 flasks;* Italy, 29,300 flasks; Spain, 25,133 flasks, and Austria-Hungary probably about 27,500 flasks. You will note that the United States made the largest production of all the countries in the world. It made practically the same production the following year; and aside from the question of a square deal for a couple of dozen quicksilver miners who invested from a few thousand to $200,000 in their efforts, these figures seem to prove that the production of quicksilver in the United States is a fairly effective industry.

The second annual report of the United States Tariff Commission for 1918 includes the following:

> "Quicksilver is an essential metal, however, of vital necessity in the conduct of war and widely used in the industries. It is stated that American resources, although low grade, can furnish an adequate supply for many years if a stable and sufficient price be guaranteed. Without tariff protection, the United States will be dependent in large part on outside sources for a vital commodity, and a grave question of national expediency is involved."

It is true that, due to imports from Mexico, over-production, and small demand since the armistice was signed, 21 out of 25 Western producers have been forced to shut down their mines; but the surplus stocks of metal are now well absorbed, and as production is now below our normal peace-time requirements, we had hoped to reopen some of our mines this summer. Like all other mines in this country, we are facing very high costs; and, in view of such discouragement from Washington, it might, indeed, be wise for the U. S. Government and other consumers to look outside of their own country from now on for further supplies of quicksilver, which Professor Ransome states "can be bought cheaply." This may be true for a time, but I do not think it will hold good after our home competition has been destroyed.

On this point, and in contrast to Professor Ransome's free-trade and world-embracing views, the following from a letter recently received from London sheds some light:

> "With reference to quicksilver, and in reply, beg to inform you that your information was correct. Messrs. Rothschilds control both Italy's and Spain's output of quicksilver. As to export free on board steamer at some Italian port, I have made full inquiry and have found that all quicksilver has got to pass through the London market, and there is none offered f.o.b. Italian port first."

In other words, the Rothschilds now control the entire world's supply outside the United States, and once peace is officially declared they will doubtless take great pleasure in quietly assisting Professor Ransome in putting us all out of business. When we are all down and out, our skilled men scattered and our mines caved in, we can safely leave it to the Rothschilds to make the U. S. Government and our other consumers pay a tax compared to which a fair protective tariff may seem a trifle. We frankly admit that we cannot compete on an even basis with the peon and convict and other cheap labor of Mexico, Spain, Austria and Italy; and unless we receive such protection as will keep us alive until conditions are normal, Professor Ransome's epitaph holds good.

United States consumers of quicksilver may soon find themselves paying for this destructive attitude at Washington, and, if so, they can thank Professor Ransome, of the U. S. Geological Survey, an organization that, according to the American Mining Congress, has outlived its usefulness and should now be absorbed by the U. S. Bureau of Mines.

In 1917, when the professor's approach was widely heralded on this coast, quicksilver miners hoped for some useful geological assistance, or perhaps some advice about their ore occurrence, but, to their regret, Ransome merely skedaddled over the hills as silent as a sphinx, and all we now get from his Western tour is his usual dish of statistics and his private opinions on free trade. He practically states that our efforts and our undertakings were a mistake— that we are a squeezed lemon, and that the United States has small use for us from now on.

I will ask you to contrast this essay by Professor Ransome with the following extract from the New York *Engineering and Mining Journal* of Apr. 19:

> "War conditions and post-war conditions have caused cessation of operations at many small mines and prospects. This is serious, because many of the great mines of the future must grow from the small mines and prospects of the present. Individual initiative and enterprise have made America what it is today, and

the cultivation of these traits has, in 150 years, made us what we are. The suppression of them for centuries has made Russia what she is. If reconstruction is necessary in the mineral industry, it is not from the top to the the bottom, but from the foundation upward. The top is in a fair way to take care of itself.

"Renewed and substantial encouragement for the small operators may not sound like an important post-war problem, but it is the foundation upon which must stand one of the columns of our national structure of the future. Its neglect will mean one weak member that may weaken or wreck the whole edifice."

As confirming the conditions on this coast, I enclose herewith a copy of a letter regarding the quicksilver situation, addressed to Secretary of the Interior Lane by the California State Mineralogist, Mr. Fletcher Hamilton, on Feb. 15.

Thanking you for your consideration, I am,

Yours respectfully,
(*Signed*) MURRAY INNES.

Mr. Hamilton's letter follows:

Feb. 15, 1919.

Hon. Franklin K. Lane,
Secretary of the Interior,
Washington, D. C.

Dear Sir:

I consider it my duty to call your attention the present condition of an industry that is in danger of being killed in this country. I refer to the mining of quicksilver, which, as you doubtless know, was of first importance in California a generation ago, but which had declined for various economic reasons prior to the outbreak of the European war in 1914. Due to the stimulus of war prices, the quicksilver mines in this country were able to double their output and supply practically the war requirements of the nation until the armistice was signed. Previous to November, 1918, there was, however, some apprehension at Washington that the domestic production would not be sufficient for the nation, and producers were requested by the War Industries Board to hold their stocks for Government use and not to contract ahead for other purposes.

As in all other branches of mining, costs of production and operations were about doubled during the war, and now that the demand for the metal is extremely limited there is very small sale in this country, and most of the mines on this coast have been forced to shut down. I believe there are but four producing mines still in operation in California, and the production in Oregon, Nevada and Arizona has practically ceased. The production in the State of Texas has been about cut in two, and, as a result, the present output of quicksilver is small indeed. The worst feature is that there is no sale at present for even this small output, owing to the increasing importation of Mexican quicksilver, which is produced with the aid of peon labor and which, during the last three months, has been imported into New York by steamer and also across the Texas border to the extent of from 300 to 500 flasks monthly.

Faced as they are with extremely high costs and war taxation, the American producers are entirely unable to compete with this product from Mexico. They feel that, having developed and equipped their properties at high cost, and having heeded the request of the War Industries Board to hold their metal for Government use, they are now entitled to some small preference over the Mexican mine owners, most if not all of whom are known to be aliens. American producers feel that the matter could be handled by the licensing of imports, thus giving them first call in supplying the small market which now exists for their product, until such time as normal conditions and costs prevail.

This matter appears of some importance to me, not only as a matter of justice to the quicksilver producers, but because of the fact that no quicksilver is produced in France nor in the entire British Empire, and, if our industry is entirely killed, it would not only add just a little more to the condition of unemployment in California and the West, but might at some future time leave this nation without an adequate supply of an essential war material.

The small Mexican mines above referred to are sufficient at this time to render domestic business unprofitable, but they do not promise adequate supply for future requirements.

The British Empire, has I believe, made every effort to develop quicksilver in its own dominions, but without success, and it would seem most unwise to permit our own industry to die when slight assistance at this time may save it. This matter is of an urgent nature, and I feel that your assistance in this regard is vital.

Thanking you for your consideration, I am,

Yours very respectfully,
(*Signed*) FLETCHER HAMILTON,
State Mineralogist.

Michigan Copper Mines

HOUGHTON CORRESPONDENCE

The exodus of workingmen from the Michigan copper district continues. Never in the history of this district has there been such a general departure of high-class mining men. Drastic as is the cut of 2000 men from the forces of the Calumet & Hecla subsidiaries, the men who are remaining on the job are pleased, for, under the new plan, they work full time and are able to make living wages, instead of on the former three-fourths basis, at a reduction from war wages.

The mines of the Copper Range, Baltic, Trimountain, and Champion are continuing operations. It is rumored that the Trimountain will suspend, but this is not confirmed, and at present all properties are working, although the production has been curtailed substantially from normal. Quincy continues to operate, but the management there asserts that it is producing approximately 65% of normal, and that it is not adding to its underground working forces. Production for April was 1,450,000 lb., which amount will not be exceeded for May. Last year, Quincy produced 19,948,965 lb. Mohawk production now is at the rate of 9,000,000 lb. a year, a falling off of 20% from normal and a slight falling off from 1918. These independent producers are losing some men, but have taken no such drastic action for curtailment of copper output as have Calumet & Hecla and subsidiaries.

Calumet & Hecla production for May will be under 8,000,000 lb. for the old mine and all subsidiaries. Production for June will be cut down to about 6,000,000 lb. This compares with an actual output of approximately 10,000,000 lb. for March, 1919, and a normal output of 13,000,000 pounds.

Though the total number of men let out is 2000, the underground working forces have been cut by only 900 men. This does not mean, however, that the underground forces will be taking out copper, for the specific order has gone forth that all underground men are to be put at new openings wherever possible.

Ahmeek production will be cut to 1,200,000 lb. for May and under 1,000,000 for June. Allouez will be curtailed to 300,000 lb. Calumet & Hecla proper will be cut down to 3,200,000 lb. Centennial's output will be practically nothing by June. The same is true at La Salle, Superior, and White Pine, which latter property will be closed down altogether. Osceola Consolidated will be curtailed to 700,000 lb. Isle Royale will be cut down to 700,000 lb. by June. These figures will not be reached in the month of May, but the slump will be appreciable.

Ore Dressing and Metallurgy

Provision to insure safety usually results in improved efficiency. The type of hook shown has obviated danger and saved time in one plant, and would doubtless be equally applicable elsewhere.

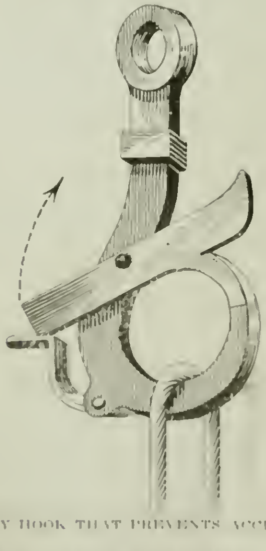
Few data have been published on the important factor of hydrometallurgical plant launder lining. The notes following show that concrete has proved a suitable material for the purpose. The lining described consists of flat slabs or U-shaped blocks. The use of magnesia cement permits repairs to be effected so that the launder is placed in operation expeditiously.

The turbo blower described is one of the noteworthy features of the new nickel refinery at Port Colborne, Ontario, Canada. Its compactness and high speed are unusual; continuous and satisfactory service has proved the soundness of design and construction.

Improved Safety Hook

A novel type of safety hook designed by J. Carroll, of the Tacoma plant of the American Smelting and Refining Co., and described by F. E. Pratt in that company's *Safety Review*, November, 1918, p. 2, is illustrated herewith.

During 1917 it was found that about once every three months an ore tub, while being lowered into a steamer's hold, would catch on the hatch combing. The cable hook would be released, and the tub and its contents would fall into the hold, sometimes injuring one or more men. The type of hook illustrated is simple and safe and has proved its reliability. In fact, its simplicity is such that no description of its operation is required.



SAFETY HOOK THAT PREVENTS ACCIDENTS

Concrete Launder Linings*

At the Consolidated Main Reef plant at Johannesburg, South Africa, a concrete liner introduced by J. T. Walker has replaced all others for some years. At first concrete U-cross-section blocks were placed in the mill launders. For a period of three years only the lining on the bends has been replaced. The wider portions of the launder taking pulp from mill pumps to tube-mill cones (slope 9½%) were lined, bottoms and sides, with 2½-in. thick flat concrete slabs and the narrower parts with U-shaped blocks.

LIFE OF CONCRETE LINING FOR LAUNDERS

Description	Slope of Launders, Per Cent	Screen Gradings of Pulp			Life to Date
		+60	+90	90	
Mill launders (U-blocks)	7½	53.55	11.38	35.07	3 years +
Wide launders conveying pulp from pump discharge to tube-mill cones (slabs)	9½	53.55	11.38	35.07	3 years +
Wide launders conveying pulp from pump discharge to tube-mill cones (U-blocks).	9½				.
Overflow launders from tube-mill diaphragm cones (U-blocks)	18	9.6	22.4	68.0	2½ years
Overflow launders from tube mill diaphragm cones (bends)	18	9.6	22.4	68.0	4 months
Launders leaving amalgamation tables (plate house) (U-blocks)	6	14.2	34.4	51.4	4 years +
Return classifier cones to mill pulp elevating pumps (U-blocks)	8½	56.8	26.8	16.4	2½ years +
Launder under return classifier cone discharge (U-blocks).	10	56.8	26.8	16.4	5 months

Note.—The + sign has been used to denote a longer life than that recorded, the liner still being in good condition at the time.

It has been necessary to renew few slabs or blocks in the last three years. Plate-house launders (slope 6%) lining of U-shaped blocks show little wear after four years' service. The U-blocks in the launder conveying the return pulp (slope 8½%) have given 2½ years of service, with promise of many additional years of life. At the head of this launder, where the classifier underflows impinge on the lining, the U-blocks last only five months. The following mixture is used for this concrete liner:

One part (by volume) dump waste (mostly quartzite) crushed to ½ inch.

One part (by volume) fine from above crushing (passing ¼ mesh).

One part (by volume) washed drift sand.

One part (by volume) Pretoria portland cement.

The blocks are cast in a long frame holding 10 to 12 molds. After allowing to set and dry for two days in the frame, they are submerged in water for six or seven days and are then ready for use.

The flat slabs are usually 2½ in. thick, with length and width to suit requirement. The blocks or section of U-cross-section are usually 18 in. long and 9 in. deep and from 11½ in. to 13½ in. wide over-all. The thickness at the bottom is from 2 in. to 2½ in., tapering off to 1 in. sides at the top. Blocks to fit bends in the launder are made with the same cross-section dimensions. The average weight of an 18-in. length section is 75 pounds.

---

* Abstract from notes by F. Wartenweiler in the November issue of the *Journal of the* Chem., Met. and Min. Soc. of S. Africa.

The slabs and U-blocks are jointed in the launders with quick-setting magnesia cement, or with mill blanketing. Either method is satisfactory. When making renewals, the worn blocks are chipped out and replaced by new ones. The discarded blocks are ground in the tube mills and pass into the pulp circuit.

Improved Turbo-Blower Unit

By W. L. Wotherspoon*

The turbo blower shown in the illustrations is a part of the mechanical equipment of the International Nickel Co.'s new plant at Port Colborne, Ontario, Canada.

The unit, which was furnished by the Rateau-Battu-Smoot Company, New York, has a capacity of 15,000 cu.ft. of free air per min., delivered at 15 lb. gage pressure. The speed of 8500 r.p.m. at which it operates is believed to be the highest attempted or attained for a machine of this capacity and type. The outside dimensions of the turbo blower are 9 ft. 6 in. long, 5 ft. 0 in. wide, and 3 ft. 11 in. high from floor line.

As will be seen from Fig. 1, the driving end of the unit consists of a three-stage steam turbine in which the wheels are forged integral with the shaft. The turbine is designed to operate on steam at 150 lb. pressure, superheat 100° F., and exhaust 2 in. of mercury absolute, under which conditions it can develop a maximum of 700 h.p. The turbine and blower shafts are connected by means of a flexible-pin type coupling. An important feature is the design of the blower impellers.

The equipment contains many special features, illustrating an advanced stage of turbo-blower design in both steam and air ends. In view of the high speed to be maintained, special attention was given to the question of exact dynamic balancing and efficient lubrication. Some repairs were found necessary at the beginning of operations, as a result of fracture of the impeller blades in the blower, due to faulty steel; but the adoption of nickel steel for these parts obviated further trouble.

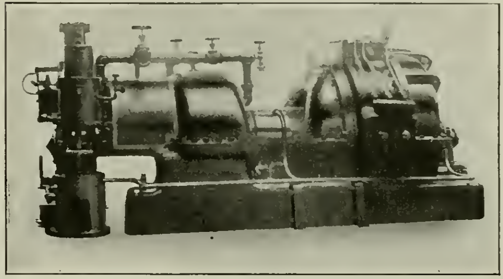


FIG. 2. THE TURBO-BLOWER UNIT AT THE INTERNATIONAL NICKEL CO.'S PLANT AT PORT COLBORNE

The unit is equipped with a sensitive, constant-pressure regulator; and, as the compressed air delivered is for use in copper converters, a stabilizer has been added to permit the blower to run without tendency to surge on all loads from zero to maximum. A safety device to prevent over-speeding is also provided. This consists of a small fan on the end of the turbine shaft, which maintains a definite pressure on a tripping device controlling a butterfly valve in the steam line. This tripping device is capable of operating practically an unlimited number of times on these high-speed machines without liability to damage to the movable parts.

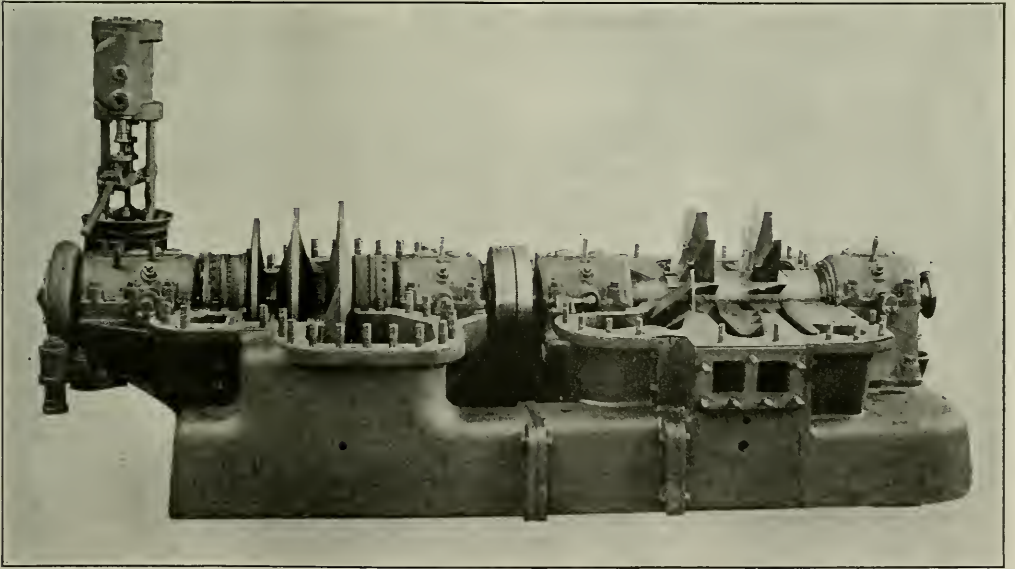


FIG. 1. HIGH-SPEED TURBO BLOWER DISMANTLED FOR INSPECTION

---

*Consulting engineer, International Nickel Co., 43 Exchange Place, New York.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief

After analyzing the locations of mining properties which are the bases of claims under the War-Minerals Act. the War-Minerals Relief Commission has selected for hearings certain central points which will be most accessible to the majority of claimants. The points at which hearings will be held are as follows: Little Rock. Tucson, Los Angeles, San Francisco, Medford, Ore.; Portland, Ore.; Baker, Ore.; Spokane, Butte, Salt Lake City, and Denver. The commission will leave Washington on June 7, and will visit the places selected for the hearings in the order named.

As it is the intention to give each claimant an opportunity to appear in person, or to be represented by an attorney, it is impossible to arrange the dates of the hearings far in advance. Several days' advance notice will be given, however. The hearings, wherever possible, will be conducted in the post office or other Federal building. After the return of the commission to Washington, it is possible that it may visit Atlanta.

The engineers and accountants of the Bureau of Mines who have made examinations in connection with the claims will not be put upon the stand during the hearings. Their reports in each case will be reduced to writing and placed in the hands of the commissioners. The report will be available to the claimants, and an opportunity will be offered for them to present evidence refuting any statements which may be made by the Bureau's engineers or accountants. The engineers have proceeded on the theory that they represent the claimants as well as the Government. Their purpose is to ascertain the facts in each claim, and not to act as experts looking for evidence with the sole object of breaking down the claimant's case. Among the claims received last week was one from a Cuban company that is operating in Cuba.

Fred P. Williams and J. A. Battle, Jr., have been added to the staff of engineers engaged in the examination of claims. Mr. Williams comes from the Fomento Development Co., which has been operating in Santa Clara Province, in Cuba, and Mr. Battle from the Northern Pyrites Co., operating in Ontario. In addition, three engineers familiar with chrome mining are to be engaged. The commission is finding that competent mine accountants are scarce, and is experiencing considerable difficulty in securing the services of enough men to meet its needs.

Mining-Engineer Consuls

Officials directing the consular service of the United States invite mining engineers, and others with a knowledge of the business side of mining, to take the consular examination, with the view to being sent to consular posts in regions where mining is the most important industry.

At present, there are few men in the consular service who pretend to be specialists in mining. It is pointed out that the only way in which the consular service could designate such men would be to have men thus qualified take the examination. The salaries paid to consuls are so small that few, if any, mining engineers are attracted to the work. It is suggested, however, that the service should appeal to older mining engineers with means. To such men, the salary would be a secondary consideration, and an excellent opportunity would be afforded them to be of great service to the mining industry.

American consuls abroad usually enjoy prestige and pleasant social relationships. Consular officials see no reason why the places would not appeal to retired mining men, and they would be glad to do all in their power to place these men where their experience would increase their efficiency, provided they can be induced to take the examination prescribed by law. The examination is not a difficult one.

Mineral Industry Census

Approximately $500,000 will be expended during the taking of the coming census in the collection of data concerning the mineral industries. The handling of the information pertaining to mines and quarries at the last census gave rise to considerable criticism. It is admitted in official circles that much of the criticism was justified.

To prevent any recurrence of the inefficiency of 10 years ago, careful plans are being made in advance. Arrangements have been completed whereby full use will be made of the technical knowledge and experience of the specialists in the Geological Survey and the Bureau of Mines. It is not improbable that a special statistical organization, under the direction of an experienced geologist, will be agreed upon by the three bureaus concerned. From this one administrative unit, all questionnaires regarding mineral commodities will be sent out.

The Western offices of the Geological Survey at San Francisco, Denver, and Salt Lake City will handle the mining schedule for the Western mining states for the Bureau in making the census. For the period of the census, practically the entire clerical and technical staff of the Minerals Resources Division of the Survey will be sworn in as census agents.

Ten years ago, the mineral returns were gathered principally by field agents. This year they will be gathered almost entirely by mail. Where it is necessary to use field agents, they will be chosen from mining engineers or others who have special qualifications for the intelligent handling of mineral data.

The Interstate Commerce Commission has authorized the Atchison, Topeka & Santa Fé R.R. to establish rates on ore dependent upon value, on shipments from Santa Rita, Fierro, Hanover, and Silver City to Waldo, N. M.

Exports of mining machinery in March, 1919, were valued at $917,898. This compares with $1,286,616, the value of such exports in March, 1918. In addition to the foregoing figures, oil-well machinery to the value of $414,589 was exported in March, 1919. This compares with $123,572 in March, 1918.

Mining and Geological Exposition

Washington Correspondence

An exposition of unusual attractiveness will be held in the building of the Department of the Interior, in Washington, for the two weeks beginning May 19. It is intended to draw attention to, among other things, the war and reconstruction work of the bureaus of the department. It will show how a non-military agency of the Government developed super-poisonous gases. Devices will be exhibited which were used to detect the presence of the enemy underground, and exhibits will demonstrate how the mining industry furnished greatly needed war minerals. Exhibits will show how the airplane is being considered as an important adjunct in topographic work. There will be a display of devices that helped to win the war, and the work of each bureau in the department will be outlined.

There are to be lecture and moving-picture programs three times daily, and arrangements have been made for the attendance of classes in schools and colleges.

The Bureau of Mines will present an exhibit showing the sources of war minerals and the preparation and the utilization of these minerals for military purposes and for use in essential industries. One feature of this display will be the history of the shrapnel shell. The copper, zinc, lead, antimony, mercury, nitrate, pyrite, sulphur, and other component materials will be shown in each state of processing.

Much attention is to be given to American graphite and clays at the exposition, and their use in the manufacture of crucibles will be demonstrated. The many varieties of American clays will be displayed in the raw material and in the finished products. Another exhibit will show the development of the iron and steel industry, especially along the lines of special steels used in military equipment. The use of manganese, chrome, tungsten, and other ferro-alloys also will be depicted. The history and world control of potash, tin, nickel, asbestos, magnesite, and mica will be shown in an attractive manner.

The Petroleum Division of the Bureau of Mines will have as its part of the exhibit given by the Department of the Interior the following features:

A miniature drilling rig, showing how an oil well is put down; a model which will illustrate the principle of making gasoline from natural gas; a model showing how gasoline is made from crude oil in the refineries; actual joints of pipe that go into the oil well. The field method that is used for separating free water from oil and the movement of oil through stone will be shown by working models. There will be a model illustrating the manner in which layers of stone and shale are laid down through geological ages, and how these are pierced to the oil-bearing sand.

When a well is drilled into water it is necessary to cement the lower part of the well if operations are to be continued. A model of the instrument which is used in this connection will be shown. Various graphic representations will serve to describe an oil anticline, how records of wells are kept, and a drawing will delineate the various processes through which the oil passes, from the time it leaves the well until it gets to the refinery. Numerous photographs will show the various phases of the oil industry, and there will be on exhibit samples of oil shale, crude oils, and war gasolines.

That the war has made some fundamental changes in methods will be seen in the exhibit arranged by the Geological Survey. This organization is already using the airplane in making topographic maps, and expects that this branch of the work will grow rapidly. The use of the airplane has already resulted in better maps than were previously possible. All this development occurred during the war, when the airmen flew over enemy territory and photographed the country, turning their results over to the Survey men, who developed the maps. The newer methods will be illustrated at this exhibit.

There will also be two large models, one of which will show an undeveloped region being investigated by geologists, topographers, and engineers, and the other the same region after they have completed their work and shown the natural resources and the possible development of the territory. The so-called war minerals, which were so badly needed for victory and which were sought eagerly all over the country, will also be displayed, conveying a unique lesson of what a thoroughly aroused nation can accomplish under stress.

Journal Copper Quotation Basis for Balaklala Suit

William A. Kerr, vice-president and general manager of the Balaklala Consolidated Copper Co., operating subsidiary of the First National Copper Co., according to the *Boston News Bureau* of May 9 has brought suit against the Mammoth Copper Mining Co. and the United States Smelting, Refining and Mining Co. for a settlement on all ores shipped during the latter part of November and the months of December and January. The amount involved approximates $40,000; the tonnage about 18,000.

Preliminary settlement had been made by the smelting company on the basis of 15c. a pound for the copper. The first quotation of the *Journal* following the shipments was 18.39c. a pound, which the Balaklala company demands shall be the actual settlement figure.

The smelting contract between the Balaklala company and the Mammoth company was for a 10-year period effective in August, 1915, and provided that the Mammoth company pay the Balaklala company for the copper content of ore shipped on the basis of the *Journal* weekly price averages. Following the armistice there was a suspension of these quotations from about Dec. 1 to Feb. 8. The first one thereafter was 18.39c. a pound.

Mines and Railroads in the Nogales District of Sonora

Of the minerals produced in the Nogales district of Sonora, copper easily leads, both as to bulk and value, states a consular report. Exports of this metal for the year 1918 reached the total of $15,471,000, of which only $70,000 worth was shipped through the port of Nogales, the remainder being shipped through the consular agencies of Cananea and Agua Prieta. Next comes silver, with a total export value of $5,237,000. Silver ore and silver bullion are of about equal importance, with silver concentrates ranking next. The larger portion of the silver exported also goes through Cananea and Agua Prieta. Graphite ore to the value of $244,000 is included in the returns of this consulate, but it is all mined in the district of Guaymas; these shipments are usually billed to Saginaw, Mich. Gold exports from the district for the year 1918 total $1,355,155. Among other ores shipped from this district may be mentioned tungsten, molybdenum, and antimony.

The Southern Pacific R. R. Co. of Mexico is the only line of consequence operating in Nogales. This road runs tri-weekly trains from Nogales to Guaymas, a distance of 245 miles. The same system operates a branch line running tri-weekly trains from Nogales to Naco via Cananea, a distance of 120 miles. The Nacozari R.R. runs trains from Agua Prieta to Pilares, Sonora, a distance of 65 miles. These are the only railroads in the district. The property of both these companies has greatly deteriorated, owing to the fact that they have been compelled on several occasions to withdraw all trains and practically abandon their roadbeds. All the bridges of these two railways have been destroyed; and all rolling stock, the roadbed, terminals, and buildings must be renewed at an early date if the roads are to continue to operate.

American Mining Congress in Alabama

At a meeting of producers in the Birmingham Chamber of Commerce held on May 1, the Alabama Chapter of the American Mining Congress was launched, with 50 charter members. The governor of the new chapter is T. H. Aldrich, a leading mining engineer of Alabama. The vice-governors are J. B. McClary, president of the Yolande Coal Co.; A. B. Conklin, president of the Clay County Graphite Co., and Eugene Fies, president of the National Pyrites and Copper Co. Other directors are Leo K. Steiner, president of the Liberty Graphite Co.; C. T. Fairbairn, general manager of the Republic Iron and Steel Co.; Theodore Swann, president of the Southern Manganese Corporation; Floyd Weed, of the Ceylon Co. (graphite), and L. Sevier, of the Sloss-Sheffield Steel and Iron Co. John N. Vincent, assistant secretary of the Alabama Coal Operators' Association, is secretary of the chapter. A membership committee, now at work, is determined to bring the membership up to 100. There will be close affiliation with the Alabama Coal Association, of which all of the coal producers of the chapter are members.

Dredging Operations in Colorado

The Derry Ranch Gold Dredging Co., of Leadville, Colo., resumed dredging operations on Apr. 20, after having been closed down, as usual, during the winter months. This dredge is situated a few miles from Leadville, at an altitude of about 10,000 ft., and the winter climate is so severe that it is to the advantage of the company to suspend operations during the cold season. The company is generally fortunate enough to secure the return of its regular dredging crew each spring, which undoubtedly contributes largely to the successful results achieved.

Operations were begun over three years ago, on a piece of ground that had been previously under consideration by many other companies, but all had hesitated to undertake the equipment of the property with a dredge. The gold recoveries were high, but boulders were large and numerous, and some of the gravel was tightly cemented. It remained for the present company to equip the property with a modern dredge, which has proved highly efficient since it began operations.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for March, 1919, and the figures for March, 1918, as finally revised, are as follows:

IMPORTS, MARCH, 1918 AND 1919

(In pounds, unless otherwise stated)

Metal and Ore	March, 1918	March, 1919
Antimony ore, contents	234,356	90,726
Antimony matte, regulus or metal	3,048,752	1,233,904
Copper		
Ore, contents	11,068,341	4,475,752
Concentrates, contents	3,724,800	2,229,506
Matte, regulus, etc., contents	3,599,160	3,441,721
Imported from (in part)		
Canada	2,703,945	1,723,017
Mexico	7,717,524	2,368,702
Cuba	5,740,547	925,295
Chile	516,916	4,903,436
Peru	40,939	127,037
Venezuela	166,033	*Nil*
Unrefined, black, blister, etc.	36,514,548	49,564,536
Refined, in bars, plates, etc	*Nil*	1,678,919
Old, etc., for remanufacture	36,400	400,240
Composition metal, copper chief value	*Nil*	10,235
Lead:		
Ore, contents	6,903,016	1,512,494
Bullion contents	14,340,440	7,937,167
Imported from (in part):		
Canada	2,084,554	1,329,994
Mexico	15,418,852	8,101,265
Pigs, bars and old	1,061,004	623,525
Pyrites, long tons	51,276	12,959
Imported from (in part):		
Spain, long tons	49,566	10,944
Canada, long tons	1,540	1,765
Tin ore, long tons	613	1,066
Tin bars, blocks, pigs, etc	13,529,209	8,284,970
Imported from (in part).		
Straits Settlements	6,801,623	7,930,972
Dutch East Indies	375,905	*Nil*
United Kingdom	3,344,557	*Nil*
Australia	379,572	71,680
Hong Kong	1,709,001	*Nil*
Tungsten ore, long tons	284	675
Manganese ore, long tons	19,300	48,238
Imported from (in part):		
Cuba, long tons	10,525	6,270
Brazil, long tons	6,907	37,935
British India, long tons	500	*Nil*
Zinc:		
Ore, contents	4,801,336	1,814,142
Imported from:		
Canada	992,380	358,605
Mexico	3,808,956	1,455,537
Blocks, or pigs, and old	4,371	*Nil*

EXPORTS OF LEAD, COPPER AND ZINC

(In pounds)

	March, 1918	March, 1919
Copper		
Ore, contents	270,175	1,600
Concentrates, contents	111,220	*Nil*
Unrefined, black, blister, etc	4,291,367	269,343
Refined, in ingots, bars, etc	59,776,855	13,088,819
Exported to (in part)		
France	38,980,549	1,214,152
Italy	9,068,568	3,540,891
United Kingdom	9,830,999	2,359,896
Canada	1,452,148	920,588
Composition metal, copper chief value	42,660	85,015
Old and scrap	64,900	219,036
Pipes and tubes	449,197	665,219
Plates and sheets	2,729,851	853,543
Wire, except insulated	918,037	12,039,554
Lead:		
Pigs, bars, etc., produced from domestic ore	16,363,220	4,289,414
Pigs, bars, etc., produced from foreign ore	1,998,566	2,635,524
Exported to (in part):		
Denmark	*Nil*	422,179
Canada	2,018,279	695,378
United Kingdom	12,714,785	3,846,563
Argentina	82,880	426,200
Japan	1,801,349	*Nil*
France	*Nil*	1,141,205
Brazil	582,269	172,000
Zinc:		
Dross	1,279,807	220,984
Spelter		
Produced from domestic ore	12,875,317	14,373,192
Produced from foreign ore	4,072,900	1,286,277
Exported to (in part)		
France	9,274,701	2,657,112
Italy	726,041	3,911,936
United Kingdom	5,401,694	8,130,264
Canada	1,110,611	593,650
Mexico	244,470	*Nil*
Japan	*Nil*	112,000
In sheets, strips, etc	1,811,980	5,368,115

Vancouver Manganese Deposits in the Cowichan district will be discussed and all available information relating thereto will be included in a publication to be issued soon by the Canadian Munition Resources Commission, according to G. C. Mackenzie, late of the Canadian Geological Survey Branch, Ottawa

Bonus Systems in Montana Mines

Butte Correspondence

Increased efficiency measures are commanding much attention from the officials of the Anaconda Copper Mining Co., which recently has put into effect a contract system for the miners employed in stoping operations. Heretofore the contract system applied only to men engaged in driving drifts, crosscuts, or mucking, the workers in the stopes being paid only their daily wage. Men on contract usually do from 25 to 30% more work, as they are paid for the results actually accomplished, and the miner is found to be more satisfied than when his daily pay ranges around $8 or $10, despite the fact that he labors far harder than ordinarily. More is accomplished for the companies under the same overhead expense, and a marked increase in efficiency is looked for through an extension of the plan. Since the signing of the armistice, which released a floodtide of labor, enabling the mining companies to select their men, efficiency in the Butte district has been increased from 20 to 30%. The North Butte Mining Co. estimates that it has increased efficiency at its mines up to about 25%, through a bonus system introduced about a month ago, with a consequent lowering of its copper costs to 14.2c. per lb., and still further improvement is expected. The bonus is paid weekly, and is based upon actual details performed in connection with the miner's daily work, whether it be in the stopes or otherwise. At present the bonus applies only to underground workers, but it is the plan of the management to extend it to every employee of the North Butte.

The Butte & Superior Mining Co. has been experimenting with the contract pay system for a period of one month, as applied to men stoping ore, with satisfactory results, according to an unofficial statement. The percentage of improvement is found to be about the same as elsewhere in the district.

American Institute of Mining and Metallurgical Engineers

The New York Section of the American Institute of Mining and Metallurgical Engineers held its regular monthly meeting on the evening of May 7. Officers for the ensuing year were balloted for, and Allen H. Rogers, chairman, declared the following elected: Chairman, E. P. Mathewson; vice-chairmen, William Young Westervelt and R. M. Atwater, Jr.; treasurer, Wilber Judson; committeemen, E. S. Berry and L. W. Mayer.

Col. O. B. Perry, of the 27th Regiment of Engineers, was introduced and entertained the members by an interesting description of the activities of the 27th in France. Colonel Perry also described the engineering organization of an army. Capt. E. S. Berry gave a short but illuminating description of the Army Supply Service.

April Pig-Iron Production

Pig-iron production during April was 2,478,218 gross tons, or an average of 82,607 tons a day, according to *Iron Age*, a falling off of 25% from production in April, 1918. The 212 furnaces active May 1 have an estimated daily capacity of 75,860 gross tons, as compared with 266 furnaces, rated at 93,165 tons, on Apr. 1, 1919, and 350 furnaces, rated at 109,675 tons, on Jan. 1. In April, 56 furnaces, including 13 in the Pittsburgh district, were blown out; 2 were blown in. Reports show a net loss of 54 active stacks in April and 138 in the first four months of this year. Only 17,308 gross tons of ferro-alloys was made, spiegeleisen amounting to but 2778 gross tons.

New Iron-Ore Prices Effective

Lake Superior iron-ore prices have been reduced 20c. per ton, following the cut from $1 to 80c. in the net vessel rate from the ports at the head of the Lakes and a reduction at the same rate, or 20%, from other ports, according to *Iron Age* of May 1, 1919. The new prices are in conformity with the decision of the recent Washington price conference, which left late 1918 prices unchanged, but subject to any reduction in either the rail rates from the mines or vessel rates, thus giving the consumer instead of the ore shippers the benefit of any reduction in carrying charges.

The few ore contracts that have been placed up to the present were at the late 1918 prices, but had a rider which provided that the buyer would be given the benefit of any reduction in transportation charges. With the formal changing of the prices, contracts taken from now on will provide that the prices named shall be subject to any change that may be made during the season in the railroad rates or in the Government tax.

The application made by some of the railroads to increase the unloading charge from 10 to 15c. per ton at Lake Erie ports was considered at a meeting held in Pittsburgh, April 25, and refused. Consequently, ore consumers will get the full benefit of the 20c. per ton reduction in carrying charges. The new carrying charges are 80c. per ton, net, from Duluth; 72c. from Marquette and 60c. from Escanaba.

Little ore is being sold, and the outlook for business during the next few weeks is not promising. Some of the ore firms have begun shipping ore in a small way, but indications are that the movement will not get well under way before the first of June.

The iron-ore carrying capacity of the Lake fleet has been reduced 520,000 tons this year, based upon a carrying season of 20 trips. There are now 377 ore carriers, with an aggregate trip carrying capacity of 3,029,000 gross tons, as compared with 3,055,400 gross tons last year. The reduction in vessel tonnage has resulted from the requisitioning of Lake vessels for the ocean trade. New ore prices, delivered f.o.b. lower Lake ports, are as follows: Old range bessemer, $6.45; old range nonbessemer, $5.70; Mesabi bessemer, $6.20; Mesabi nonbessemer, $5.55.

Arizona Tax Commission Defeated

Phœnix Correspondence

The victory of the Standard Oil Co. of California at San Francisco, on May 5, when it won its suit against the Arizona Tax Commission, is of great interest to Arizona mining men. By a decision of the U. S. Court of Appeals, a temporary injunction was granted against the Tax Commission's increase of assessed valuation for 1917. This means that the basis for the objectionable Arizona mine-tax law will be swept away.

The appellate decision upheld the company's appeal, which charged that the Tax Commission's valuation was fundamentally erroneous and unwarranted. The decision also overruled that of the Arizona district court, which upheld the increase.

Editorials

The Need of a Policy

WHEN Senator Hitchcock, of Nebraska, heard that this country was to receive potash in part payment for food exported to Germany, he sent a protest to Paris in the interest of American producers, urging that the shipment of the fertilizer be prevented. In reply, Mr. Baruch, adviser to the Peace Commission, told him that the potash industry could be defended against imports from Germany only by an act of Congress.

This brings up the question of what can or what should be done by Congress in respect to all of that group of products known as "war minerals." It is not only the producers of American potash who seek legislation that would enable them to produce and sell at a profit, but in the same class are the producers of magnesite, chromite, pyrite, manganese, tungsten, mercury, and graphite.

Are we to have free importation of these ores, are they to be shut out by high tariffs, or are we to have limited importations? The reasons for free importation or for domestic development, consumption, or conservation are so nearly identical in each case that the group might well be considered as a whole, the policy adopted for one being the policy adopted for others.

The problem is not an easy one to solve. Three important and more or less conflicting interests demand consideration. First, there is the producer, who, collectively, has many millions of dollars invested in these various "war-mineral" enterprises. It goes without saying that his capital should be protected; and, if protected, he is willing to invest further along the same lines and add to the industrial development of the country. Second, we have the manufacturer and consumer. It is obvious that the consumer should obtain his raw material at the lowest possible price, and, likewise, the manufacturer, so that his industry may thrive and grow. Third, we have the interest of all the people, the Government. We have learned that foreign supplies of any of these necessities may be unexpectedly cut off, thereby bringing about a serious situation. From the Government point of view, sources of all of these materials should be so developed that at short notice the United States would be in a position to produce all of its requirements without extraordinary effort, and at only a reasonable advance in price.

Fifty years ago the producer was the favored business man, and the development of our natural resources was the subject of greatest importance; but gradually, as the years have gone by, there has been a letting down of the tariff bars in the interest of the consumer, until in the case of manganese and chromium neither could be profitably produced in this country.

If we had only the personal interest of the producer, on the one hand, and the personal interest of the consumer, on the other, to consider, a fair and reasonable compromise might be effected. We know what it costs to produce under normal conditions; we know the effect of tariffs on imports; we have data for a reasonable compromise, which would, of course, be affected to some extent by the force with which the case of the producer or consumer was presented. The questions that are pending may reach a solution in this manner, but we cannot overlook the third factor—the interest of all the people in providing against the possibility of being deprived of the prime necessity in the event of limited domestic developments and sudden cessation of free importations.

Perhaps international relations of the future will permit each country to produce that mineral or minerals which it can produce best, with no thought of free commerce being interrupted and no emergency to be provided for. Though such an ideal condition is desirable, it will not be the part of wisdom to take for granted that it has arrived. We have been taught a lesson in preparedness. Let us remember it for a generation or two at least.

Reversion to the importation regulations existing prior to 1915 not only means the permanent closing of the mines of our uncommon ores, if we may use that term, but it will throw the Government back into exactly its same condition of unpreparedness as of that date. The sin would be greater now than it was then, for we would all know that we were unprepared. This is not an appeal for a high tariff on the ores and minerals mentioned, nor an appeal for free importation, but merely an attempt to look at the three sides of the question.

Vast amounts of money are due us from abroad. Gold cannot possibly be sent to us, and we could not use it if we could get it. Our credits can be liquidated only with raw and manufactured products from across the seas. We do not desire to close any of our factories, and our prosperity depends largely upon our debtors paying their bills. We cannot close our ports to those things that they can produce most cheaply.

Whatever the solution to this set of problems, we hope that they will not be studied and treated separately. The question of potash is only one of many. If presented alone, the producers of potash, being numerically small as compared with the consumers, may receive scant consideration. Likewise the producers of each of the other minerals, if working alone, will fail to produce the necessary impression. A constructive and sound national policy in respect to the war minerals is urgently needed; and, in making the appeal to Congress for it, it is most important to remember that "United we stand, divided we fall."

An Open Market for Steel

THE stabilization of steel prices has been abandoned, and the Government's price-stabilization program, initiated by Secretary Redfield, is at an end. The refusal of Walker D. Hines, Director-General of Railroads, to accept the steel prices fixed by the Industrial Board, was the first blow which struck the tentative plans of that body. That it was effective is now shown by the action of Secretary Redfield in accepting the resignations of the members of the Industrial Board. On top of this comes the announcement of Attorney General Palmer that the proposed plans of the board for stabilizing industry violated the anti-trust laws and are unauthorized by law.

There is now an open market for steel, and the steel industry will have to take its chances, like any other industry. The price question seems to be now settled for a long time. It is said that the U. S. Steel Corporation will continue the prices rejected by the Railroad Administration, and it bases its stand upon the assertion that the costs of production will not permit of a cut in the present price of steel products without a reduction in the wages paid to the steel workers. However this may be, the important fact is that the steel industry is now on a competitive basis. The law of supply and demand will quickly determine the ruling prices, and permit industries dependent upon steel to resume.

Metallurgical Accounting

AN ANONYMOUS correspondent, who directs our attention to an account of the operations of the West End Consolidated Mining Co., which appeared in the Nov. 23 issue of the *Journal*, wherein "increase of tonnage milled" should have read "increase of tonnage mined" (the culpability for which we acknowledge and which we gladly correct), points out the lack of reference in the article to the extraction of the metals. Our account gave the tonnage treated, the gold and silver content in the ore milled, and the actual gold and silver recovered. These figures were taken from the annual report, and seemed to us to present the fundamental results of the year's work in a form condensed to suit the available space in our columns. It also happened that the time to make the necessary calculations, so as to be able to present other data in as complete a form as we should have wished, was not available.

Our correspondent's objection draws attention to the urgent need for a standardization of company reports, particularly with reference to metallurgical results, so that vital data would be available at first sight and verbose statistical repetitions would be avoided. We have made a detailed study of the report in question and find that, although it is clearly stated that the mill operations resulted in a total recovery of metals amounting to 12,853.93 oz. gold and 1,219,860.68 oz. silver, a closer examination shows that the figures include 2634.4 oz. of fine metal which was left in the slag, and which, by no stretch of the imagination, could be considered as having been recovered. To those who insist that such a system of accounting is logical, one would ask whether they would agree that, if slovenly work developed at a smeltery, and half the metal instead of only a minute proportion was left in the slag, the estimate of recovery would remain unaltered. The percentage of recovery should be one of the most vital indices of metallurgical efficiency, but it would be valueless in this connection if it did not represent the metal finally obtained in salable form, and that only.

Our correspondent's objection raises still another point —with regard to the statement of percentage of extraction and recovery; and in this connection a few explanatory remarks will not be amiss. On several occasions it has been pointed out that percentage extraction and recovery are no indications of the comparative efficiency of operations or the suitability of the process when unaccompanied by information as to the metal content per ton of the ore being treated. A 97% recovery from a 1000-oz. ore might leave much to be desired; a 90% recovery on a 10-oz. ore might be considered commendable. If percentage recovery figures are quoted they should be accompanied by an estimate of the weight of the metal in the ore. If this factor is not taken into consideration, the achievements at the plants of some of the low-grade copper mines would be entirely overlooked.

Again, the money value of a silver-gold ore or of the bullion produced cannot logically be stated in connection with recovery figures, because a fluctuation in the price of the silver would result in a corresponding fluctuation in estimated recovery percentage, without any change having occurred in actual metallurgical results. So the metallurgist in charge might be blamed in one case, and praised in another, for variations over which he had no control, and for which, therefore, he could not be held responsible.

By making the necessary calculations we find that the grade of the ore treated at the West End mill during 1917 was, approximately, 19.7 oz. silver and 0.203 oz. gold per ton. It is difficult to understand why these significant figures were omitted from the annual report. Such data convey a definite impression as to comparative metal content, whereas the information given—"a value of $20.51 per ton"—certainly does not.

Engineering, Latin, and Greek

AMONG the reconstruction problems confronting our colleges and universities is that of readjusting their curricula to modern needs, or to requirements that appear to have developed within recent years. Modifications of entrance requirements are being made. We read notices of first one institution and then another reducing the conditional knowledge of Latin and Greek, or eliminating both from entrance requirements. The idea seems to be popular, but we are not sure it is wise.

Latin or Greek roots have little to do with the successful erection of a bridge, the sinking of a shaft, or with the smelting of an ore. The ability to read a page of Virgil is of little assistance in developing a process for the separation of chalcopyrite from sphalerite by selective flotation. Xenophon throws no light on armatures or electro magnets. Then why worry ourselves with the dead languages? Why not put them into the discard, and study only to familiarize ourselves with the tools that are used directly in the solution of the problems of the day?

To answer these questions one must formulate in his own mind his conception of the character of an engineer: what he should know, but, more particularly, what he should be. We might possibly define the word "engineer," giving briefly a clear and concise definition of the appellation, and yet fall far short of conveying our conception of the term. In our every-day life we are likely to use some words carelessly; we speak of a politician when we may be thinking of a political boss, or it may be of a statesman—men whose characters are as opposite as the magnetic poles. So in using the word "engineer" we may use it in speaking of men whose technical training may have been carried to the extreme without any attempt to form character, or, on the other hand, men whose characters have been developed without much technical training.

If the term engineer is to be strictly interpreted, if it is to be confined to one engaged only in the solution of technical problems, one who uses the forces of nature, the laws of mechanics and chemistry to earn money, if we have in mind only brain development for commercial purposes, then we are thinking of a character that may be completely formed without the use of Latin or Greek, without the study of history, of humanity, or even without English.

But if, on the other hand, our conception of the title pictures a man with some of these attainments, but also with real character, a man of broad and deep insight, a man equally at home with labor or with capital—their connecting link—a man capable of leading his fellow men in fields of science, commerce, or statesmanship—then we are thinking of a character of a finer sort. We are thinking of one whose education rests on principles, not on details of laboratory practice. On the one hand, we have the specialist so deep in his own particular subject that he fails to realize that there is another life more worth the living, which knows nothing of technical details. On the other hand, we have a man who would confine himself to principles, and to so many of them, that his education, like a veneer of handsome wood over a large area, would be so thin that it would stand no wear—the slightest abrasion would show the coarse-grained common lumber underneath.

In the drastic changes that have been recommended in our colleges we fear that the authorities, in their recognition of the fact that there has been a tendency to veneer the character, are jumping toward the other extreme, and are preparing to educate men solely for the purpose of making money. We hope that our colleges will, if they advance in this direction, go slowly and carefully and not sacrifice the things which go to make life enjoyable for those which lead only to remuneration and to the thoughts of greed, gain, and power.

Latin is a dead language only in so far as we do not know it. It is with us every day, in our own English, in French, Italian, and Spanish. It is with us in the laboratory, in our reagents, ores, and minerals. If we would know history and enjoy it, we must know the language that preceded ours. When we speak with those with whom it is worth while to talk, we will often find that we are talking with men who know the dead languages.

None of us knows what lies before him, and what it is best to study. We look into the future, but there is a lack of background with which to form a perspective. If we look into the past, there we have a distinct background and we can see things in their proper proportions. We cannot look far into the future, but we can look backward and reason by analogy. Did our ideal engineering characters study languages and history, or did they confine themselves to technical subjects? Did the men who really enjoy life, and whom we enjoy, study language, history, English, art and music? King, Douglas, Raymond were all technical men, but they were more—they were engineers in the sense that we may strive for, if we do not attain. These men might possibly have held that Latin was non-essential, but we cannot conceive of their being ignorant of it.

We need specialists, but we need more broad-minded engineers, capable of directing specialists—men who will be managers in every sense of the word; and to make such men we must not limit the work of our students to technology. Mortimer E. Cooley, Dean of the College of Engineering at the University of Michigan, wrote in a recent communication to the New York *Sun*, "For the young American going into engineering I would advise a thorough preparation in fundamentals, eschewing all fads, even manual training and the practical things thought so essential to his success, and including not less than two years of Latin, preferably three or four years. Considerable history, some political economy. A good knowledge of English and of literature. A speaking knowledge of at least one foreign language, and, if only one, it should be Spanish. Some philosophy and as much of art, music, and other things apparently having nothing to do with engineering as possible."

A proper balance of classical and technical education for the coming generation of engineers is a subject of deep concern. This is particularly true in view of the endeavors now being made to bring the engineer in closer touch with political and civil life. The best advice must come from those who have reached maturity in their professions.

We hope that our technical societies will not overlook the opportunity of permitting their views to be recorded either in approval or disapproval of the alterations in curricula now being advocated and adopted at our universities.

BY THE WAY

Tasmania is subject to dry spells of a kind that have naught to do with Constitutional amendments and such. As on the mainland of Australia, there exist not only some queer animals that are peculiar to the country but several scattered areas possess alluvial tin deposits. Some of the latter comprise fairly rich spots that are well worth working, provided water can be obtained in sufficient quantity. In at least one case, the government took control of a ditch line and extended it several miles, supplying water to what is known as a "small man's field," on a sliding royalty scale based upon the market price of the product. Some companies installed their own ditches or "water races" 30 and 40 miles long. A few years ago one of the companies was doing fairly well in every other way, but experienced a peculiar difficulty that ran the total costs up to an annoying figure. A little animal called the duck-billed platypus, or *Ornithorhynchus paradoxus*, took to the water like a duck, swam around like an otter, and playfully bored holes in the banks. Coming in increasing numbers, the lady platypi laid eggs and kept on increasing the numbers of her brood and the costs of mining. The Latin name is most appropriate, for the creature is certainly a paradox. It is about a foot and a half long when full grown, has a body like an otter, a tail like a beaver, thick, dark-brown fur, and a broad, horny bill and webbed feet, suggestive of the duck. The male has spurs like a rooster; the female lays eggs in a nest; and the paradox of it all is that it is cold-blooded enough to be classed as a reptile. This nuisance is fond of making its nest near a quiet stream, making the entrance from below the surface of the water and winding along sometimes as much as 50 ft., and then upward to a large chamber. It then raises a ventilating shaft to surface; the latter also serving as a "safety-first" exit in case of emergency. Building such nests along the ditches, they certainly are sons of Belial.

NEW PUBLICATIONS

Illinois Mining Statutes Annotated. (Including All Illinois Mining Laws). By J. W. Thompson. Pp. 594. Bulletin 169, U. S. Bureau of Mines, Washington, D. C.

The Canning River Region, Northern Alaska. By Ernest deK. Leffingwell. Pp. 251, illus. Professional Paper 109, U. S. Geological Survey, Washington, D. C.

North Carolina: Biennal Report of the State Geologist, 1917-1918. Joseph Hyde Pratt, State Geologist. Pp. 110, illus. North Carolina Geological and Economic Survey, Chapel Hill, N. C.

Analysis and Tests of Rigidly Connected Reinforced Concrete Frames. By Mikishi Abe. Pp. 102, illus. Bulletin 107, Engineering Experiment Station, University of Illinois, Urbana, Ill.

Bibliography and Index of the Publications of the United States Geological Survey Relating to Ground Water. By Oscar E. Meinzer. Pp. 169. Water-Supply Paper 427, U. S. Geological Survey, Washington, D. C.

The Geology of the North Coolgardie Goldfield. Part I, The Yerilla District, by C. Sidney Honman; with appendices by R. A. Farquharson and J. T. Jutson. Pp. 98, illus. Bulletin 73, Geological Survey of Western Australia, Perth, Western Australia (1917).

Sooke and Duncan Map Areas, Vancouver Island, by G. H. Clapp; with Sections on the Sicker Series and the Gabbros of East Sooke and Rocky Point, by H. C. Cooke. Pp. 445, illus. Memoir 96, Geological Survey of Canada. Department of Mines, Ottawa, Ontario (1917).

El Petroleo en la Republica Mexicana. Estudio Geologico Economico sobre los Yacimientos Petroliferos Mexicanos. First part. By Miguel Bustamante. Pp. 216, illus. Boletin 35, Instituto Geologico de Mexico, Mexico City.

Abstracts of Current Decision on Mines and Mining, Reported from January to May, 1918, and from May to September, 1918. By J. W. Thompson. Pp. 160 + 138. Bulletins 172 and 174, U. S. Bureau of Mines, Washington, D. C.

Contributions to Economic Geology, 1917. (Short Papers and Preliminary Reports). Part I, Metals and Nonmetals, Except Fuels, F. L. Ransome, E. F. Burchard, and H. S. Gale, geologists in charge. Pp. 304, illus. Bulletin 660, U. S. Geological Survey, Washington, D. C.

Decisions of Courts Affecting Labor, 1917. By Lindley D. Clark and Augustus P. Norton. Pp. 299. Bulletin No. 246 of the U. S. Bureau of Labor Statistics, Labor Laws of the United States Series. U. S. Department of Labor, Washington, D. C.

Physics and Chemistry of Mining and Mine Ventilation. By Joseph J. Walsh. Second Edition. 5¼ x 7¾, pp. 219, illus. D. Van Nostrand Co., New York.

A practical handbook for vocational schools, and for those qualifying for mine-foreman and mine-inspector certificates.

Metal Statistics, 1919. Twelfth Annual Edition. 4 x 6, pp. 447. The American Metal Market, New York.

A compilation of tables giving data regarding production, imports and exports, and prices of iron and steel and the nonferrous metals, over a series of years.

A Geologic Reconnaissance of the Inyo Range and the Eastern Slope of the Southern Sierra Nevada, California, by Adolph Knopf; with a section on The Stratigraphy of the Inyo Range, by Edwin Kirk. Pp. 130, illus. Professional Paper 110, U. S. Geological Survey, Washington, D. C.

A Geological Reconnaissance of the Country Between Laverton and the South Australian Border (near South Latitude 26°), Including Part of the Mount Morgan Goldfield. By H. W. B. Talbot and E. deC. Clarke. (Petrology by R. A. Farquharson). Pp. 207, illus. Bulletin 75, Geological Survey of Western Australia, Perth, Western Australia (1917).

The Charters Towers Goldfield. By J. H. Reid, Government Geologist Pp. 236, illus. Publication 256. Geological Survey of Queensland, Brisbane, Queensland (1917).

Contents: General Description of Field, History and Technology of the Gold Deposits, Physiography, Geology, Petrology of the Igneous Rocks; The Ore Deposits; The Mines.

Temiskaming Northern Ontario Railway Commission (Ontario Government Railway): Seventeenth Annual Report for Year Ended Oct. 31, 1918. Published by A. T. Wilgress, King's Printer, Toronto, Ontario.

Included is the report of Arthur A. Cole on the mining industry in that part of northern Ontario served by the railway in question.

Coal-Mine Fatalities in the United States, 1918, and Coal-Mine Statistics, Supplementing Those Published in Bulletin 115. Compiled by Albert H. Fay. U. S. Bureau of Mines, Washington, D. C.

In addition to usual data regarding accidents there is included the list of permissible explosives, lamps, and motors tested prior to Jan. 31, 1919.

The Geology and Mineral Resources of the Yilgarn Goldfield. Part III, the Gold Belt North of Southern Cross, Including Westonia, by T. Blatchford and C. S. Honman; also Notes on the Minerals of Westonia, and Petrological Notes, by E. S. Simpson and R. A. Farquharson, respectively. Pp. 321, illus.; plates I—XIX (maps and sections) accompany the report in a separate volume. Bulletin 71, Geological Survey of Western Australia, Perth, Western Australia (1917).

A Summary of Mining in the State of Washington. By Arthur Homer Fischer. Pp. 124, illus. Bulletin 4, Engineering Experiment Station Series. University of Washington, Seattle, Wash.

A thesis submitted in partial fulfillment of the requirements for the degree of master of science in mining engineering. It was prepared under coöperative agreement between the College of Mines and the U. S. Bureau of Mines, and was edited by Milnor Roberts.

Trade of the United States With the World, 1917-1918. Part I, Imports. Miscellaneous Series 78, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

Statistical tables of imports into the United States, by countries, and principal articles, during the fiscal years ended June 30, 1917 and 1918, continuing similar tables which have been published from time to time by the Department of Commerce. The figures given in this report are especially valuable at this time, when there is great interest in foreign trade. A similar report of exports, by countries and articles, will follow in a separate publication.

A Preliminary Report on the Mining Districts of Idaho. By Thomas Varley, Clarence A. Wright, Edgar K. Soper, and Douglas C. Livingston (in coöperation with the University of Idaho). Pp. 113, illus. Bulletin 166, U. S. Bureau of Mines, Washington, D. C.

Coöperation between state organizations and the U. S. Bureau of Mines gives promise of producing excellent results. This bulletin describes the achievements on the part of the University of Idaho and the Bureau, presenting a study and review of the mining districts of Idaho. In a compact form it gives much information about the state, and should be well received by the mining industry.

Graphical and Mechanical Computation. By Joseph Lipka. Pp. viii + 364; 6 x 9 in., 205 figures, 2 charts. John Wiley & Sons, New York.

This book is a treatise on the uses of charts, scales, and instruments to represent engineering data and to solve engineering problems. It is a textbook rather than a work of reference, but the treatment is clear, and the ordinary engineer should find no difficulty in following the explanations given. Some of the subjects covered are: plotting on ordinary and on logarithmic coördinate paper, graphic solution of cubic and biquadratic equations, the plotting of a graph to represent known data, the calculation of equations from graphs, the use of planimeters,and other means of mechanical integration.

Structural Engineers' Handbook. Data for the Design and Construction of Steel Bridges and Buildings. By Milo S. Ketchum. Second edition. 6½ x 9, pp. 950 + xvi, illus.; flexible leather. McGraw-Hill Book Co., New York.

This important and well-known book for the use of the structural engineer, designer, and student, as well as of engineers who may at times have to do with structural problems and design, has now passed into its second edition. The author states in his preface to this edition that details of steel windows and doors, data on cement and gypsum tile roofs, solutions for bending moments in mill building columns, and stresses in stiff frames have been added in Chapter I, and Chapter III, Steel Highway Bridges, has been rewritten and enlarged. All known errors have been corrected.

The Mining Manual and Mining Year Book, 1919. By Walter R. Skinner. 5 x 8½ in.; pp. 1000. Walter R. Skinner, London, E. C., England.

This reference book, which has appeared regularly for thirty-three years, is so well known that detailed comment is no longer necessary. The publisher has spared no efforts to maintain the reputation that the manual has had for completeness and accuracy, and it has been published with commendable promptness, being dated March, 1919. Its arrangement and indexing are good and add to its value as a reference work. Full data regarding capitalization, officials, operations, and financial position of 1170 companies are given, and 2470 additional companies are covered in the supplementary index, which contains the names of those concerns which have either ceased to be of public interest or are in too dormant a state to justify their inclusion in the body of the work. No important innovations have been made, but there has been some condensation of the matter, which it is believed will render it still more convenient for quick reference. The usual lists of directors, secretaries, engineers, and mine managers are included; also the crushing tables and output of the principal gold mines, and the dictionary of mining terms, all of which are regularly revised.

Women in the Lead Industry. By Alice Hamilton. Bulletin No. 253, U. S. Bureau of Labor Statistics, Department of Labor, Washington, D. C.

The susceptibility of women workers in lead industries to certain forms of lead poisoning, and the dangerous effects of this occupational poison on their children, are two important facts emphasized. Lead, which is by far the most common industrial poison, is responsible for no less than 95% of all the poisoning due to occupation, according to Teleky, a German authority. In this country lead poisoning is a fairly familiar occurrence, but until comparatively recent times it has not been common among women workers, because relatively few women have been employed in lead industries. Now, however, women are beginning to enter occupations in which exposure to lead is inevitable, and it is regarded as important to supervise carefully the question of their employment in such occupations and to determine whether it will be better to safeguard them by requiring employers to use every known means to reduce or eliminate the hazard of lead poisoning, or by prohibiting the employment of women entirely in those occupations in which lead poisoning constitutes a considerable hazard

The bulletin discusses the various lead compounds that are used in industry, noting their comparative danger, suggests how lead may enter the body, and describes in some detail the industries in the United States involving exposure to lead.

The Diagnostics and Treatment of Tropical Diseases. By E. R. Stitt. Third Edition, revised; pp. 534. P. Blackiston's Son & Co , Philadelphia, Penn.

The mining engineer is essentially a man of wide interests. His duties take him to all parts of the world, and his responsibilities often extend far beyond the generally accepted scope of his work. Successful mining operations in tropical regions are practicable only when due regard has been paid to hygienic and medical considerations. The principles of hygiene are the same virtually the world over. Tropical ailments and diseases are, however, in a class by themselves; and combating them by prophylaxis and treatment is a prerequisite to successful industrial work in tropic countries. Nothing can help more to a realization of this than the dissemination of information through the medium of reliable textbooks. The mining engineer is no narrow specialist when he is once in the field. For his own sake, as well as in the interest of those over whom he has control and for whose well-being he is in no small degree responsible, it is imperative that, if his work takes him to tropic countries, he should possess some knowledge of tropic diseases. There is every reason why he should obtain this from a reliable source.

The book under review is written primarily for the practitioner, but interest in such a subject must inevitably extend beyond the medical profession, because it so often happens that doctors are unavailable in isolated tropical localities. The author is a recognized specialist on the subject, and his aim has been to present the data in as clear and simple a form as possible. The general arrangement of the book is excellent, and maps are given to illustrate the distribution of the various diseases covered. The subject matter has been brought strictly up to date, and the treatise is one that should find a place on the bookshelf of every tropic settlement, and whether medical attention is available or not. A. W. ALLEN.

The Mineral Deposits of South America. By Benjamin L. Miller and Joseph T. Singewald. Pp. 598; illus. McGraw-Hill Book Co., Inc., New York.

This book presents, in condensed and well-arranged form, the best example that has come to our notice of what a treatise on a subject such as this should be. It covers an exceptionally wide field—the whole of South America—and the authors, with commendable breadth of view, have supplemented the data and impressions gained during a trip through most of the South American republics, in 1915, with practically all the available information that could be collected from published accounts and personal communications. A feature of the preface is the acknowledgment of assistance received in this connection; and at the end of each chapter a complete bibliography of material published, and dealing with the particular country in question, is given.

The book opens with a chapter on the economic geology of South America, in which the authors draw attention to the fact that geological surveys, adequately supported by the governments of the different countries, would undoubtedly justify the necessary expenditures within a few years. The suggestion is not new, but its reiteration is timely and may well be heeded by our South American neighbors. "The preëminence of the mining industry in the United States," the authors claim, "in comparison with that of other countries, is due in a large measure to the dissemination of accurate information concerning the mineral resources of the country by the Federal geological organization. Every one of the South American countries has failed to appreciate fully the value of such work; and in those countries where a geological organization is maintained it is inadequately supported. The maintenance of an able staff of geologists engaged in the study of the country's mineral deposits would do more to encourage the development of encouraging sections, and to discourage the investment of capital in unlikely districts, than any other factor."

The book supplies a long-felt want; and the authors are to be congratulated on the thoroughness of their work, and also on the clarified form in which so much valuable information has been published. A. W. ALLEN.

Personals

Perry G. Harrison has returned to Salt Lake City from the Lordsburg, N. M., district.

A. W. Allen has been elected a member of the Mining and Metallurgical Society of America.

Harry J. Wolf, of the Malm-Wolf Co., examined mining properties in Arizona early in May.

Frederick F. Sharpless is in the vicinity of Hermosilla, Sonora, Mexico, on examination work.

Hugh K. Picard has been elected president of the Institute of Mining and Metallurgy, succeeding Hugh F. Marriott.

Charles A. Burdick has removed his mining and metallurgical engineering offices to No. 120 Broadway, New York; telephone, Rector 1645.

H. S. Gale, of the U. S. Geological Survey, has completed a study of the potash situation in Alsace and has returned to Paris.

J. R. Finlay, who has been spending the winter in Arizona, is proceeding to California by automobile, visiting the Grand Canyon en route.

J. W. Beede, of the Texas State Geological Survey, is at work with a party in Hueco Basin, east of Sierra Alto Range, in Hudspeth County.

T. M. Owens, of Wallace, Idaho, superintendent of mills for the Federal Mining and Smelting Co., has returned to Australia, his former home.

W. F. Gowans, who has recently returned from France, will take charge of the underground work at the Wright-Hargraves mine, in Kirkland Lake.

John D. Ireland, general manager of the M. A. Hanna & Co., Minnesota interests, has returned from an extended vacation trip in the south to Duluth.

Maxwell W. Atwater, of Butte, general manager of the Davis-Daly Copper Co., is at Mayo Brothers' hospital, Rochester, Minn., undergoing an operation.

J. A. McVichie, who has been in Cobalt for the last 14 years, and was recently manager of the Chambers-Ferland mine, is leaving Cobalt for western United States.

Percy E. Barbour, who until his recent discharge was a captain in the Engineer Corps, U. S. A., has received a commission as major in the Engineer Section of the Reserve Corps.

Robert Linton has returned from a periodical visit to properties of the North Butte Mining Co. at Butte, Mont., and the Consolidated Coppermines Co., at Kimberly, Nevada.

Frank Davis, formerly metallurgist at the Toledo smeltery, near La Dura, Sonora, Mexico, and **W. H. Davidson** are developing property in Lemon mining district, 40 miles east of Alamos, Sonora.

Robert E. Cranston has returned to San Francisco from Washington after serving with the U. S. Food Administration for the last seven months. He will resume the practice of his profession.

A. H. Burroughs, Jr., who has been in charge of construction work on the navy nitrate plant, Indian Head, Md., has obtained his release from active service in the U. S. Naval Reserve Force.

Vao. H. Manning has been made a member of the Coal Export Committee of the American Mining Congress, which has been formed to aid American coal producers in obtaining South American business.

A. B. Emery, general manager of the Messina Development Co., Messina, Transvaal, is in Butte studying modern copper smeltery construction with a view to the installation of a smeltery in South Africa.

N. C. Sheridan, mining engineer of Wallace, Idaho, is in Nevada to inspect mining properties near Elko and Palisade, representing New York interests. He will examine low-grade gold properties in central Idaho.

L. H. Goodwin, with the firm of Rogers, Mayer & Ball, at 42 Broadway, has left New York for an extended scouting trip through parts of Canada and the Western states in the interests of the firm and its clients.

Daniel Harrington, of Golden, Colo., mining engineer in charge of safety work in the Rocky Mountains for the Bureau of Mines, is in Butte making plans for a state "first-aid" meeting to be held at Billings, Montana.

Alfred Roos, consulting and mining engineer of Tucson, has been making a geological examination of the Tularosa Basin oil field for an association of Arizona mining men headed by Edward Bush, of Tucson, Arizona.

J. B. Umpleby, of the U. S. Geological Survey, who was called to the Peace Conference as a special adviser on the mineral resources of the areas involved in the settlement, sailed on May 14 on his return to the United States.

Donald Mackenzie is making a geological study of the Tularosa basin in Otero County, N. M., in the interest of E. W. Hartman. Mr. Mackenzie has recently returned from geological work in Brazil, Ecuador, Colombia and Panama.

C. W. Newton, of Wallace, Idaho, manager of the Interstate-Callahan mine, and one of the directors of the company, will attend the annual meeting of directors in New York, which will be held on May 19, instead of in June, as previously announced.

Major A. S. Dwight, D. S. O., originally with the 11th Engineers, returned last week after nearly two years of service in France. Major Dwight is one of the few American officers who has been decorated by the British with the Distinguished Service Order.

John R. Allen, dean of the College of Engineering of the University of Minnesota, has proffered his resignation and will become director of the National Bureau for Heating and Ventilating Research, recently established at Pittsburgh by the Federal Government and the American Society of Engineers.

E. A. Holbrook, acting chief of mining engineering, Bureau of Mines, represented H. Foster Bain, who was selected to represent the American Institute of Mining and Metallurgical Engineers, at a meeting of the conference committee called by the Commissioner of Education, Mar. 31, in Washington, D. C.

Wilfred C. Polkinghorne has been appointed superintendent of the Ahmeek stamp mill, succeeding Joseph Satterly, who has taken a position with the Nash Motor Co. Mr. Polkinghorne has been metallurgist for various Calumet & Hecla subsidiary mills since his graduation from the Michigan College of Mines.

J. D. Mooney, recently discharged from the Army, after having served overseas as a captain with the 309th Ammunition Train, 84th Division, has accepted a position with the General Motors Corporation, New York. Mr. Mooney was manager of the Hyatt Roller Bearing Co.'s industrial division prior to joining the Army in 1917.

Charles L. Hirshman, who has been associated with a number of leading mining companies in the western United States, and has latterly been engaged with the Rapid Transit Subway Co. of New York, has been given charge of the operations of the Atlas Gold Mines, Ltd., in the West Shining Tree district of northern Ontario.

Emmett J. Flynn has been placed in charge of the safety and welfare department of the Republic Iron and Steel Co.'s northern iron mines, with headquarters at Gilbert, Minn. Before entering the Army, where he held a commission as major, Mr. Flynn was for eight years private secretary to Francis J. Webb, general manager of the Republic Iron and Steel Company.

H. Foster Bain, assistant director of the Bureau of Mines, has resigned and will leave early in June for China, traveling by way of Vladivostok. Mr. Bain accepted the post of assistant director in an effort to be of service during the national emergency. **J. C. Pickering,** also of the Bureau, who specialized in gold, silver and platinum, is resigning to go to New York to resume practice as consulting engineer.

Societies

American Bureau of Welding, at a meeting on Apr. 11, at the Engineering Societies Bldg., New York, adopted bylaws and elected officers. Regular meetings are to be held on the third Friday of each month. The bureau voted to establish a research committee for carrying out plans of coöperation in conducting investigations and tests.

American Institute of Mining and Metallurgical Engineers, at the autumn meeting, at Chicago, will include a symposium on pyrometry, when 20 papers, it is expected, will be presented on this subject. Paul D. Foote is secretary of the pyrometer committee.

American Institute of Mining and Metallurgical Engineers, Montana Section, had as guests recently at a banquet at the Silver Bow Club, in Butte, James F. Kemp, professor of geology at Columbia University, and Charles K. Leith, mineral adviser to the Shipping and War Industries Boards. Messrs. Kemp and Leilh have been called to Butte as experts in connection with the suit of the Elm Orlu against the Butte & Superior. Frederick Laist, general manager of the Anaconda's smeltery plants at Anaconda and Great Falls, Mont., presided as toastmaster. Prof. Kemp in an address briefly reviewed the work accomplished by the American Institute of Mining and Metallurgical Engineers. Mr. Leith spoke of his war-zone observations.

American Society for Testing Materials has issued a provisional program of the 22d Annual Meeting at Atlantic City, N. J., June 24 to 27; headquarters, Hotel Traymore. The features of special interest announced will be the presidential address, the memorial session, a topical discussion on magnetic analysis and a joint session with the American Concrete Institute on cement and concrete. Other sessions will include the following: "Preservative Coatings, Lubricants, and Containers"; Steel and Wrought Iron"; "Corrosion and Magnetic Analysis"; "Malleable Iron and Non-Ferrous Metals"; "Ceramics, Lime and Road Materials"; "Concrete and Gypsum." Committee meetings will be held on June 25 and the annual golf tournament on June 26. The following nominations for officers are announced by the committee: For president, J. A. Capp; for vice-president, C. D. Young; for members of the executive committee, Ernest Ashton, H. F. Moore, C. F. W. Rys, and Admiral D. W. Taylor.

The American Society of Mechanical Engineers will hold the spring meeting at the Hotel Statler, Detroit, from June 16 to 19. A session on June 17 on the subject of "Industrial Research" will be held under the auspices of the Research Committee of the A.S.M.E. Several papers and reports will be presented. This is to be made a leading subject, because of the great impetus which has been given to industrial research as a result of the conditions resulting from the war. The afternoon session will be on the subject of "Industrial Relations," with several addresses by men of national reputation. This session will constitute an interchange of views as to what must be done to assure industrial peace. On June 18 a session in charge of the Detroit local committee and of several of the other sections of the society will be held, and technical papers will be contributed by members of these various sections. Also a gas power session with discussion on oil engines. The closing session, on June 19, will have discussion of fuels, including powdered fuel and oil fuel. The Detroit local committee is arranging many events for the entertainment of the members of the society and others who may attend. Among those will be an afternoon and evening devoted to a boat ride on the lake, during which dinner will be served.

Industrial News

The Chicago Pneumatic Tool Co. has moved its Milwaukee office from Room 1305 Majestic Bldg., to Room 1418 in the same building.

Alfred W. Pick, mechanical engineer, announces removal of his engineering and drafting offices to 506-07 Quincy Bldg., 17th and Curtis Sts., Denver, Colo. Phone, Main 902.

Standard Electric and Elevator, Inc., of Baltimore, has opened a New York office at 280 Broadway, in charge of C. A. Harrington, formerly sales manager of the company.

American Malleable Castings Association, Cleveland, Ohio, has issued a treatise on malleable iron, which is a forerunner of a comprehensive volume to be issued later. A copy of this book will be sent upon application to the association at Cleveland, Ohio.

Cableways. Lidgerwood Manufacturing Co., New York. Bulletin 34; 9 x 12; 12 pp.; illustrated. Descriptive of Lidgerwood cableways and transfers for storing and reclaiming coal, and handling ashes and similar material. A perforated specification sheet is included, with blank spaces for furnishing data in making estimates.

The Stephens-Adamson Manufacturing Co., of Aurora, Ill., has appointed Fred W. Wells as assistant engineer of the New York district office. Mr. Wells was associated with this company prior to his entering the service early in 1918. He was commissioned first lieutenant in the 26th Engineers, served in various sections of France and with the First Army during the Argonne-Meuse operation.

The Hardinge Conical Mill Co. reports the honorable discharge from war service of J. C. Farrant, its London manager. Mr. Farrant for over four years was held a prisoner of war in Germany. First Lieut. J. J. Cadot, of the Air Service, A. E. F., returns to take charge of the company's Denver office. Capt. Harlowe Hardinge, Signal Corps, director of radio schools in the A. E. F., will return to his duties as vice-president of the H. C. M. Co. in the New York office. The Hardinge company anticipates the early return of three more of its staff.

Black & Decker Manufacturing Co., of Baltimore, Md., manufacturers of portable electric tools, electric air compressors and special machinery, has just established a New York office—Room 2920, Equitable Bldg.—which will be in charge of G. R. Lundane, who will supervise the distribution of the company's products in New York City and surrounding territory, including the State of Connecticut. The Black & Decker Manufacturing Co. now has branches in New York, Philadelphia, Atlanta, San Francisco, Chicago, Detroit, Columbus, Buffalo, and Boston, the general offices being at Baltimore, Md. The company also has foreign connections in England, France, Norway, Sweden, and Japan.

Nordberg Manufacturing Co., Milwaukee, Wis., announces the development of a new type of uniflow poppet valve engine. This company was the first to develop uniflow engines in this country, and the advantages of that type in maintaining high economy at underloads and overloads is well known. The new Nordberg-Todd uniflow engine is built in sizes ranging from 200 to 2000 h.p. for any available steam pressure, any available superheat, any available vacuum and any available back pressure. The assertion is made that under any of these conditions these engines will operate with lower steam consumption per horsepower, over wider variations of load, than any steam prime mover thus far developed. Of special interest is the fact that the engine can be changed from condensing to non-condensing operation, or the reverse, while running.

Trade Catalogs

Rails and Accessories.—Walter A. Zelnicker Co. St. Louis. Bulletin 258, descriptive of rails, all weights and sections, with fastenings, girders, guards, bars, crossings, frogs, switches, spikes, tie plates, portable track, and similar parts., in stock at the company's East St. Louis works and various points throughout the country, permitting quick shipments at low freight rates.

"Over 1000 Scoop Conveyors" is the title of a 20-page folder just published by the Portable Machinery Co., of Passaic, N. J. This folder, replete with illustrations showing the various uses of the scoop conveyor, describes clearly the labor, time, and money-saving features of the machine in storing, reclaiming, loading, and unloading coal, coke, ashes, sand, gravel, crushed stone, fertilizer, cement, chemicals and like materials. Copies of the folder will be sent free to those interested, upon application to the manufacturers.

Carbide Lamps, Hardware Specialties. Justrite Manufacturing Co., Chicago. Catalog 6 x 9; 88 pp.; illustrated. Descriptive of miners' cap lamps with various types of feed; metal mine lamps up to 5-hour capacity; superintendents' lamps, lanterns, drivers' headlights and mine car lamps. A large number of accessories, including various repair outfits, tip cleaners and reamers, containers, reflectors and other parts, are also described in detail. The catalog contains much valuable and complete information on the subject of mine lamps. Other specialties described are safety oil cans, waste receptacles, garbage pails, and oil cups for loose pulleys.

Bailey Electric Furnaces. The Electric Furnace Co., Alliance, Ohio. Booklet 5-B; 8½ x 11; 24 pp., illustrated. Descriptive of the following types of Bailey electric resistance furnaces for melting non-ferrous metals: Tilting 1500-lb. brass furnace of two hours' melting time; non-tilting or tapping type with 600 kw. transformer of melting rate of two tons of brass per hour and hearth capacity of nine tons; 1000-kw. zinc cathode of 200 tons' daily capacity; 105-kw. nose-tilting, motor-operated type, hearth capacity of 5000 lb., melting rate of 2000 lb. per hour. Comparative melting costs using coke, oil, and electricity, and tables of records of melting phosphor bronze, zinc cathodes, and reduced metal loss in brass melting, are given.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Alumina. Production of Alumina. Anson G. Betts, Asheville, N. C. (U. S. No. 1,300,110; Apr. 8, 1919.)

Aluminum Alloy. Charles Van Amburgh, Tacoma, Wash. (U. S. No. 1,300,058; Apr. 8, 1919.)

Amalgamating Machine. William B. Tucker, Healdsburg, Calif. (U. S. No. 1,300,054; Apr. 8, 1919.)

Belt Scraper. Frank A. Goodykoontz, Miami, Ariz. (U. S. No. 1,299,324; Apr. 1, 1919.)

Blast Furnace. Frank Oskar Miller, Portsmouth, Ohio. (U. S. No. 1,298,761; Apr. 1, 1919.)

Loading Machine. Robert P. Greenleaf, Cleveland, Ohio, assignor to Frank Billings, Cleveland, Ohio. (U. S. No. 1,297,150; Mar. 11, 1919.)

Mine-Car Wheel. Henry W. E. Brosl, Girard, Kan. (U. S. No. 1,296,914; Mar 11, 1919.)

Mining Machines, Drive Gearing for James A. Brantley, Sand Springs, Okla (U. S. No. 1,297,647; Mar. 18, 1919.)

Oil Shale—Obtaining Oil From Shale. Frederick G. Shreves, Denver, Colo. (U. S. No. 1,297,022; Mar. 11, 1919.)

Ore-Charging Machine for Retorts. Jozeph Nieznalski and Jan Belczynski, Detroit, Mich. (U. S. No. 1,296,998; Mar. 11, 1919.)

Pick. Thomas F. Bird, Wilkes-Barre, Penn. (U. S. No. 1,297,065; Mar. 11, 1919.)

Platinum—Composition of Matter for Platinum Substitute. Frank A. Fahrenwald, Cleveland, Ohio, assignor to the Rhotanium Co., Cleveland, Ohio. (U. S. No. 1,296,938; Mar. 11, 1919.)

Potassium—Process of Extracting Potassium From Minerals. Henry Blumenberg, Jr., Los Angeles, Calif., assignor to Chemical Construction Company, Los Angeles, Calif (U. S. No. 1,296,457-58; Mar. 4, 1919.)

Potassium Compounds, Process of Obtaining. George F. von Kolnitz, Stockertown, Penn. (U. S. No. 1,296,141; Mar 4, 1919.)

Potassium Nitrate—Process of Producing Potassium Nitrate. Henry Blumenberg, Jr., Los Angeles, Calif. (U. S. No 1,296,460; Mar. 4, 1919.)

Potassium Sulphate, Process of Producing Henry Blumenberg, Jr., Los Angeles, Calif. (U. S. No. 1,297,638; Mar. 18, 1919.)

Refining—Electrolytic Refining of Metals. Blasius Bart, Newark, N. J. (U. S. No. 1,295,100; Feb. 25, 1919.)

Roasting—Ore Roasting Furnace. Edwin T. Goldthorpe, Chicago, Ill., assignor, by direct and mesne assignments, of three-eighths to Fred Von Nessen and three-eighths to William H. Dicks, Chicago, Ill. (U. S. No. 1,295,729; Feb. 25, 1919.)

Salt—Process of Extracting Salt From Natural Brines. Arthur E. Schaefer, Saginaw, Mich. (U. S. No. 1,297,737; Mar. 18, 1919.)

Separation—Mineral-Separating Apparatus. Allison S. Loventhal, Birmingham and Emmett C. Nunnelley, Ashland, Ala. (U. S. No. 1,297,372; Mar. 18, 1919.)

Separator — Precious-Metal Separator John James Roberson, Springville, Utah, assignor of one-half to James I. Rounds, Colton, Utah. (U. S. No. 1,297,911; Mar 18, 1919.)

Ventilating Apparatus for Mines. Daniel F. Lepley, Connellsville, Penn. (U. S No 1,297,191; Mar. 11, 1919.)

Zirconium Ores, Process of Purifying William B. Loveman, Lakewood, Ohio, assignor, by mesne assignments, to National Carbon Co., Inc. (U. S. No. 1,297,371; Mar 18, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—May 10

Total Crude Oil Production in California from beginning of the industry to end of 1918 amounted to 1,141,988,481 bbl. The records of production begin with 1876. Prior to that year the estimated production was 175,080 bbl., credited to Ventura-Newhall fields, and those fields are the only producers of record up to 1894, though wells were drilled in four other areas prior to that year. The following summary showing the life and total production by fields is taken from a complete tabulation of production by fields for each year published in the "Standard Oil Bulletin" for April. Midway, 18 years, 254,508,060 bbl.; Coalinga, 23 years, 213,155,497; Kern River, 19 years, 206,566,725; Whittier-Fullerton, 22 years, 110,487,718; Santa Maria-Lompoc, 17 years, 88,057,211; Sunset, 19 years, 71,363,027; McKittrick, 21 years, 54,165,388; Los Angeles-Salt Lake, 25 years, 51,300,112; Lost Hills-Belridge, 9 years, 33,816,134; Newhall-Ventura, 13 years plus, 21,311,263; Summerland, 25 years, 2,231,947; miscellaneous fields, 22 years, 992,102 barrels.

BUTTE, MONT.—May 9

Anaconda's April Production was 13,750,000 lb. of copper, compared with 13,900,000 in March and 26,500,000 in the same month a year ago. April of 1916 was banner month in history of company, when 33,300,000 lb. was produced. April silver production, 687,600 oz. Orphan Girl property, where orebody was recently cut, is shipping daily about 100 tons silver-zinc ore. Further development of Bonanza group of claims in southwestern part of Butte district was suspended and option given up after failure to find ore, although approximately 5000 ft. of shaft sinking, drifting, and cross cutting was done. Steward shaft being sunk from 3200 to the 3800 level. Development work and efficiency program are occupying attention of the company. Operations continue 60% of normal.

Anglo-Saxon orebody cut on the 500-ft. level of the Orphan Girl property of the Anaconda Copper is attracting much attention in local circles in consequence of the heavy tonnage indicated, and, in the opinion of the Anaconda's engineers, no more promising development in years has been had than this, the milling-ore width being more than 35 ft., with indications of a possible 50, all of it averaging about 11 oz. of silver, about 15% zinc, and carrying lead and gold. Two more fissures remain to be developed on the 500-ft. level of the Orphan Girl mine, the Orphan Girl and the Orphan Boy veins, both of which show ore, the former about 15 ft. in width at the surface and the latter 2½ ft. where the fissure was crosscut on the 500. The Orphan Boy shoot is to be drilled, the ore carrying high silver and high zinc content. The Anglo-Saxon orebody is the second large deposit to be opened in what is termed the "west side" of the Butte district, the other being at the Hibernia mine of the Davis-Daly Copper Co., where an ore width of 35 ft. has been uncovered, all of it averaging 22 oz. of silver and about 19% zinc, with lead and gold.

DENVER, COLO.—May 10

Work for Miners is plentiful in the leading mining camps of Colorado. In the Cripple Creek district the larger mines are in great need of skilled American miners. The

Vindicator Consolidated Gold Mining Co. can use 25 to 30 first-class men at once. The Portland Gold Mining Co., Cresson Consolidated Gold Mining Co., Rose Nicol and many others are short handed. The managers say they want good American miners and they do not desire to employ foreign labor if Americans can be found to do the work. Mine managers in other leading camps of the state are in the same position. At the present time there are jobs for over 400 men in the Telluride section alone. The Liberty Bell mine, which was recently shut down on account of power-plant troubles, is open again and in need of men. The Humboldt properties will resume operations early in May and can use over 100 men. Other mining companies in need of men are: Tomboy Gold Mines Co., Ltd., Smuggler-Union Mining Co., Belmont-Wagner Mining Co., and Black Bear Mining Co., all at Telluride. Over 200 men could find employment in these mines. The Primos Chemical Co., now rebuilding its mill near Vanadium, will need several hundred men in August, and could use 25 to 50 at the present time. Telluride operators have announced that there will be no cut in wages.

WALLACE, IDAHO—May 8

Labor Shortage has come to be a serious matter in the Coeur d'Alene district, and this in the face of the fact that the mines have generally reduced their forces on account of the low price and weak market for lead. It is believed that the high wages paid in the agricultural districts of the northwest and also in the lumber woods are the cause of the shortage, men preferring that class of work during the spring and summer rather than work in the mines.

The Second Class in Vocational Training of miners has been organized by Director Frank H. Skeels through an arrangement with James F. McCarthy, manager of the Hecla mine. The class will be engaged in extending a raise that is being made from the 900 to the 300 level. The work is being done under contract, and Mr. Skeels expresses confidence that the success achieved by the first class, which made better than wages drifting under contract in the Morning mine, will be duplicated at the Hecla. The experiment in vocational training of miners in this district is being watched with much interest by operators, who see in the system the possibility of eventually raising the standard of efficiency of underground employes.

The State Bureau of Mines and Geology, which was created by the last session of the Idaho Legislature, has effected organization and outlined plans for work for the next two years. The immediate plans of the bureau are set forth in resolutions adopted by the board of control, in which it is stated that the policy of the board will be to cause to be made such geological and topographical investigations as will stimulate the development of all districts showing indications of containing metallic or nonmetallic mineral deposits of economic value, and to make the results of such investigations available at the earliest possible moment. Announcement was also made that the present coöperative agreement with the U. S. Bureau of Mines in carrying on research work in Idaho would be renewed upon the expiration of the present agreement on June 30. Likewise, an agreement will be perfected with the U. S. Geological Survey for the completion of a detailed topographical survey of the Teton coal basin and for a certain amount of coöperative geologic work. Arrangements were also made for the immediate publication of a report of the geological work recently completed in central and northern Idaho. The Legislature appropriated $30,000 for the maintenance of the bureau for two years, distributed as follows: For coöperative work with the U. S. Bureau of Mines, $15,000; for coöperative work with the U. S. Geological Survey, $10,000; for geological and economical investigations of the mineral resources of the state, $5000.

Coeur d'Alene Mines experienced a great slump in production and profits during 1918, as compared with the record of 1917, a result that was due chiefly to insufficient and inefficient labor. With the exception of zinc, the average prices of metals were higher than in 1917, the price of zinc being only a fraction of a cent less, and the war demands maintained a steady market up to the time of signing the armistice. Wages and the cost of mining material and supplies were somewhat higher, but it is evident, from the reports just filed with the county assessor, that the real difficulty was inability to produce the tonnage with the labor available. The war drew heavily upon the mines for men, and the high wages in the shipyards on the coast attracted labor that would otherwise have found employment in the mines. Under the mining law of Idaho, mining companies are required to pay taxes on their net profits in addition to the usual property tax on real estate and improvements, and at the same rate. To determine the net profits for the purpose of taxation, the companies are required to file with the county assessor each year, on or before May 1, detailed statements, under oath, showing tons of ore extracted, gross value, cost of extraction, freight and smelting costs, expenditures for betterments and repairs, and net profits. These statements have now generally been filed. The gross value of ore produced for the calendar year 1918 was $26,307,367, and net profits were $7,970,353. These figures include all profit-earning companies except the Gold Hunter and Richmond. A fair estimate of the profits from these two is $150,000, which would bring the total net earnings of the mines of this district up to $8,120,355. The returns for 1917 showed the gross value of ore produced to be $39,677,689, and the net profits for that year were $12,765,113. As a matter of interesting comparison, the gross value of ore produced and net profits of the principal mines of the district for the years 1918 and 1917 are here given:

1918

	Gross Value	Net Profit
Bunker Hill & Sullivan	$6,094,285	$1,379,318
Caledonia	1,096,776	647,819
Federal (Morn'g mine)	3,079,144	761,369
Hecla	4,902,611	1,984,820
Hercules	6,193,539	1,915,766
Interstate-Callahan ..	1,833,671	272,330
Tamarack & Custer...	2,211,457	696,868

1917

Bunker Hill & Sullivan	$9,584,963	$2,447,285
Caledonia	1,849,254	1,227,155
Federal (Morn'g mine)	4,620,344	1,319.962
Hecla	4,462,030	1,895,065
Hercules	9,880,978	3,690,400
Interstate-Callahan ..	3,250,835	1,234,063
Tamarack & Custer...	1,338,321	350,857

Hecla maitained normal production in 1918 through good fortune in securing men, and advanced from third to first place in net profits. Caledonia employs only about thirty men and was not materially affected by labor shortage. The increased production and profits of Tamarack & Custer in 1918 are explained by the fact that the mine was inactive during part of 1917 while a new mill was being constructed. A new company made its appearance in the list of profit earners last year in the Yukon Gold Co., which operates a steel dredge on Prichard Creek and reported handling 1,487,706 cu.yd. of gravel, having a gross value of $177,140, and which yielded a net profit of $81,962. The Interstate-Callahan was closed down several months in 1918.

BIRMINGHAM, ALA.—May 5

Alabama Chapter of the American Mining Congress was to be organized at a meeting called for May 1. The preparing of a compensation law for Alabama was to be one of the important subjects to be considered. There is also considerable interest in the mining congress's efforts to standardize employers' liability laws throughout the United States, modification of the Sherman anti-trust laws, and securing recognition in the President's Cabinet.

HOUGHTON, MICH.—May 10

Approximate Shipments of Rock for the month of April are as follows: Champion, 38,000 tons, as compared with 45,000 for March; Baltic, 22,000, the same as March; Trimountain, 15,000, the same as March; Wolverine, 24,000, as compared with 26,000 for March, and Mohawk, 49,000, as compared with 50,000 for March. Michigan shipped 5240 in April, the same as March.

IRONWOOD, MICH.—May 10

Labor Agitators scattered thousands of pamphlets printed in several languages through the mining sections of the Ironwood district in an attempt to gain members for the I. W. W. and to start a May Day strike for a six-hour day. In the latter they failed completely. Few if any men "struck," and there were no public demonstrations. Wages are over $6 per eight-hour day for miners, and, anyway, the men would be reluctant to strike when they know that a great many miners are unemployed in the Michigan mining districts.

DULUTH, MINN.—May 10

Minnesota Has More Iron Ore now than it had in 1907, according to figures set forth in a recent report of the State Tax Commission. By discovery, exploration, and development the unmined reserve, which was 1,191,969,757 tons on May 1, 1907, had been increased to 1,455,568,770 tons on May 1, 1917, in spite of 303,212,769 tons which were shipped out of the state in the interim. Of the increase, the Cuyuna Range is credited with 70,857,865 tons, a small tonnage is in the Vermilion Range, and the remainder in the Mesabi Range.

SALT LAKE CITY, UTAH—May 10

Salt Lake Stock and Mining Exchange Brokers are beginning to file bonds to meet the requirements of the new state law (going into effect May 12) regarding stock transactions. The law requires the filing of a $5000 bond by any broker engaged in putting a stock or security on the market, and many brokers are not waiting for a specified occasion to arise, but are filing bonds ahead of time so as to be prepared for contingencies. Other fees which must be paid by brokers operating here are: $25 to the city, $60 to the U. S. Government, $10 to the state and $100 for the privilege of operating on the exchange. Unusual activity on the exchange during the last days of the month has brought the total of sales for April to 1,667,686, of a value of $361,720, which represents the largest volume of business in one month for some time. In general, though sales are not keeping up to the rate of the record days, it is felt that the light trading of recent months incident chiefly to conditions prevailing in the mining industry in this section, and now showing some improvement with the high price of silver, is giving way to more normal activity.

A Strike at Park City resulted in the closing of the mines of the district. The walk-out occurred on the morning of May 7, the men having presented their demands to the mining companies the evening of May 5, without warning. The terms asked are extreme, and on their face impossible of fulfilment. They are in the main a six-hour day and pay at $5.50, with two men on a machine. Also, guarantee against discrimination because of any affiliations of the men is asked. Present wages are $4.50 and $4.75 per day. The strikers voted to allow men on pumps and engineers to remain at work until the evening of May 7. At the present writing, the pumps at the Silver Hill shaft of the Silver King Coalition, where the damage of flooding, although the cause of large expense in the future, would not be irreparable, have been pulled. In the case of the Ontario, where the orebodies at depth are not high grade, and flooding would probably result in an indefinite period of idleness, the pumps late on the night of May 7 were operating under sheriff's guard. The other mines of the district—the Judge, the Silver King Consolidated and Daly West—are dry. In view of the extreme nature of the demands made by the miners, it is felt that the strike has not been brought in the hope of obtaining demands felt by the men to be legitimate, but that it has been fomented as sabotage by some outside organization, such as the I. W. W. and alien associates, with the distinct purpose of embarrassing the industry. This is also borne out by the fact that the strike is unpopular with a large number of resident miners, who have a strong feeling against the movement. The local union of the Western Federation of Miners is said to be in no way connected with the strike.

WARREN, ARIZ.—May 10

Copper Companies of the Warren District, the Calumet and Arizona Mining Co., the Shattuck Arizona Copper Co. and the Copper Queen department of Phelps Dodge Corporation are redeeming their promise to find jobs for the returning soldiers. In spite of the adverse conditions which prevail in the copper market, they are putting returning men to work each week; one company has found places for 168 soldiers since Dec. 1. Of this number, 70 had not worked for the company previously. The policy of the companies in pushing development work at this time will in all probability make room for the new men without displacing any of the old employees.

JOPLIN, MO.—May 10

Electrolytic Zinc Refinery to be constructed immediately at Picher, Okla., is planned by the Oklahoma Ore Storage Association, according to an announcement of J. McNicholas, secretary and manager. Experiments have been carried on at Orange, N. J., recently, for the company, tending to prove the availability of this district's ores for electrolytic treatment. The plans of the company at present do not include the erection of a large roasting plant. The management hopes to persuade producers to erect roasters at their individual properties.

Attempted Sale of the Royal Mine, at Picher, Okla., recently, was a failure. It was stipulated that the property must bring at least $3000 in excess of debts, and the debts amounted to $40,000. There was not a single bid. The sale was brought about by a legal tangle. It is believed that the mine is a good one, but the demand for zinc mines just now is exceedingly light. In direct contrast with this circumstance, however, is the announcement that the Commerce Mining & Royalty Co., of Miami, Okla., has just sold a 9% royalty interest in the Blue Bonnet mine, east of Picher, for $65,000. The Blue Bonnet has been operating only a few months, but has been shown to be one of the best properties in the field. It has been paying a royalty charge of 20% and the 9% reduction at a cost of $65,000 was decided upon by W. H. Logan, manager and one of the principal owners of the property, after a careful computation of the mine's prospective value, as shown by ore recovery and ore blocked out.

Revision of Royalty Charges in this district is about to become a fact. J. W. Howell, special supervisor of Indian affairs and chief attorney in probate service in the Department of the Interior at Washington, has, after careful study, decided upon a new system of royalty charges to apply to the Indian-owned land in the field, which includes virtually all of the zinc lands in the Oklahoma section. According to this plan, the recovery and royalty charges shall be the same. That is, if a mine is making a 7% recovery it will pay 7% royalty to the land owner, so long as zinc ore sells for $50 per ton or less and lead for $65 per ton or under. With each increase of $10 per ton in the selling price of ore, an additional 1% royalty shall be charged. Thus, if ore was selling for $100 a ton, a mine recovering 7%, would pay 7 plus 5, or 12% royalty. A minimum royalty of 5% and a maximum of 20% is provided. Judge Howell arrived in Joplin on May 10, and will remain in the district, with headquarters at Miami, probably for one month. During this time it is expected that most operating companies will appeal to him for a revision of their royalty charges, as at most properties the pyramiding of royalties has made these charges excessive. While here, Judge Howell also will investigate several Indian land controversies that are pending and will consider the petition of the people of Picher, Okla., for the removal of the restrictions to town-site properties.

TORONTO, ONTARIO—May 10

The Railroad Project in the Kirkland Lake district will remain at a standstill for the present, according to a decision of the government, and in the meantime a good motor road will be built from the railway to the mines. Apparently this will be more satisfactory to companies than a railway. It is expected that the road will cost from $60,000 to $70,000. A motor road will also be built from the railway at Elk Lake into the Gowganda camp, costing from $250,000 to $300,000, and it has also been decided to build a good motor road in the Porcupine district, connecting all the mines.

VICTORIA, B. C.—May 3

A Gold Strike which is attracting attention is reported on the Morley River, about 150 miles to the northeast of the town of Skagway and just a few miles south of the international boundary. Morley River runs into Teslin Lake. The surface dirt is said to pay from 30 to 50c. Bed rock has not yet been struck. It is expected that there will be a rush to the new diggings with the opening of the summer season.

An Immense Cave-In has occurred in the workings of the Granby mine, at Phoenix B. C. No serious damage, however, is reported, as such an occurrence was not altogether unexpected. The Great Northern and Canadian Pacific, Ry. companies' rails are not being used in the vicinity of the break, and a temporary interference with transportation consequently has resulted. Residents are moving from the affected area.

Affairs of the Dolly Varden Mining Co. promise to reach a settlement without loss of time. It has been reported authoritatively that the company admits the claim of the Taylor Engineering Co., which amounts to $462,628.28. This was expended in the construction of 18 miles of railway from tidewater in the Alice Arm district, B. C., to the Dolly Varden mine. Payment of the sum must be made to the engineering company within 30 days, and it is assured that the admission of the claim is an indication of the company's readiness to settle within that period. If this is so, the title to a good mine as well as to the railroad which taps some promising mining country in the Northwest will be cleared, the mining company will be in a position to sell or to operate, and activity and prosperity should return to the section affected. The Taylor company, too, will be able to pay its creditors, among whom are 100-odd workmen who were engaged on construction and who have been impatiently waiting for their wages.

The Mining News

ALASKA

ALASKAN COPPER SHIPMENTS for March were 2986 gross tons of domestic copper ore and matte, to the United States; copper contents was 1,471,398 lb., valued at $294,437.

W. F. ROCK will operate property at Wasilla this year to full capacity. Has just shipped in compressor drills and mill supplies. Gold property.

LADYSMITH SMELTERY, which recently took over W. A. Dickey property at La Touche, expect to remove all machinery to other properties which are in prospect stage. La Touche property will be enlarged and new machinery installed.

ALASKA MINES (Fidalgo Bay)—Expect to install compressor, recently bought, this summer. Good copper ore. Mine has been operated by hand. Mr Twitchel, care San Juan Fish Co., Seattle, Wash., interested.

JUALIN ALASKA MINES (Jualin)—Will let contract soon for tunnel, as Manager Titus is expected back from Atlin, B. C., in the near future. Will be longest tunnel project since Gastineau tunnel was driven.

ALASKA JUNEAU (JUNEAU)—Expects to make improvements at mill, having recently raised necessary money.

ALASKA TREADWELL (Treadwell)—Sending prospecting party from San Francisco June 1 for Alaska. Outfit will be complete, including compressor drills, drill sharpener and mill equipment. All purchases will be made at the company's San Francisco office.

ARIZONA

Gila County

GILA MONSTER (Globe)—Developing old Mack Morris, Richmond, and La Plata mines, in Richmond Basin. Old dumps will be worked. Crosscuts at 70-ft depth in Richmond show good ore. Ten-stamp mill will be built. W. H. Seamon, superintendent.

INSPIRATION CONSOLIDATED (Miami)—April production was 6,900,000 lb copper.

PORPHYRY MINING (Miami)—Being consolidated with Barney Combination, also includes part of Philadelphia property above Miami, recently acquired by Porphyry company.

Greenlee County

ARIZONA COPPER (Clifton) — Extensive changes under cons[illegible] To provide work for Mexican labor when Metcalf property shut down recently, men were given road work; because one shirker was discharged, whole gang quit. Work will not be continued at this time.

S. G. MURILLO (Clifton)—With Clifton-Morenci associates optioned seven gold claims in Sierra County, N. M. Work will be started at once on extensive development.

ASH PEAK MINING CO. (Duncan)—Preparing to install 100-ton cyanide mill, 9-ft. vein opened for 600 ft. on 800 level. Quartz ore carrying gold.

DETROIT COPPER (Morenci) — Planning to either remodel old mill or erect new mill. W. H. McLain, superintendent.

STARGO SYNDICATE (Morenci)—Planning 100-ton cyanide plant. J. M. Callow and J. H. Watson making ore tests at No. 6 concentrator of Arizona Copper Co. J. M. Hannon, manager.

Pima County

AJO-CORNELIA (Ajo)—Reorganized by Ajo men, who paid debts and moved headquarters from Miami to Ajo. Frank Z. Steele, president. Consists of 11 claims, adjoining New Cornelia on east. Shallow inclined shafts developed good ore, carrying gold and silver.

NEW CORNELIA (Ajo)—Leaching suspended for a time through failure of water supply, owing to fire in pump station in 610-ft. main well. Water for camp brought in by tank cars from Gila Bend, 12 miles distant. Five carloads sulphide sent daily to C. & A. smeltery at Douglas. New 1000-ft haulage drift for flotation plant more than half finished. Second gloryhole started south of first.

Pinal County

SOUTH RAY COPPER CO. (Kelvin)—Operations begun May 1 at old Norman or Ripsey group, about 16 miles from Kelvin, under direction of W. B. Duvall. Shaft will be unwatered and retimbered. Plans further exploration of copper orebodies developed at 500 ft. depth under former management.

TROY ARIZONA (Kelvin)—Development in Climax shaft continues to open up ore in shoot cut near surface. Drifting continues on vein from Alice crosscut. J. C. Devine in charge.

U. S. VANADIUM DEVELOPMENT (Kelvin)—Under lease to Allied Metals Co. of Denver, for a year. [illegible] to possession of owners, who plan additional exploratory work.

ARIZONA HERCULES (Ray)—Completed pumping plant on leased ground from Kelvin Sultana Copper Co., at Kelvin. Water carried across Gila River in 12-in. redwood stave pipe line on suspension bridge having span of approximately 500 ft. Two large Scranton pumps of 1000 gal. per min. capacity, operated by 200 hp. motors, installed.

GREAT RAY COPPER CO. (Ray)—Churn drill on ground; plans to resume drilling operations this month.

Santa Cruz County

GOLDEN ROSE (Patagonia)—Developing. August Brodine in charge.

HARDSHELL (Patagonia)—Placing new compressor and hoist.

LAYMAN SYNDICATE (Patagonia)—Jerome capital will take over Pierce-Gardner and Blue Nose. Former shipped last three months 27 cars silver-lead sulphides. James Layman and W. E. Moore, principals.

MORNING GLORY (Patagonia)—Preparing to begin work.

WORLD'S FAIR (Patagonia)—Application for receivership made by Frank Powers, claiming, under bond given by him, April, 1918, A. A. Holland agreed to provide adequate mill and do certain work and that Holland has failed to keep his contract. Mill is alleged to be saving much less of the metal contents than it should, and it is contended that proper development work is not being done.

Yavapai County

UNITED VERDE EXTENSION (Jerome)—Assigning one-eighth acre garden patch to any employee, ground ready for seeding, water furnished by company free. B. Huser, agriculturist, employed by company to assist and advise. Many applications for tracts already made.

ARGONNE (Mayer)—Newly organized company purchased 23 claims of Frank E. Andrews, Guy Mosely, and W. A. Murphy, for $50,000.

Yuma County

JOHNSON (Quartzite)—Reported sold by Joe Johnson to Boston company for $250,000. Has strong ledge quartz, sampling high in gold.

YUMA CONSOLIDATED (Quartzite)—Using steam shovel on cement placer ground employing 150 men.

ARKANSAS

Independence County

CAVE MANGANESE (Batesville)—Preparing to put in switch which will run directly under property. Ore can then be loaded directly from mine into cars. Also plan putting in crushing plant for crushing stone for road building. Office at Peters Bluff.

OZARK (Batesville)—First dry cleaning plant put into successful operation by McSpadden and associates. Has capacity of 150 tons a day, and said to make clean saving. Being operated on manganese ore.

OZARK WONDER (Batesville)—W. A. McClure, one of the owners of this manganese mine, formerly known as Lucky Mack, states shaft being sunk and taking out good tonnage of boulder ore. Prospecting also disclosed body of red lead ore, and 5 ft. vein of phosphate rock. Expect to install small crushing plant to handle latter. Lately purchased adjoining 160 acres.

CALIFORNIA

Amador County

LIGNITE, near Ione, recently tested by Bureau of Mines, reported to yield 62 gal. of oil per ton and 18 lb. ammonium sulphate; 31% volatile matter and 16% fixed carbon; heating value, 6060 B.t.u. Many similar lignite beds in California, but commercial value unattractive on large scale so far.

Inyo County

R. & S. SILVER (Bishop)—Near Queen, said to have 125 tons ore ready for shipment.

NATURAL SODA (Keeler)—Work resumed with 100 men. Reported work will be resumed by other operators on Owens Lake.

Sierra County

ELDORADO-WISCONSIN (Alleghany)—Incorporated in Nevada to option and develop Eldorado mine. Same incorporators, John Backlin and Thomas Flynn, operate Mariposa. New hoist to be installed.

PRIMROSE (Sierra City)—Optioned by Matzene interests, of Syracuse, N. Y. Good prospects, but mine is not fully developed.

BRUSH CREEK (Mountain House)—Optioned by S. A. Hendricks and associates, of Milwaukee, Wis.

Siskiyou County

FAIRVIEW (Dunsmuir) — Incorporated by W. E. Estes and associates. Main office at Dunsmuir. To reopen mine in eastern edge of county near Minersville. Former producer.

Tuolumne County

EXCELSIOR (Confidence)—Optioned by Sledge and Crosson. To reopen immediately. Former producer.

NATIONAL GOLD MINES CO. (Groveland)—Incorporated in South Dakota, to option and develop four claims near Priest Station. Price, $20,000. Owned by Jesse Mangante and associates. Will deepen 250.-ft. shaft to 500 ft., install new boarding house, machinery and small mill. Constructing new road now.

GOLD DREDGE PLACER (Jacksonville)—Fifty acres purchased of G. W. Bates, of La Grange, by A. G Chatom, of Turlock. Formerly owned by E. A. Wiltsee, of San Francisco.

ELLIOTT (Jamestown)—Good ore at 75-ft. depth in new shaft. Nine men employed. Wayne Rudy, superintendent. Large amount gold produced from this vein by Mexicans in early days.

CARLOTTA - PENNSYLVANIA (Tuolumne)—To install cyanide plant to treat ore crushed in 7-stamp mill. Pennsylvania shaft to be deepened to 500 ft.; 15 men employed. J. P. Kennah, superintendent.

GRIZZLY (Tuolumne)—New incorporation with $150,000 capital stock to reopen mine and install machinery.

COLORADO

Boulder Co.

VICTORIA (Boulder)—Fourth level advanced recently on vein of high-grade silver ore, for 80 ft. Oreshoot supposed to be downward extension of rich orebody opened some years ago nearer surface. Winze being sunk in shoot below level. W. S. Garland, of Brockton, Mass., president.

HUMBOLDT (Ward) — New company organized to take over Humboldt and Texas properties. New shafthouse to be built; lumber and equipment delivered. A 100-hp. boiler and hoist being installed; shaft unwatered to 350-ft. level; compressor plant and machine drills ordered. The 350 level will be advanced from bottom of shaft to develop Grand View property. C. J. Walters, manager.

WHITE RAVEN (Ward)—Winze sunk to 900 level below tunnel; commercial silver-lead ore opened. Two carloads shipped to Boulder Ore Sampling Co. since Apr. 1.

IDAHO

Shoshone County

AMAZON-DIXIE (Wallace)—Station and sump being cut on 1100 level and new pump being installed. Crosscut on this level 335 ft. to south vein. Drifting 60 ft. shows considerable lead-silver and copper ore, which will be further explored at once. Another crosscut being run on this level to north vein, now advanced 300 ft., will cut vein in 100 ft. further. Situated just across Montana line. Controlled by Cleveland men.

BIG CREEK (Wallace)—G. Scott Anderson, manager, announces steps being taken to build 60-ton mill. Ore, lead-silver, running high in latter, and also gray copper. Has been shipping for several years, first under lease and now under company operation. Shipping product sorted and hand jigged. Two miles to railroad.

SUNSHINE (Wallace)—Owns large group of claims on Beaver Creek, where large body lead-silver and zinc ore exposed. Arranged to crosscut from old Roy tunnel, from which 300 ft. will cut ore at further depth of 500 feet.

KANSAS

Cherokee County

BLUE MOUND (Baxter) — Completed north field shaft, but will use only for air for present. Now using 16 mules underground. Operating double shift at both mill and mine; also double shift at Blue Diamond mill, on adjoining acreage.

LUCKY JEW (Baxter)—Contracted for 400-ton concentrator on lease northwest of U. S. Smelting Co. No. 2 mine.

LIBERTY M. & M. (Galena)—Starting shaft sinking on tract in entirely new territory west of Lowell, Kan. Drilling showed ore deposits at 190 to 250 ft. If development favorable, a new field will be introduced.

MICHIGAN

Gogebic Range

NEWPORT (Ironwood)—Main drift 25th level advancing 50 to 60 ft. per week, driven by two eight-hour shifts. About 200 ft. from "K" shaft crosscut and still in ore.

STREET RY. (Ironwood)—Is constructing 700 ft. of track in new location. Old line to Jessieville abandoned on account of mining operations.

Menominee Range

BUREAU OF MINES RESCUE CAR No. 7 will be on range for several weeks; at Niagara, week ending May 11; at Iron Mountain, week ending May 18; at Norway, week ending May 25.

MINNESOTA

Cuyuna Range

FEIGH (Ironton)—Development about completed and shipping of first ore to begin soon. Modern equipment, including electric hoist. Property of Hanna Ore Mining Company.

HUNTINGTON AND MARTIN (Ironton)—Installing electric locomotives for underground haulage.

PENNINGTON (Riverton)—Beginning shipments May 1. First cargo completed May 7.

Mesabi Range

GRACE (Chisholm)—Completed shipment of stockpile. Property worked out and surface plant and pumps removed. Inland Steel Co., operators.

HAROLD (Hibbing)—Conducting extensive experiments with loading machines.

WEBB (Hibbing)—Working day shift only. Night crew laid off. Started direct shipments from shaft. Washing plant idle.

EMMET (Virginia)—Being reopened by Bowe-Burke Co., contractors. Will be on shipping list this season.

MISSOURI

Joplin District

CIRCLE (Oronogo)—Sidney Wilkins resigned as manager, and A. J. Burnham, of Webb City., Mo., who formerly managed this property, reëmployed. Circle plant, owned by Connecticut Zinc Corporation, represents nearly a million dollar investment, but has produced little concentrate during the last six months, though the new mill, largest in district, has been ready for operations.

MONTANA

Lewis and Clark County

HELENA (Helena)—Cruse Consolidated drifting north-south on 400 level. Vein showing better, with higher grade than above in silver contents

LIBERTY (Silver Camp)—Mike Horse Co., in Spokane, reorganized under name of Liberty. Mike Horse vein in Silver Camp shows good orebody, and 150-ton mill in place. Mining and milling silver-lead-zinc ore.

Powell County

MONARCH (Elliston)—Operations carried on at Bison Mountain, where Monarch mine is situated. Mill and power plant to be constructed.

NIGGER HILL (Elliston) — Several quartz properties under operation on Nigger Hill include Black Jack and Big Dick.

UNCLE BEN PLACERS (Marysville)—Hydraulic and ground sluicing begun in Uncle Ben Gulch, west of Marysville.

NOLAN (Ophir)—Shipment silver ore from vein opened by crosscut.

Silver Bow County

BUTTE & SUPERIOR (Butte)—April production 8,250,000 lb. zinc in concentrates and 150,000 oz. silver, as compared with 7,250,000 lb. zinc and 135,000 oz. silver in March. Mined 29,000 tons ore, and recovered 7500 tons concentrates 55% zinc. Mill heads averaged 15% zinc; mill recovery averaged 96%. No. 2 shaft, being raised out from 2050-level to the 1900, will require about a month, then sinking will start. Angus McLeod, superintendent.

DAVIS-DALY (Butte)—Blocking out high-grade ore preparatory to increasing tonnage when copper market warrants. Chief work at Colorado mine. Enlarging 2500-station to make ready for sinking to the 2700. Only ore being shipped that from development work, which is paying all expenses and affording sufficient to carry on surface improvement program. Monthly average copper content has been above 8%. William Frazi superintendent.

EAST BUTTE (Butte)—April output, 1,347,580 lb. copper, 47,771 oz., silver, as compared with 1,717,230 lb. copper and 53,650 oz. silver in March. Operating from 60 to 70% of normal. Chief work is development of 1800 level of Pittsmont mine. A. G. Ray, superintendent.

NORTH BUTTE (Butte)—April production 620,800 lb. copper; 27,338 oz., silver; 38 oz., gold. Operating less than 50% of normal. No stoping of ore, rock shipped being that broken in development. Working out bonus system as measure to promote efficiency. Results thus far show about 30% improvement. Lester Frink, superintendent.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments for week ended May 1 were: Prince Consolidated, 25 cars; Virginia-Louise, 7 cars.

STELLA, in Comet district, is shipping high-grade silver ore. Second carload in transit to smeltery; third awaiting shipment.

Nye County

TONOPAH SHIPMENTS for week ended May 3 totaled 7335 tons, of estimated milling value $124,695. Shippers were: Tonopah Belmont, 2238 tons; Tonopah Mining, 1050; Tonopah Extension, 2100; West End, 890; Jim Butler, 222; Montana, 73; Tonopah Divide, 420; MacNamara, 210; miscellaneous, 32 tons.

IN DIVIDE DISTRICT among properties sinking, installing machinery or preparing for development work at depth are the Reno Divide, High Divide, Ajax Divide, Gold Wedge, Rosetta, Emancipator, Gold Reef, Gold Seam, Belmont, Charter, Silver Divide, Grimes, Verdi, Victory, Mohawk, Florence, Allied, Revert, Ben Hur, Divide Syndicate, Junior, Silver King, North, Annex, Apex, Smuggler, Keystone, Argentine, Hasbrouck Divide, Liberty, Calumet, Big Divide, Central, Wilson, Divide City Mining, Jim's Divide, Mizpah, Rand, Treadwell, Goldsmith, Eureka, Kendall, Crown, Gold Bank, Horseshoe, Marne, Sunbeam, Doctor, Toggery, Northwestern, Mighty, Belcher, Liberty Bell, Operator, Midway, Pyramid, Rosalind, Pershing, High Divide Extension, Allied Divide Extension, Sutherland Extension, Ben Hur North Extension, Hercules, Aztec, Old Timer, Giant, South Divide, Congress, Bullion, Bevis, Union, Chariot, Kernick, Standard, Argonne, Rainbow, Lookout, American, Wonder, Champion, Comstock, Vindicator, Homestake, Brooklyn, Mecca, Airedale, Albany, Hecla St. Patrick, Buckskin, Gold Mountain, Great Divide, Klondyke, Yukon, Lucky Boy, New Divide, West Divide, Pay Divide, Portland Silver and Gold, Telephone Girl, Crescent, Doughboy, National, Sterling, all with Divide attached to their names. More than 50 companies are financed, with from $20,000 to $100,000 in their treasuries.

SUTHERLAND DIVIDE (Divide)—Machinery in operation; 400-ft. incline shaft repaired and timbered and will be sunk 200 ft. deeper while drifts and crosscuts are extended on 300 and 400 levels. Shipped good ore in the past.

TONOPAH HASBROUCK (Divide)—Ore from vein opened in main tunnel, 400 ft. from portal, shipped to Tonopah. Tunnel advanced 950 ft.; cut main lode of the mountain through property for long distance, and yielding good assays at surface, showing ore carrying free gold. Shaft, collar of which is 60 ft. below tunnel level, is 360 ft. deep and has been retimbered. Old workings at 200 level being reopened. Foreman in charge under John McKane, in 1904, has returned and says vein was developed at this depth by drift and crosscuts at 50-ft. intervals for 750 ft. McKane, who was associated with Charles M. Schwab, abandoned work on Hasbrouck because of larger interests in Tonopah and Goldfield. George Kernick bought and worked the Hasbrouck mine, shipping 1000 tons from the tunnel, leaving in sight 3000 tons to be shipped now while opening the lower levels.

STAR OF THE WEST MINING (Gazette Bldg., Reno)—Recently incorporated, having taken over Nevada Mining Co. property, consisting of three patented claims and mill sites. Was tied up in litigation for years, preventing operations, but prior to that was good gold and silver producer. About a mile of underground workings, deepest being 170 ft. Old mills are obsolete, and new one purchased from Colorado Iron Works to treat 50 tons daily as first unit of new plant. It is intended to erect this unit when weather permits. R. B. Todd, president and manager. Directors: R. J. Withers, John F. Clapisson, L. L. Griffiths, who is also consulting engineer. New York office, 1482 Broadway.

NEW MEXICO

Grant County

ORGAN ORE (Lordsburg)—Chartered, capital $50,000; $6000 paid in. L. B. Bently, Organ, N. M.; W. W. Cox, D. Isaacs, V. B. May, C. T. Seale, of Las Cruces, directors.

BOSTON HECLA (Lordsburg)—To sink shaft and erect buildings, excavations for which are complete.

BUFFALO OIL AND GAS (Lordsburg)—Incorporated by local men for $250,000, with $2000 paid in. Will drill for oil. Control 5000 acres oil locations in vicinity.

DEMING OIL, GAS AND DEVELOPMENT (Lordsburg)—Preparing to drill for oil, 15 miles west. Have 4000 acres oil locations.

JACK STEVENS (Lordsburg)—Preliminary work has started on this ground at Gold Hill looking to permanent lease if conditions justify.

LAST CHANCE (Lordsburg)—Shipping 25-ton car silver concentrates to El Paso smeltery, contents valued approximately $25,000. J. Shottwell, superintendent.

MONTE RICO (Lordsburg)—Litigation between Boyd and stockholders decided in Federal court in St. Louis in favor of Boyd. Work will be started when plant, idle three years, is repaired. Tunnel will be extended 175 ft. to cut Lee's Peak dike. Howard Boyd, superintendent.

OCTO (Lordsburg)—E. K. Davis, general manager, in charge, states work will start soon.

SOUTH DAKOTA

Lawrence County

CUTTING (Deadwood)—New two-compartment shaft gained depth of 200 ft.; 500 ft. to be driven before lateral work started.

Pennington County

NATIONAL TIN (Hill City)—Formerly American Tin Co. Work resumed, and Cowboy Shaft will be sunk additional 500 ft. Alexander Roy, of New York City, appointed general manager.

SUMMITT (Oreville)—Sold to John R. Bland, of Custer, who has started work. Regular copper shipments will be made to smelter. Occurs as chalcocite. To be hand sorted.

TEXAS

Brazoria County

WEST COLUMBIA field showing decrease in production. Several wells have stopped flowing. Decrease in gas pressure due to blowout at Hogg well No. 15 thought responsible. Salt water has appeared in field.

ROXANA PETROLEUM abandoned No. 4 Seaburn well at about 1400 ft., and Freeport Sulphur Co. its No. 1 Dannembaum & Tolar at 1335 ft. Both wells, on Stratton Ridge, were abandoned in salt.

WEST COLUMBIA average daily production for week ended Apr. 22 was 18,363 bbl., as follows: Crown Oil and Refining Co., 2480 bbl.; the Texas Co., 6116 bbl.; Humble Oil and Refining Co., 7845 bbl.; Gulf Productions Co., 1887 bbl.; Hannicker Oil Co., 35 bbl. Production decreased on account of two wells temporarily shut off.

CROWN OIL AND REFINING (West Columbia)—Storing product here. Planning to build barge channel to Pasadena on Houston ship channel. On refinery site here steel tanks will be built for overflow production until refinery completed.

Concho County

SCHULTZ OIL CO. (Paint Rock)—Well No. 2, eight miles south of town, struck oil sand at depth of 3100 ft.; oil showing good, and no water in well. First well of this depth in county.

Harris County

RECENT COMPLETIONS IN HUMBLE FIELD are: Deep Sand Co.'s No. 1 W. & P., salt water at 1640 ft.; Earnings Oil Co.'s No. 1 Long, salt water at 1215 ft.; Gulf Production Co.'s No. 8 Busch, pumping 50 bbl. at 900 ft.; Hancock Oil Co.'s No. 7 Bender, abandoned at 1188 ft.; Invincible Oil Co.'s No. 17 Cherry, abandoned at 1150 ft.; the Texas Co.'s 235 Landslide, bailing at 2968 ft.; No. 175 Hermann and 26 Koehler bailing, and No. 1 Bready pumping 10 bbl. at 610 ft.; Crown Petroleum Co. bailing No. 1 Bailey and setting strainer at 1190 feet.

FREEMAN LEASE (Goose Creek)—Well No. 2, of Warren Estate, Chicago, came in Apr. 21 as strong gusher. In bay between Hog Island and Atkisson Island.

DEEP BLUE RIDGE OIL CO. (Houston)—Capitalized for $1,500,000. To prospect for oil and operate leases in south Texas, especially Blue Ridge section. Incorporators, C. H. Lane, W. C. Hardcastle and T. T. Pendleton.

Liberty County

EMPIRE GAS AND FUEL CO. (Dayton)—Well No. 2 completed at 1200 ft. Now standing full of water to within 200 ft. of top. Considerable gas escaping. New strainer set, and well expected to pump 400 bbl. per day.

Matagorda County

TEXAS GULF SULPHUR (Gulf)—New $1,000,000 sulphur plant recently in operation and contracted for construction of large storage bins and other facilities to make Texas City the deep-water shipping port for its product. Now producing 1200 tons daily; to be increased by drilling additional wells. Expects to ship over 200,000 tons raw sulphur yearly, a large amount going to South America and Europe.

UTAH

Juab County

TINTIC SHIPMENTS for April, 597 cars, estimated at 29,500 tons, valued at $900,000, as compared with 581 cars in March and 590 cars in February. Total by Tintic in last four months about 100,000 tons, valued at over $3,000,000. Twenty-four shippers in April.

IRON KING (Eureka)—Expected to ship iron ore for fluxing as soon as railroad is completed. Shaft already down considerable distance to be sunk to prospect for continuation of Tintic Standard ore. Upper part being retimbered. Grading being done on surface for foundations to new gallows frame, hoisting engine and other equipment.

LEHI TINTIC (Eureka)—Tunnel driven for better air in 1800 ft., connections to be made soon with main workings.

Salt Lake County

ROAD UP LITTLE COTTONWOOD CANYON open from Wasatch as far as Tanner's Flat. Hauling season to open soon.

COLUMBUS-REXALL (Alta)—Ore in new raise driven near old stopes making out into bedding. Importance not yet determined. Several cars second-class ore ready for shipment. Snow covering spur to narrow-gage road melting.

UTAH IRON AND STEEL (Midvale)—Plant, down about two months, again operating. Employs about 250 men.

Summit County

PARK CITY SHIPMENTS FOR APRIL, according to preliminary figures, 6425 tons of ore and concentrates. Shippers were: Judge Mining and Smelting, 1882 tons; Silver King Coalition, 1818; Ontario Silver, 1800; Daly Mining, 205; Daly West, 165; Silver King Consolidated, 55; miscellaneous, 500 tons. March output, 7984 tons. First four months 1919, about 35,000 tons, valued at $2,000,000.

SILVER KING COALITION (Park City)—Large hoisting plant at main shaft to be electrified. Other changes made to facilitate production. Shipped 1,317,600 lb. ore and concentrates week ended May 3.

CANADA

British Columbia

CANADA COPPER CORPORATION'S NEW MILL now under construction in the Princeton district, being hurried to completion in order to begin milling early in summer. Situated on Copper Mountain. Initial mill capacity to be 2000 tons daily.

CONSOLIDATED MINING AND SMELTING CO., in Princeton district, has acquired Voight copper group, on Copper Mountain, and has put large crew working on development.

Ontario

BAILEY (Cobalt) — Shareholders, by large majority, voted in favor of merger with Northern Customs Concentrator, Limited.

BEAVER (Cobalt) — Struck 3-in. vein of high-grade on 600 level.

CAMPBELL & DEYELL, Ltd. (Cobalt)—Customs sampling plant taken over and will be operated under same management, by T. & N. O. Ry. Commission. With decrease in output of high-grade from Cobalt mines, and higher operating costs, old company unable to operate at profit, and decided to close down. Plant of much benefit to northern Ontario and Railway Commission decided to operate.

MINING CORPORATION (Cobalt)—Will prospect the conglomerate Keewatin contact in Bucke Township by diamond drill. Overburden is heavy and surface prospecting practically impossible.

PETERSON LAKE (Cobalt)—Resumed treatment of Seneca-Superior tailings in flotation mill.

SILVER-CLIFF (Cobalt) — Leased to Northern Customs Concentrator, Limited.

TOUGH-OAKES (Kirkland Lake)—In April did 1000 ft. of underground work. Opened up new orebody on 300 level.

BURTON-MUNROE (Matheson) — Resumed operations.

HOLLINGER (Porcupine) — Treating 2300 tons ore a day.

INSPIRATION (Porcupine)—To be prospected with diamond drill.

SCHUMACHER (Porcupine)—No definite date yet set for dewatering Schumacher mine and beginning operations.

MEXICO

OIL CONCESSIONS have been granted to a Japanese commission, headed by Baron Hasegawa, captain of engineers, for exploration purposes in the northern part of the country, particularly in Durango and Chihuahua, according to a statement of the Department of Industry and Commerce. The commission has completed an investigation of the petroleum possibilities in the Tampico region.

Coahuila

COAL MINES of this state resumed operations, producing 10,000 tons coal monthly, being about one-half normal production, and 18,000 tons coke, being about one-third normal production.

Durango

JAPANESE STEEL INTERESTS reported to have leased mountain of iron ore at city of Durango, formerly owned by Honey Syndicate. Modern steel plant in vicinity reported as part of plans.

Sonora

QUINTERA (Alamos)—Has record of 20,000,000 oz. refined silver. Owned by French syndicate, under option through S. L. Pearce. Claimed to have 20,000 tons workable ore on dumps.

GREENE CANANEA (Cananea)—April production was 3,000,000 lb. copper, 1,131,133 oz. silver, 1730 oz. gold.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver New York, Cents	Silver London, Pence	May	Sterling Exchange	Silver New York, Cents	Silver London, Pence
8	4.6788	103	48⅝	12	4.6850	119¾	58
9	4.6825	105¾	53½	13	4.6875	114¾	55½
10	4.6850	111	58	14	4.6775	111	54

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
8	15⅜	†72½	4.75 @4.85	4.55 @4.60	5.95
9	15⅜	†72½	4.75 @4.85	4.57½ @4.62½	5.97½
10	15⅜	†72½	4.75 @4.85	6.62½ @4.67½	5.97½
12	15.40 @15.45	†72½	4.90 @5.00	4.62½ @4.67½	5.97½
13	15.60 @15.70	†72½	5.00	4.70	6.00
14	15.70 @15.80	†72½	5.00	4.70	6.02½

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

May	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
8	76¼	76¾	80	229	228¼	24⅛	24⅜	34¾
9	76⅜	77	80	231½	229	24	24¼	34¾
10	...	...	...	...	...	...	...	...
12	76¼	76¾	80	236	233	24	24¼	34¾
13	76¾	77¼	80	235	232¾	24¼	24	35¼
14	77¼	77¾	81	236	233	24¼	24½	35

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—May 14, 1919

The chief event of this week was the spectacular rise in the price for silver, which was 103 on Thursday, 105¾ on Friday, 111 on Saturday, and 119¾ on Monday. On Tuesday the market became reactionary, the official quotation being 114¾, and today it is down further. London was a bidder for silver in this market and was immediately responsible for the advance. There were wide variations in prices between morning and afternoon of each day. The official prices that we quote are usually published about noon, but during the last week have been delayed until later in the day, tardiness in the receipt of the London cables being responsible for this. American producers of silver were able to sell little, if anything, at the high price that was named on Monday. Several reported inability to make sales. The sharp advance is attributed to a speculative squeeze in the spot position in London.

Besides the rise in silver there was a sharp advance in copper, on large business, a marked improvement in lead, and a slight improvement in zinc. There was a better tone all around, which, no doubt, to some extent reflected the bull market in Wall Street.

Transatlantic freights remain unchanged at 1c. per lb. to British ports and 1½c. to French ports. The rates from San Francisco to Japan and China remain unchanged at $15 per ton.

The stocks of metals held by the British Munitions Ministry on May 1, (with corresponding figures for Apr. 1 in parentheses) were as follows: Copper, 114,531,200 lb. (109,092,480); lead, 244,186,880 lb. (216,061,440); spelter, 76,090,560 lb. (85,225,280); aluminum, 25,854,080 lb. (49,772,200); nickel, 5,750,080 lb. (5,351,360); antimony, 9,992,640 lb. (9,768,640.)

Copper—A large business was done at steadily advancing prices. Beginning with Thursday all producers were willing to sell at 15½c., regular terms. There was a substantial demand, and some producers whose sales in previous weeks had not been quite satisfactory were able to place such large quantities that on Friday afternoon one of them raised its price to 15⅝c., regular terms. Another followed on Saturday morning, but up to the close of business on Saturday there were still sellers on a large scale at 15½c., regular terms. On Monday, however, everybody went up, although not immediately, to 15¾c. On Tuesday that price was firmly established, and by the end of the day 16c. was being asked in some quarters, but the market has not yet become established on that basis, although that price would have to be paid for July delivery. May-June copper sold today at 15⅞c., regular terms.

While the transactions of the week foot up to a large figure, especially considering that they were mainly confined to domestic business, the larger part of the business was done in the earlier days of the week at the 15½c. level. In the later days, although there was some strong buying, more conservatism began to be exhibited. As in previous weeks, wire-drawers were the chief buyers, but some substantial business was done with brass-makers. Speaking generally, however, the brass-makers are not in a happy state of mind. The buying of this week was mainly for May-June delivery, but some contracts were entered into for July delivery. However, the latter constituted only a small proportion of the total.

Copper Sheets—The base price of copper sheets is 23c. per lb. Copper wire is quoted at 17½@17¾c. per lb. f.o.b. mill, carload lots.

Tin—There is nothing much to report. The stock held by the U. S. Steel Products Co. is being taken very slowly by consumers, and instead of its being absorbed by the middle of June, the present forecast is for early in July, while some people think that it may be Aug. 1 before news is published that all has gone.

Lead—Lead manufacturers report improving business, especially for such articles as are required in house building. Producers experienced a better demand and stiffened their prices accordingly. During the last two days of the week a considerable tonnage of lead for prompt shipment from the West was sold at 5c., New York. The disposition of the Government's stocks ceased to be so much of a worry.

Zinc—Not much interest on the part of consumers was reported, but there was considerable speculative buying, which led to an advance in prices. However, there does not appear to be anything in sight of a nature to inspire enthusiasm.

High-grade zinc, 99.9%, sold this week on terms corresponding to 6¼c., St. Louis.

Zinc dust of the ordinary prolong grade is available at 9c.

Japan inquired for spelter in this market, but ideas as to price were far below our existing level.

Arrangements for handling the Government's stocks have not yet been consummated.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Nominal at 33c.

Antimony—This market was again somewhat stronger, a fair business being done from day to day. We quote spot at 7@7¼c., and futures at 7c.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The New York price is quoted at $80, but sellers are not keen about accepting that price, and some small sales are reported as having been made at $82@83. A short supply on hand in this market is the reason for the strength. San Francisco telegraphs $75, steady.

Gold, Silver and Platinum

Gold—All manufactures of gold the bullion value of which does not exceed 65% of the total value can now be exported without individual export licenses.

Silver—The silver market has been in an excited condition the last week, owing to the removal of Government restrictions on price and export licenses by both the Federal and British governments. As a result the price made the phenomenal advance of about 20c. per oz. on May 9 and May 10, due to the urgent demand of buyers in London on a market short of supplies. The accumulated demands from various buyers for coinage and commercial purposes which had not been filled owing to Government restrictions were thrown on the market for immediate purchase, and as sellers were inclined to hold off, the result was the forcing of the price too high, and buying orders were canceled. With sellers pressing for sale, a natural reaction has occurred, and the market closes weak and lower. India and China have not been buyers at the advance, and it seems probable that, after the filling of these special orders, the market will settle down to the basis of the nominal India demand, with fluctuations depending on market conditions.

Pixley & Abell report in their circular of Apr. 24 that there are now in Shanghai 28,600,000 taels of sycee and 18,400,000 Mexican dollars.

Mexican dollars at New York: May 8, 79; May 9, 80; May 10, 84; May 12, 89; May 13, 87; May 14, 85.

Platinum—We quote refined ingot at $100. Demand continues good.

Palladium—We quote $118@120.

Zinc and Lead Ore Markets

Joplin, Mo., May 10.—Blende, per ton, high, $39.80; basis 60% zinc, premium grades, $37; Prime Western, $36@35; sludge and flotation, $34@30; Calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $36.44; calamine, $24.12; all zinc ores, $36.

Lead, high, $61.75; basis 80% lead, $56@55; average settling prices, all grades of lead, $52.75 per ton.

Shipments the week: Blende, 9295; calamine, 359; lead, 2566 tons. Value all ores the week, $482,790.

Failure to effect concerted action for controlling the zinc-ore output caused an overproduction, bringing prices to a level that threatens disaster to zinc mining. Mine after mine is being quietly closed down, and the pumps are being stopped. Where the present depression will end is problematical, but it cannot stop until a steady appreciation of prices warrants operation of the mines.

Platteville, Wis., May 10.—Blende, basis 60% zinc, $38 base both for premium grade and high-lead grade.

Lead ore, basis 80% lead, $53 to $54 per ton.

Shipments reported for the week are 2029 tons blende, 107 tons galena, and 1291 tons sulphur ore. For the year to date the totals are 35,780 tons blende, 1827 tons galena, and 3902 tons sulphur ore. During the week 2557 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—Ore of 45% or over is reported offered at $26 per ton, f.o.b. San Francisco.

Molybdenum Ore—No business reported.

Manganese Ore—No important business, that we hear of, is being done.

Tungsten Ore—A little business in Chinese ore was done at $6.50@7. More inquiries from Europe are reported.

Pyrites—Spanish pyrites has been sold at 20½c. per unit for furnace ore, c.i.f. New York or any South Atlantic or North Atlantic port.

Iron Trade Review

PITTSBURGH—May 11

While the dissolution of the Industrial Board last Friday does not directly affect the steel market situation, since the board's effort to control the situation had been proved ineffectual weeks ago, the dissolution is likely to have a beneficial effect upon sentiment generally, making buyers and sellers more anxious to get together. Only after Secretary Redfield had accepted the resignations of the members of the board, tendered late in April, did it come out that on Apr. 1 the Attorney General had rendered an opinion that the whole operation was illegal, and thus in no circumstances could the program have been carried out according to the original plan. Doubtless Judge Gary knew of this decision of the Attorney General when on Apr. 21 he occasioned such surprise by stating at the annual meeting of Steel Corporation stockholders that he understood the Industrial Board plan had been "abandoned entirely."

The estimate made in this report a week ago, that the steel industry was then running at somewhat under 60% of capacity, is confirmed by the monthly report of the American Iron and Steel Institute, which shows that during April the mills ran at an average of 65% of capacity, this comparing with 77% in March, 85% in February and 87% in January. As the decrease in operations was steady, it may be assumed that the rate was a trifle over 70% Apr. 1, 65% Apr. 15 and a trifle under 60% May 1. This week the rate is probably about 55%. Two or three large independents are known to be running at between 40 and 45%, but the Steel Corporation is averaging above 60%. This divergence may influence some independents to cut loose from the fixed schedule of steel prices, because of their costs being increased by the light operation, with poor distribution of overhead.

PIG IRON

Pig Iron—Rumors are increasing of price shading in the local market, but precise prices cannot be secured, and the market generally is quotable at the prices effective Mar. 21, though quite weak at those prices: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, with $1.10 freight to Pittsburgh. One furnace interest, however, with freight to Pittsburgh 30c. less than the Valley rate, is willing to sell f.o.b. furnace at these prices, representing a saving of 30c. to Pittsburgh buyers.

STEEL

Steel—Inquiry for billets and sheet bars is extremely limited. Full prices, $38.50 for billets and $42 for sheet bars, are being quoted, except for commissions to middlemen which are too small to justify the dealer splitting with the consumer.

FERROMANGANESE

Ferromanganese—It is reported that a small lot of re-sale 80% ferromanganese has gone at $105, delivered, but the market generally seems quotable as a week ago, $110@115, with the furnaces still quoting $150 as their price. Resale 18% spiegeleisen remains quotable at $33@35, delivered, but there has not been enough demand to test the market.

COKE

Coke—The spot market is again stiffer, the lower price sellers having quit, while the recent purchases of about 10,000 tons by the Jones & Laughlin Steel Co., because of labor trouble at the coal mine supplying its own coke works, at $3.50, have had an influence. Spot coke cannot be had below $3.75, and quotations run up to $4, which was the common settling price for May deliveries on contracts calling for monthly price adjustment. The market is now likely to remain steady until negotiations begin for second half, as many contracts expire June 30. Negotiations will likely start by furnaces bidding about $3.50 for second half. Spot foundry coke remains at $4.25@5, depending on brand, with no contract market developed.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	41.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	..	37.940	48.980	
June	76.971	99.500	...	39.065	48.875	
July	79.010	99.625	.....	40.110	48.813	
Aug.	85.407	100.292	....	43.418	49.077	
Sept.	100.740	101.125	....	50.920	49.500	
Oct.	87.332	101.125	....	44.324	49.500	
Nov.	85.891	101.125	....	43.584	48.969	.. ..
Dec.	85.960	101.125	.. .	43.052	48.492	.. ..
Year	81.417	96.772	.	40.851	47.516	.

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	152 46	110.000	77.300	125.000	82.200
May	23.500		110.000		125.000	.
June	23.500		110.000	..	125.000	.
July	25.904	...	119.913	...	134.913	.
Aug.	26.000	...	122.000	....	137.000	. . .
Sept.	26.000	...	122.000	.....	137.000	.. ...
Oct.	26.000	....	122.000	.....	137.000	...
Nov.	26.000	.....	122.000	....	137.000	...
Dec.	(a)	...	118.447	.	133.167	. .
Year	24.628	. .	115.530		130.507	

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.815	225.275
May	(a)		364.217	.
June	(a)	.	331.925	.
July	(a)	..	360.347	.
August	(a)	...	380.900	.
September	(a)	....	343.905	.
October	(a)	..	335.543	
November	(a)		323.550	
December	(a)		267.736	
Av. year	(a)		330.138	.

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.00	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818		6.704		29.00	
June	7.611		7.511		29.00	
July	8.032		7.750	..	29.00	
August	8.050		7.750	...	29.00	
September	8.050		7.750	....	29.00	
October	8.050		7.750	...	29.00	.
November	8.050		7.750	.	31.20	.
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	7.022	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314		7.114		54.000	
June	8.021		7.791		54.000	
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.000		54.000	
October	8.801		8.451		54.000	
November	8.491		8.114		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$36.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	22.54	33.95	31.40	33.95	29.17
April	36.15	20.35	33.95	27.15	33.95	28.15
May	36.20		33.00		34.00	
June	36.30		33.16		34.10	
July	36.60		33.40		34.40	
August	36.60	. . .	33.40	.	34.40	
September	36.60	. .	33.40		34.40	
October	36.60		34.40	.	35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.15	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	May 13
Alaska Gold M.	3¼
Alaska Juneau	2
Am.Sm.&Ref.,com.	79½
Am.Sm. & Ref., pf.	109
Am.Sm Sec., pf., A.	93
Am. Zinc	17
Am. Zinc, pf.	48½
Anaconda	67
Batopilas Min.	2
Bethlehem Steel	75
Butte & Superior	25
Butte Cop. & Zinc	13½
Cerro de Pasco	45
Chile Cop	24½
Chino	38½
Colo. Fuel & Iron	46
Crucible Steel	72½
Crucible Steel, pf	96
Dome Mines	15½
Federal M. & S.	19
Federal M. & S., pf.	46
Great Nor., ore ctf.	45¾
Greene Cananea	40¾
Gulf States Steel	63¾
Homestake	‡89
Inspiration Con.	53
International Nickel	[illegible]
Kennecott	34¼
Lackawanna Steel	75¼
Mexican Petrol.	181½
Miami Copper	25
Nat'l Lead, com.	75
National Lead, pf	108
Nev. Consol	17½
Ontario Min.	10¼
Ray Con	21¾
Republic I. & S., com	84¾
Republic I. & S., pf.	103½
Sloss-Sheffield	58
Tennessee C. & C.	15¾
U. S. Steel, com.	101¾
U. S. Steel, pf.	114¾
Utah Copper	78½
Va. Iron C. & C.	63½
Worthington Pump	69

BOSTON CURB*	May 13
Boston Ely	1¾
Boston & Mont.	69
Butte & Lon'n Dev	12
Calaveras	.50
Chief Con.	3½
Contact	05
Corbin	‡ 25
Cortez	12
Crown Reserve	.35
Crystal Cop	17
Eagle & Blue Bell	2½
First Nat. Cop	1½
Gadsden Cop.	3
Houghton Copper	40
Intermountain	‡ 05
Iron Blossom	40
Iron Cap	10½
Majestic	18
Mexican Metals	15
Mines of America	‡ 05
Mojave Tungsten	13
Nat. Zinc & Lead	13
Nevada-Douglas	18
New Baltic	1½
Oneco	30
Pacific Mines	†‡ 25
Rex Cons	.14
Yukon Gold	76

SAN FRAN.*	May 13
Alta	‡ 08
Andes	39
Best & Belcher	35
Caledonia	24
Challenge Con	‡ 03
Confidence	25
Con. Virginia	2 70
Gould & Curry	12
Hale & Norcross	26
Jacket-Cr. Pt	25
Mexican	62
Occidental	40
Ophir	2 00
Overman	10
Savage	19
Sierra Nevada	19
Union Con	40
Utah Con	‡ 04
Belmont	3 50
Jim Butler	44
MacNamara	‡ 15
Midway	51
Mont.-Tonopah	25
North Star	10
Rescue Eula	24
West End Con	2 62½
Atlanta	04
Booth	13
Comb. Frac	07
Florence	45
Jumbo Extension	14
Kewanas	04
Nevada Hills	07
Nevada Packard	19
Round Mountain	30
Silver Pick	09
White Caps	23

COLO. SPRINGS*	May 13
Cresson Con	4 50
Doctor Jack Pot	03
Elkton Con	05
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	‡ 79
Granite	14
Isabella	05½
Mary McKinney	‡ 07½
Portland	95
United Gold M.	16½
Vindicator	30

BOSTON EXCH.†	May 13
Adventure	‡ 50
Ahmeek	73
Algomah	.75
Allouez	37½
Ariz. Com.	12½
Arnold	‡ 20
Bingham Mines	10
Bonanza	‡ 10
Butte-Balaklava	65
Calumet & Ariz.	62
Calumet & Hecla	380
Centennial	12½
Copper Range	44¾
Daly West	3½
Davis-Daly	6½
East Butte	10½
Franklin	2
Granby	‡66½
Hancock	5
Hedley	‡12
Helvetia	3½
Indiana	.50
Isle Royale	26½
Keweenaw	‡1½
Lake	4½
La Salle	‡2½
Mason Valley	2¾
Mass	5¾
Mayflower	6½
Michigan	5½
Mohawk	58½
New Arcadian	2¾
New Cornelia	18¾
New Idria	8¾
Nipissing	13¾
North Butte	11½
North Lake	60
Ojibway	‡ 1
Old Dominion	34
Osceola	48½
Quincy	60
St. Mary's M. L.	49
Santa Fe	‡ 25
Seneca	20
Shannon	2½
Shattuck-Ariz.	‡11
So. Lake	1½
So. Utah	.18
Superior	5
Superior & Bost.	2½
Trinity	1
Tuolumne	‡ 81
U. S. Smelting	68½
U. S. Smelting, pf.	49½
Utah Apex	2
Utah Con	9½
Utah Metal	2
Victoria	2½
Winona	1⅛
Wolverine	18½

N. Y. CURB†	May 13
Am. Tin & Tung.	¾
Big Ledge	¾
Butte & N. Y.	.50
Butte Detroit	‡ 04
Caledonia	39
Calumet & Jerome	1¾
Can. Cop. Corpn.	2⅛
Carlisle	¾
Cashboy	11
Con. Ariz. Sm.	1½
Con. Coppermines	5¾
Goldfield Con	‡ 18
Goldfield Merger	‡ 05
Hecla Min	5⅛
Howe Sound	‡3½
Jerome Verde	‡1½
Louisiana	¾
Magma	31
Marsh	10
McKinley-Dar-Sa.	.62
Milford	‡ 75
Mother Lode	41
Nixon Nevada	73
Ohio Cop	‡ 50
Rawley	‡2½
Ray Hercules	2½
Richmond	‡ 50
Rochester Mines	22
St. Joseph Lead	‡13
Standard S. L.	1⅛
Stewart	24
Success	‡ 03
Tonopah	4
Tonopah Divide	10½
Tonopah Ex.	3½
Tribullion	‡ 25
Troy Arizona	‡ 0
United Eastern	4½
United Verde Ext.	‡36½
United Zinc	‡1
Utica Mines	‡ 05

TORONTO*	May 13
Adanac	24
Bailey	03
Beaver Con	45
Chambers Ferland	‡ 10
Coniagas	2 00
Hargraves	05
Kerr Lake	5 75
La Rose	37½
Lake Shore	93
Min. Corp. of Can	2 00
Peterson Lake	09
Teck-Hughes	18
Temiskaming	40
Wettlaufer-Lor	03
Davidson	1 88
Dome Exten	32
Dome Lake	73
Hollinger	7 27½
McIntyre	1 75
Newray	12½
Porcu. Crown	30
Vipond	70
West Dome	13

*Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

May 24, 1919

Volume 107 *Number* 21

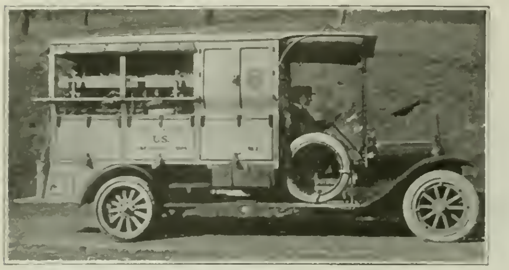
THE PITTSBURGH EXPERIMENT STATION OF THE BUREAU OF MINES, WITH POWER PLANT IN THE FOREGROUND

The Pittsburgh Bureau of Mines Experiment Station

A brief history of the work which was initiated in 1904 in connection with the testing and analysis of fuels, and which was expanded to cope with the needs that developed, and ultimately led to the erection and equipment of the Bureau of Mines experiment station at Pittsburgh, Penn. Details of the scope of the work and the result of several years' intensive research are given.

THE work of the experiment station of the Bureau of Mines originated in an exhibit dealing with the testing and analysis of fuels at the Louisiana Purchase Exposition in 1904. The work proved so successful, and its utility was recognized to such an extent, that Joseph A. Holmes was placed in charge in 1905. Extensive testing was undertaken in connection with the physical properties of coal; and, later, the work was extended to include structural steel. The growth of these operations and the ramifications of the work led to the establishment of a branch of the U. S. Geological Survey, for the special purpose of testing fuels and materials, with Mr. Holmes in charge. The equipment and investigations were then moved to Jamestown, Virginia.

The work at Pittsburgh was begun before the Federal Bureau of Mines was established, and, by an arrangement with the War Department, a part of the arsenal grounds, on Butler St., was loaned for the purpose. Operations at the beginning centered around experimental investigations and the collection of data in an endeavor to prevent accidents in coal mines. Exhaustive tests were made on the properties of coal dust; and full-scale operations were carried out at an experimental mine at Brucetown, 13 miles south of Pittsburgh. The results were of considerable value in the prevention of mine accidents, the insurance of safety, and the provision of adequate "first aid." The many disasters in coal mines in 1907 directed attention to the need for immediate action. The work that had already been done was seen to be entirely justified, and it was then realized that there was an imperative need that the investigations should be continued on an extended scale.


U. S. BUREAU OF MINES RESCUE TRUCK, NO. 2

The need for the further expansion and the fact that the experiment station at Pittsburgh was in temporary and inadequate quarters belonging to War Department necessitated a change. A site in the Schenley Park district, in the residential section of Pittsburgh and near the Carnegie Institute of Technology, the Carnegie Museum, the Mellon Institute, and the University of Pittsburgh, was chosen, and the new buildings were completed in September, 1917. The site proved to be eminently satisfactory from every point of view. The juxtaposition of the new laboratories with the various state organizations facilitated that coöperation that has been so marked a feature of the work of the Bureau of Mines, and which has resulted in the notable achievements which have developed as a result of the coördination of experience and research.

The Pittsburgh experiment station, which, incidentally, serves as a memorial to the personality and work of the late Joseph A. Holmes, is now the headquarters of the investigation work of the Bureau of Mines. Other stations have been established in other states, according to the demands for specialized local investigations or assistance. These operations are, however, all directed from the Pittsburgh station, and are under the general superintendence of Dorsey A. Lyon. With the establishment of the new Eastern station, an extensive and ambitious program was projected. The work was planned to include an analytical study of coal mining in all its branches, the development of a system which would provide adequate provision in the event of mine accidents, intensive research into all phases of "first-aid" and mine rescue work, the testing of explosives, the investigation of more efficient utilization of the country's supply of coal, and the metallurgy of iron and steel.

INSTRUMENT SHOP AT THE BUREAU OF MINES PITTSBURGH EXPERIMENT STATION

The buildings of the new station comprise complete and extensive laboratories. The main building is three stories high and has a frontage of 332 ft. Two wings at each end extend back for a distance of 211 ft. and the entrance is surmounted by a monolith in concrete. An auditorium seats 228 persons, and is equipped with every facility for demonstration.

Ample space has been provided to allow for future expansion. The building contains the entire administration office, a library and reading room, computing and draughting rooms, extensive provision in the way of photographic, dark room and motion-picture equipment, machine shops, instrument rooms, test rooms for mine rescue work, engineering and mechanical laboratories, and a complete division for chemical and physical research. An excellent cafeteria for the staff and other employees is provided on the top floor. The power house is in a separate building, situated at a lower level than the main building; and tunnels have been driven to house the mains for the supply of power, steam, and compressed air to the various departments of the experimental station.

A BOMB-PROOF WHERE THE RATE OF DETONATION OF EXPLOSIVES USED FOR MILITARY OR MINING PURPOSES IS DETERMINED

A feature of the work in the mining section to which adequate attention has not, perhaps, been directed heretofore is comprised in the investigations into the question of mineral waste in coal-mining operations. From the year 1820 to as late as 1870 the wasteful methods practiced at coal mines in the United States were such that only one-quarter of the coal in place found its way to the market. Mining methods were so unsatisfactory and uneconomical that, in some cases, more than half the coal was left in the ground. In addition, there were extensive and avoidable wastages on the surface. The need for stricter economy in operation, both on the surface and underground, was an incentive for the initiation of a scheme which had for its purpose the teaching of economical and efficient methods in coal mining.

The investigations into the question of coal mining generally and the experimental mine tests are under the control of J. W. Paul, chief coal mining engineer. Mine safety and mine rescue work is in charge of a mine safety engineer, D. J. Parker. This department has rendered signal service at mine disasters. Miners are trained in safety methods, and complete provision has been effected with regard to atmosphere, obstacles, and other unusual conditions that may be encountered underground, and the training is thoroughly practical and of far-reaching utility.

A PART OF THE MECHANICAL LABORATORY DEVOTED TO THE DETERMINATION OF THE PHYSICAL PROPERTIES OF METALS

In addition to the work outlined that is done at the station, arrangements are made to hold periodical meets in the field for "first-aid" work, and these have proved of immense value. Auto trucks are held in readiness for instant dispatch to the scene of an accident, and constitute an excellent insurance against loss of life underground from preventable causes. The safety truck is equipped with resuscitating apparatus, safety lamps, oxygen cylinders, stretchers, and "first-aid" supplies, and is manned by men who have been specially trained and are thoroughly experienced in the work.

At the experimental mine at Brucetown a large amount of valuable research has been carried on, and the investigations have led to the adoption of several improvements in mine safety work. It was here that the tests were held which resulted in the adoption of stenches to warn miners underground of impending danger. By the use of such compounds as butylmercaptan or isomercaptan, which were, by an ingenious arrangement, supplied to the compressed air mains, immediate warning was given. Whether working at pump or drill, the miner receives an early alarm, and has an opportunity to reach a place of safety.

The work at the experimental mine has included large-scale tests on the characteristics of coal dust, and the effect of moisture variation. Experiments have been made with rock-dust barriers which are automatically formed when shelves containing the material are tipped by the force of an explosion in the mine. It has been demonstrated that the wall of material formed is an effective barrier against the spread of the danger. Troughs have also been developed which discharge a thin sheet of water, and other miscellaneous investigations have been carried out.

The general testing work at the plant in the mining section has included an investigation which has already proved the worthlessness of a number of the so-called fuel-saving powders that are on the market, and a bulletin is to be issued soon. It was at the Pittsburgh station that the Gibbs mine rescue apparatus was developed and perfected. Extensive facilities also exist for the testing of mine equipment, particularly with reference to its possible harmfulness in connection with mine explosions. A quantity of electrical apparatus is being regularly tested, and when found satisfactory is passed for use in mines.

FRONT VIEW OF THE U. S. BUREAU OF MINES EXPERIMENT STATION AT PITTSBURGH

The explosives section is in charge of S. P. Howell, and the equipment includes a ballistic pendulum, a Mattegang recorder, as well as large and small impact machines. The facilities provided for research and experimentation include four instrument shelters and three bomb-proofs. The work recently carried out includes much that was of distinct value to the Government during the war period. In addition to the general testing of explosives and detonators, there are excellent facilities for the study of the physical characteristics of explosives and the composition and quantity of gases evolved.

The work performed at the chemical research laboratories, in charge of A. C. Fieldner, supervising chemist, includes investigations and analyses relating to petroleum, natural gas, mine gases, industrial gases, explosives, coal, coke, and peat. The petroleum section, in charge of E. W. Dean, is engaged on investigations relating to the more efficient utilization of the petroleum resources of the country, including the testing and inspection of fuel oil for the Government, and more especially the study of various methods of cracking petroleum and increasing the yield of gasoline.

The analytical section, in charge of W. A. Selvig, makes the necessary chemical analyses and other determinations in connection with fuel-testing investigations, the examination of mine gases, mine-explosion investigations at the experimental mine, and other experimental work. The general research section, in direct charge of the supervising chemist, is subdivided into research units, covering the general field of fuels, gas masks, and respirators, mine and industrial gases, natural gas, microscopy, explosives and physico-chemical measurements. One of the new lines of work in this department is in adapting the Army gas mask to industrial needs and approving it for specific uses.

The metallurgical section, in charge of F. B. Foley, has done an extensive amount of metallographic work, particularly in connection with the structure and properties of nickel, tungsten, and molybdenum steel. The fuel department is in charge of H. Kreisinger; and R. A. Wood controls the equipment and staff in the technical division, where complete photograph records are made and classified dealing with every detail of the work in the various departments.

Labor at Broken Hill

MELBOURNE CORRESPONDENCE

The agreement between the companies and the miners on the Barrier expires in June, and the Amalgamated Miners' Association, the A. M. A., has formulated a number of claims which are given in detail hereafter. In view of the fact that the companies are now dependent on the sale of their products at the world's market price, the agreement with the British government for the purchase of the whole output having expired, it is evident that the association gave little consideration to the present economic conditions.

The general policy of Australian unions in making demands for increased wages and improved labor conditions nowadays is to ask for considerably more than they expect to receive, believing the concessions granted are in proportion to the demands. From that point of view, therefore, the demands must not be taken too seriously, but it is worthy of notice that the unions have expressed opposition to compulsory arbitration in favor of "direct action."

The following are the demands set forth by the association:

> Five days of six hours each shall constitute a week's work, with half an hour for crib (lunch period). Overtime shall be classed as time of duty on all Sundays and holidays, and between the hours of 8 and 12 a.m., and after the cessation of the ordinary day or shift. On Saturdays employees shall be paid double time. That the night shift be abolished.
>
> That the wages of all men working along the line of lode be increased to £1 per day. That boys receive the same rate of wages as men. Full pay on the officially recognized holidays, New Year's Day, Good Friday, Easter Monday, Eight Hours' Day, Christmas Day and Boxing Day, all federal, state and municipal general elections day, and on May Day.
>
> That the contract system be abolished on the surface. That five days of six hours per shift from bank to bank shall constitute a week's work for all employees.
>
> Work shall be prohibited in all working places in the mines of Broken Hill where the temperature is 76 deg. F. or over (wet bulb), and if in the opinion of the company the work is absolutely necessary to be carried on, the following hours shall apply in all places where the temperature is 76 deg. F., or over: Four-hour shifts.
>
> That five days shall constitute a week's work for all underground employees, irrespective of the hours to be worked; no work to be done on Saturdays, except as overtime beyond the ordinary working hours, be paid for at the rate of double time.
>
> In the case of an employee meeting with an accident or being required to attend to another who has met with an accident, he shall be deemed to have been on duty during the whole of the shift; and in the case of contractors the company is requested to pay the men wages.
>
> That the contract system for all classes of work along the line of lode be abolished, and the wages system introduced.
>
> That for every machine used for boring purposes two men shall be in attendance, and that three men shall be prohibited from using two machines.
>
> Ambulance men shall be certificated men who have passed the "first-aid" course. One man shall always be in attendance at the ambulance room, and shall be required to do ambulance work only. "First-aid" appliances shall be placed by the companies in all levels where the men are working, at a depot to be agreed upon.
>
> All underground employees shall be paid the same rate of wages, irrespective of their occupation, and a minimum rate shall be the miner's wages, viz., £1 per shift. That all employees shall be paid in the employer's time.
>
> That this rate of wages shall obtain only along the line of lode and within a radius of two miles from the post office; 25% above the line of lode rates to be demanded for all employees working outside the said radius.
>
> That an analysis of the air underground shall be taken in the various mines periodically.
>
> That compensation for occupational complaints be included in the claim on the basis of full wages, the complaints to be specified by the committee collecting evidence for the Board of Trade inquiry.

The probabilities are that the companies will negotiate only through the arbitration court, and that they will demand amendments to the present agreement.

Garnet in North Carolina and the Market For Abrasive Garnet*

By FRANK J. KATZ†

Although abrasives were relatively inconspicuous war materials, they were nevertheless highly important to the war program and were regarded as "essentials" and as "war minerals." There developed during the war large interest in, and at times in some quarters much concern over, supplies, particularly of emery, corundum, artificial abrasives, and garnet. During the summer and autumn of 1918, the aid of Government agencies was solicited for increasing the garnet supply. In that connection Mr. Katz participated in an examination of garnet deposits in North Carolina and made a special canvass of producers and consumers of abrasive garnet for the purpose of determining the output-producing capacity and consumption of garnet. Results are described in the following article.

GARNET is a group name for certain orthosilicate minerals, alike in crystal structure and homologous in chemical composition, which exhibit a more or less continuous limited range of physical properties correlated with differences in chemical constituents. Their chemical composition is typified by formula $3R''O.R_2'''O_3.3SiO_2$, in which $R'' = Ca, Mg, Fe''$ Mn; $R''' = Fe'''$, Al, Cr. The common types are grossularite, the lime-alumina garnet; pyrope, the magnesia-alumina garnet; almandite, the iron (ferrous) = alumina garnet; and andradite, the lime-iron (ferric). Many others have been named, but garnets rarely conform to the simple types, and the names cover intermediate varieties which may be regarded as mixtures of type varieties and which differ from one another slightly in chemical composition, color, and other properties. One of these special varieties, which has been named and is important to the present discussion, is rhodolite, a garnet of rose-pink color and intermediate between pyrope and almandite.

All ordinary garnets have in common the following properties, which affect their industrial usefulness: They are harder than quartz and approximately as hard as topaz (about 8 in the common scale of mineral hardness, in which quartz is 7, corundum, ruby, or sapphire is 9, and diamond 10); they are without natural cleavage—that is, they have not the inherent capacity exhibited by many minerals to break readily on parallel planes—but are strong and break with conchoidal or splintery fracture into pieces which have very sharp edges and points; and all are easily fusible. Garnets occur in many colors, but the ordinary varieties range from light browns and reds through darker shades to black. Those of exceptionally rich color and transparency are prized as gems.

Aside from a limited use as gems and as "jewel" bearings in cheaper watches, garnets are used only as abrasive material. In such use garnet is applicable chiefly to work on wood and leather, and to much less extent to that on brass and other metals, and on glass. Most of the abrasive garnet is used in the form of evenly sized grains glued to paper, so-called garnet sandpaper. Some is also used on cloth, and in loose powders and flours. Garnet may also be made up into wheels, blocks, files, or variously shaped grinding and polishing tools such as are made of emery, although this use is uncommon, with, however, the serious limitation that it cannot be made up with so-called vitrified or ceramic bonds, because garnet is fusible at low temperatures.

GARNET DEPOSITS IN NORTH CAROLINA

In North Carolina, as elsewhere in regions of crystalline rocks, garnet-bearing rocks are extensively developed and widely distributed. Garnet is, in fact, a common mineral, and occurs in many varieties of rocks and in sands and gravels. However, not all kinds of garnet are suitable for use, nor will all garnet-bearing rocks serve as sources of garnet. The garnet must be sufficiently abundant and in crystals large enough to make its extraction from rock profitable. Successful exploitation of garnet deposits depends, also, on those features of situation which affect ease and cost of quarrying and milling and accessibility to market. In Clay, Jackson and Madison counties, North Carolina, certain occurrences of garnet have long been regarded as favorable for the development of abrasive-garnet production and have at times yielded a small output.

CLAY COUNTY

The garnet deposits in Clay County which have attracted interest are on Shooting Creek, near the post office of the same name, and at the head of Buck Creek, on Penland Bald Mountain. These deposits are 20 to 30 miles by wagon road from the nearest shipping points, Murphy or Marble stations on the Southern Railway.

The garnet deposits on and near Penland Bald are on the crest of a sharp ridge that stands 4700 to 4900 ft. above sea level and on the steep slopes immediately below this ridge facing westward, toward the valley of Buck Creek. The country rock there, which in itself constitutes the garnet formation, is a medium to coarse-grained layered hornblende gneiss, a part of that described by Arthur Keith in the Nantahala Folio of the "Geologic Atlas of the United States," under the name of "Roan gneiss." At Penland Bald this formation is made up of several layers ranging in composition from almost pure hornblende rock to a hornblende feldspar rock approximately dioritic in composition. Some of the layers contain garnet, which is an ordinary bright red almandite. The garnet-bearing rock is exposed on the summit of Penland Bald and farther north for about 300 ft. along the crest. North of this stretch of 300 ft. there is an interval of approximately equal length of hornblende rock which is not garnet bearing; and north of that again, along the ridge, through about 2000 ft., there is a succession of garnet-bearing and garnet-free hornblende gneisses, but most of the rocks in this stretch are garnet bearing.

---

*Published by permission of the Director, U. S. Geological Survey.

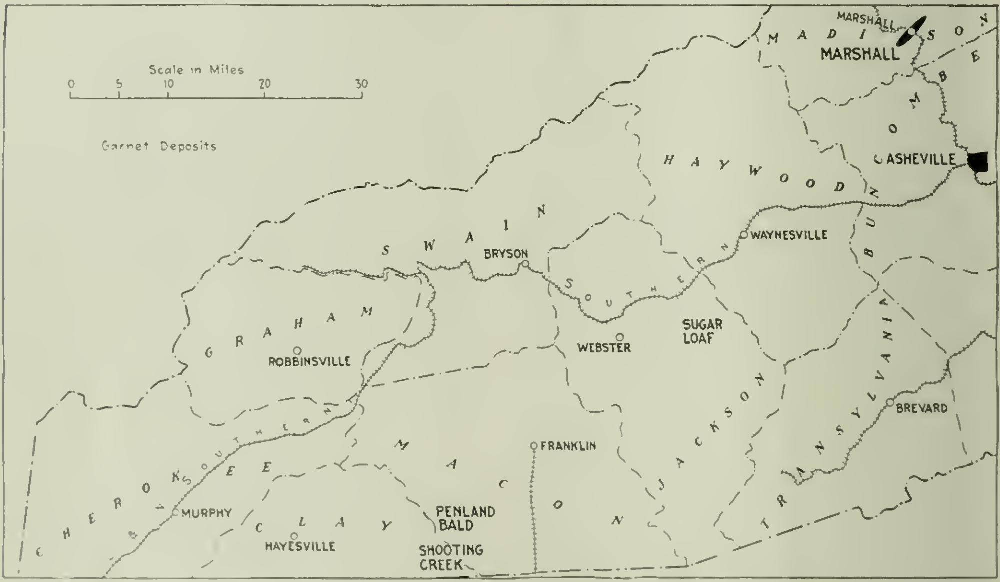
†Geologist, U. S. Geological Survey, and specialist on abrasive materials.

Along the crest of the ridge the gneisses have a general northeast strike, varying from north-northeast to east-northeast. The several departures from this general trend are due to minor undulations in the layering of the gneiss and to at least one short dislocation along a fracture plane. The rocks dip westward toward Buck Creek at various angles, but in general at about 45°. On the west side of Penland Bald ridge through a vertical distance of 600 ft., on steep slopes, in places 30° or more, the rocks exposed in several cliffs and bare ledges are garnet bearing. Below these slopes, through a further vertical height of 200 ft. in and on the sides of ravines, are many other small exposures. Below these, through a further descent of 100 ft., a heavy cover of coarse, angular talus composed of garnet-bearing rock mantles the slope. Beyond and below a point about 3900 ft. in elevation and seven-eighths of a mile east of main Buck Creek, garnet-bearing ledges and talus are not seen. The zone occupied by the garnetiferous gneiss crosses Penland Bald diagonally from northeast to southwest and extends undetermined distances in both these directions. In the area examined there is a length of exposure of garnetiferous gneiss of about 1700 ft. along the strike, about 1200 ft. horizontally and 800 ft. vertically, in a direction inclined to the strike and down the slope.

The garnet in the rocks on Penland Bald is in rudely dodecahedral, approximately spherical crystals, the largest 2½ in. in diameter. Some of the crystals are very small, and those most commonly seen in the outcrops are between ¼ in. and 1¼ in. in diameter. They are irregularly and unevenly distributed through the rock, being sparse in some places and rather numerous in others, and are visibly segregated in certain layers or zones in the hornblende gneiss, but these layers, within the parts which may be generally designated garnet bearing, are not widely spaced, so that the entire bulk of rock underlying the area outlined may be considered workable. The apparent garnet content ranges from 2 or 3 to 5% and, locally, upward to 12 or possibly 15% by volume, and here and there over small patches it may aggregate 25%. I took four samples by crushing and mechanical separation. These samples do not represent the average garnet content of the Penland Bald exposures, but are merely typical of specific occurrences, and they were taken to determine the reasonable expectation of garnet recovery from certain better parts of the rocks examined. This was found to be probably 10% (by weight) on the average. By selection of the more richly garnetiferous rock, a much higher yield of garnet might be obtained.

In the evidently large area of garnet-bearing rock within which quarries might be developed, a tract including Penland Bald summit and the slopes immediately below it was estimated to contain 5,000,000 long tons of garnet-bearing rock, or 500,000 long tons of garnet, at least half of which, or 250,000 long tons, is recoverable. This is more garnet than will be needed, at the present rate of consumption, to supply the United States for 30 years. In the above calculation no account is taken of other blocks of ground possibly not so large as the one considered but otherwise equally favorable, and in addition there are large volumes of "float" rock in the talus on the lower slopes immediately below the tract estimated, and this "float" is also favorably situated and in good condition for quarrying and milling.

Only cursory examination was made of the red garnet deposits on Shooting Creek near the mouth of Thumping Creek, about a mile from Shooting Creek post office. These deposits lie in a zone of hornblende gneiss which extends from north of Thumping Creek south-southwestward across the forks of Eagle Fork, and, as mapped in the Nantahala Folio, are part of the band of Roan gneiss of Penland Bald already described. The



SOUTHWEST NORTH CAROLINA, SHOWING LOCATION OF GARNET DEPOSITS rocks and the garnet content are like those on Penland Bald. They visibly occupy a large area, and their quantity is unquestionably adequate to invite quarrying. There are several convenient quarry and mill sites on these deposits.

In the vicinity of Shooting Creek there are also deposits of so-called black garnet, which are said to be large and to yield readily an abrasive garnet of excellent grade. These deposits were not examined and the garnets themselves have been only casually examined. They appear to be almandites, normally red garnet, but are so filled with small inclusions of black or dark minerals that the garnets appear black except in very thin splinters. The inclusions are minute and are completely incorporated in the body of the garnet crystals, and they apparently in no way interfere with the abrasive quality of the garnets; indeed it has been stated, although not confirmed, that these black garnets approach emery in abrasive efficiency.

JACKSON COUNTY

The Sugar Loaf Mountain garnet deposit is 2½ miles south of Willetts Station, in Jackson County. It is connected with Willetts by a rough mountain road. The geologic conditions affecting the Sugar Loaf garnet project are simple. The country is occupied by various gneisses and schists of the Carolina gneiss formation, which strike northeast to east-northeast and stand nearly vertical. Of these, a zone or group of layers from 200 to 600 ft. thick, possibly thicker—precise measurement being impossible because of lack of suitable exposure—is composed of mica schists and mica-quartz-feldspar schists containing pink garnet of the rhodolite variety. Within this zone there is considerable variation of rock from band to band. The bands, however, are all thin, ranging from a fraction of an inch to a few feet in thickness, and the greater part of them are garnetiferous. Some of the bands contain only rhodolite and mica, the rhodolite being predominant in quantity, and some are composed of rhodolite, quartz, and mica, the rhodolite again predominating.

In all of the three larger openings made on this mountain the garnet content of the rocks, taking as a whole all rock layers exposed, will not run lower than 25%. The largest garnets in these bands are ½ to ¾ in. in diameter. Most of them are between ⅛ and ¼ in. in diameter, and in some bands they are so thickly studded that they constitute more than 60% of the rock and are separated only by small amounts of mica or mica, quartz, and feldspar. These rocks extend from the stream just south of the Great Ruby Mines Garnet Mill, at the base of Sugar Loaf Mountain, continuously to the summit of Sugar Loaf, a vertical distance of 1000 ft. The rocks are less well exposed on the opposite side of the mountain, but are doubtless continuous from the summit to the creek at the southwest base of Sugar Loaf Mountain. In a triangular block of garnet-bearing rock 1000 ft. in height, 3000 ft. on the base (that is the distance across the mountain or along the strike through which the rocks were traced) and 200 ft. thick, there is 300,000,000 cu.ft. of garnet-bearing rock, all of which contains at least 25% of garnet of the rhodolite variety. Assuming 12 cu.ft. to the long ton, there are 6,000,000 long tons of garnet. Further, according to geologists Arthur Keith and Douglas Sterrett,[1] who have mapped the region, this garnet belt is virtually continuous through Double Top Mountain, a peak standing 1000 ft. higher than Sugar Loaf, and extends 1¼ miles eastward along the strike. Therefore the supply of garnet at this locality is for all practical purposes inexhaustible.

MADISON COUNTY

Garnet is found in large amounts west and northwest of Marshall, in Madison County. This region has produced some garnet, and it may again be productive. The deposits there were under investigation in 1918. The garnet-bearing rock is a fine to moderate grained gray mica schist, which is mapped in the Asheville Folio[2] as a part of the Carolina gneiss. This rock contains numerous garnet crystals, which in places make up one-fourth to one-half of the rock. Most of the crystals are ¼ to 1 in. in diameter; the largest measure 2 in. They are for the most part well-shaped dodecahedrons and where not altered by weathering are bright red. The richly garnetiferous layers, like the inclosing schists, dip southeastward and strike east to north. One of these layers or so-called veins is 8 to 10 ft. thick and has been developed as garnet bearing for a quarter of a mile. These garnets are of the almandite variety and make an excellent abrasive. The rock is rich enough in garnet for economical treatment, and the situation close to the railroad along French Broad River is favorable for profitable exploitation.

MARKET OUTLOOK

The market outlook for abrasive garnet may be forecast by balancing against present and probable supply of garnet the present and immediate future consumption or demand for garnet. The garnet supply of the United States has been derived from domestic production, and during recent years also from imports from Spain. The domestic production has been made chiefly by concerns operating quarries in the Adirondack region, New York, but there have been considerable contributions also from Merrimack County, N. H., and from Clay and Jackson counties, N. C. The latter, however, have been varying in amount and intermittent, ranging from 10 to 20% of the total. The table shows the sales made annually by the producing companies for the years 1911 to 1918, inclusive.

TABLE I. SALES OF GARNET BY PRODUCING COMPANIES

Year	Quantity, Short Tons	Value	Year	Quantity, Short Tons	Value
1911	4,076	$121,748	1915	4,301	$139,584
1912	4,947	163,237	1916	6,171	208,850
1913	5,308	183,422	1917	4,995	198,327
1914	4,231	145,510	1918	4,600	242,400

The total annual output has ranged from 4231 to 6171 short tons. The entire garnet-producing capacity of all the concerns has not been drawn on during any recent years, and, as far as I am able to determine, has been approximately 6500 short tons a year.

Part of the garnet supplied to the domestic industry has come, as stated, from Spain. This imported material has been in the form of small rolled grains of garnet recovered by washing stream gravels in the Province of Almeria. Complete and accurate records of the imports of garnet are lacking. Official Spanish reports of mineral production, together with fragmentary records of imports into the United States, indicate that in 1916 approximately 1800 tons, and in 1917, possibly 2000 tons, were imported. It is probable that the imports have never exceeded 2500 tons a year, and the total new supply in the United States in any one year, from both domestic production and imports, has not been over 8500 tons. The year of largest supply was 1916.

---

[1] Oral communications to the writer.

[2] Keith, Arthur, "U. S. Geol. Survey Geol. Atlas," Asheville Folio, No. 116.

The actual consumption of garnet in the United States in making garnet paper and cloth in 1918, as determined by a thorough canvas of the manufacturers, was 6000 short tons, and it will be about the same in 1919. Data on the quantity of garnet used loose or made up into abrasive tools or materials, other than paper and cloth, are not accurate, but the best information available leads to the belief that the amount so used is less than 500 tons.

The present domestic consumption of abrasive garnet is about 6500 short tons a year, but this is hardly a fair measure of the capacity of the market to absorb the garnet, as an indeterminate amount will be taken by manufacturers and consumers who wish to acquire reserve stocks. At present there is apparently little stock in reserve, both because of the cutting off of Spanish imports owing to shortage of ships and difficulties in shipping during the war, and because war conditions have enforced operation at reduced capacity by domestic producers for the last two years.

One other consideration which would suggest a growing or increased market for garnet is the probable discovery or invention of new uses for abrasive garnet. It has been suggested that garnet may be used as a substitute for emery in working plate glass. Reports of glass grinders on experiments already made differ as to the desirability of using garnet for this purpose, but at least one manufacturer believes that plate glass can be successfully beveled with good garnet. If such practice is established, there may be an additional demand for as much as 1000 tons of garnet yearly. It has also been suggested that crushed garnet grains, instead of crushed quartz or silica sand, may be used for sand blasting in cleaning castings and like work. Tests are reported to have proved that garnet is far superior to the materials ordinarily used for this purpose. If such use of garnet is generally adopted, the amount required will be large; it may possibly far exceed the total garnet used for all other purposes. The third new or increased use may be found by perfecting the methods of bonding garnet grains in wheels, blocks, files, and other shapes.

There does not appear to be much market for garnet outside of the United States. Attempts to market garnet grains in Europe have been unsuccessful, but there has been a little sale there for garnet paper and cloth as a substitute for sandpaper, and upon the return of industry to normal conditions more American garnet will probably be marketed abroad. The use of garnet as an abrasive appears to be largely restricted to America, but it may be developed in foreign countries by proper introduction and advertising.

CONCLUSION

As a result of lack of imports and of reduced domestic output during the last year, the supply of abrasive garnet is short to the extent that reserve stocks are small or are exhausted. The demand is strong and prices are high. During the later part of 1918 the price per net ton of cleaned crushed garnet was nearly twice the pre-war normal price of $30 to $35. The developed productive capacity of the country is, however, approximately equal to the normal demand, so that the demand and prices will probably fall off with return to normal conditions.

Without the development of new uses of garnet the outlook is good for garnet-producing concerns that are fairly well established both as to plant and as to acquaintance and experience in the market. There would appear to be no attractive opportunity for the establishment of new producers or for the exploitation of deposits now undeveloped. If, however, new uses are found, or if appreciably larger quantities of garnet will be needed for present purposes, there will be some need for an increase of garnet production in the United States, possibly by the opening of deposits now unproductive.

Mining in Costa Rica

The only minerals mined in Costa Rica are gold and manganese, states a consular report. The Costa Rica Manganese and Mining Co. is the only concern that has so far exported manganese in quantity. Manganese mines have been opened by Dr. Guistiniani at San Pablo, by José Ma. Castro at Tambor, and by Rafael Yglesias at Puerto Viejo. But these have so far been insignificant producers. The Nicoya Mining Co., of Playa Real, has exported manganese in small quantities. The gold output shows a tendency to decrease, owing to the increased cost of working. Practically all capital invested in Costa Rica mines is American. It is not unlikely that the fall in the price of manganese will make its mining in Costa Rica unprofitable, owing to the high export duties and to the restrictions that have been placed upon the mines.

Arizona Mineral Locations

By A. L. H. STREET *

According to law, a mineral location that is to be valid for any purpose must be made upon unappropriated Government land, open to location, in which mineral has actually been discovered in place. Until such discovery, all acts tending to consummate a valid mineral location give the locator no right other than to continue reasonable search for mineral.

The period allowed by the Arizona statutes within which the location is required to be completed is limited to 90 days after the discovery of mineral on the ground, in any event, and the addition of such further time as may pass before conflicting rights intervene. The unquestionable right of the locator to the possession of the area within the boundaries of the claim marked on the ground by the requisite monuments, as described in the location notice posted at the location monument, carries the privilege of possession of every appurtenant belonging to the realty, including timber, soil, country rock, percolating waters, and natural springs, with the exception of certain mineral springs.

These principles of mining law were laid down recently by the Arizona Supreme Court in the case of McKenzie vs. Moore (*176 Pacific Reporter 568*), a suit involving rights as between conflicting locations.

A Potash Concession has been given to Raphael A. del Valle by the Mexican government for the extraction of potash from seaweed on the coast of Lower California. Senor del Valle is desirous of interesting American capital in a plan to build a plant for the extraction of potash; and states that the undertaking can be made profitable. The Foreign Trade Bureau has been requested to give publicity to this statement. Interested parties should communicate with C. L. Lugue, Mexican Commercial Agent, Wright Arcade Bldg., St. Louis, Missouri.

---

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota

Control of Ore-Dressing Operations

BY GEORGE J. YOUNG

The success of ore-dressing and milling operations is determined not only by good mill design and construction, but more, perhaps, by the proper control of operations. The writer of the accompanying article discusses points to which the mill superintendent should direct attention and which contribute to the success of the plant.

A MILLING plant receives daily a more or less continuous stream of material, which is divided by the appliances into two parts, one of which is essentially waste or tailings and the other a marketable product. Both parts contain valuable minerals, but the tailings contain the lesser proportion of the original weight of valuable mineral in the stream of ore. Control signifies the technical supervision of the separation in such a way that all of the valuable material that it is possible to save appears in the marketable product. In addition, the term includes the technical supervision of the costs of operation, to the end that milling operations be effected at minimum expense.

A third feature and an important one is that the marketable product be of such a nature that it can be readily sold, and that the cost of marketing be reduced to a minimum. A steady supply of ore of uniform grade is the first essential imposed by the requirements of effective operation. This can be accomplished by the judicious selection, both as to quantity and kind, of ore drawn from different parts of the mine. It is good mining practice to have a number of stopes open, and, by careful sampling and estimation of quantities, to mine from each stope at such a rate as to produce the necessary uniformity in the ore stream. It is also good practice to maintain a surplus of broken ore as a reserve. Large mill bins are desirable, as they serve to tide over temporary interruptions in the ore supply. By careful distribution in the ore bin, the different grades of ore can be mixed sufficiently to comply with the requirement of uniformity in grade.

The weight of ore delivered to the mill and the taking of a representative sample for assay and analysis are essential for the accurate determination of the metal input. The mill superintendent must also make a thorough study of the physical and mineralogical characteristics of the ore of average grade and the variations that might be expected to occur in the continuous operation of mine and milling plant.

The outflow from the plant must be quantitively estimated. This requires that the stream of waste be carefully sampled and the mineral contained therein determined. The shipping product is also weighed and sampled. The input, less the weight of the shipping product, will give the weight of the tailing. Input values and waste values, together with the value of the shipping product, are quantities which make possible an accurate check on the work of the mill as a whole. The money outgo in a unit of time, a month for instance, is the check in expense for the plant as a whole.

What has just been described constitutes the overall control of the work, and, were this all, there would be little to the problem. The work of different plants will differ in detail, but the procedure of control of the detail work is similar in principle in all plants. If it is assumed that the major operations are crushing, sizing and classification, coarse concentration and fine concentration, the control work can be specifically described.

The layout of the crushing division is assumed to be such that there is no unnecessary handling of material and no unnecessary crushing. If crushing is in stages, the crushing machines of each stage should be considered as one unit, and the control work laid out for each separate unit. The input to each machine should be determined either from weights, or by the deflection of the stream for a given time interval. Samples of the input and output streams should be taken, and a screen analysis made on each sample.

Oversize returns should be given special attention. The result of these determinations indicates whether each crushing machine is in proper adjustment and is doing the work that it is supposed to do. The frequency of such an examination is determined largely by the conditions of each case. In my opinion, once a month would be sufficient. At the time of the examination each motor should be carefully metered, and, if more than the normal amount of power is being consumed, a careful examination of the shafting and machines should be made, and necessary readjustments and repairs promptly carried out. Inspection of bearings and machines should be made at frequent intervals, as, by so doing, the repair work can be greatly diminished and costly breakages avoided. Oilers should be required to inspect each bearing at least twice a shift.

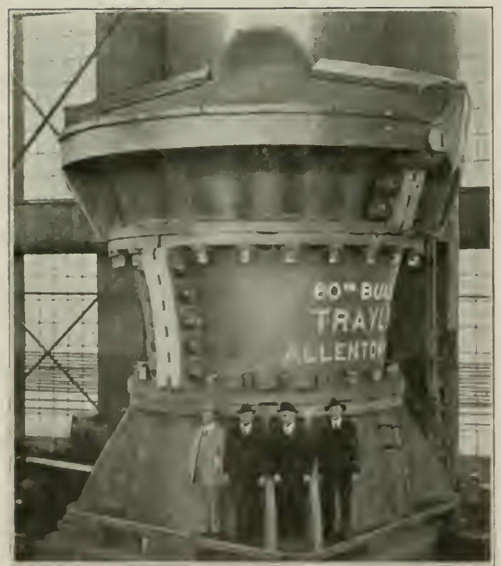
Sizing and classification require systematic sampling and screen analysis of products at major intervals of a month, and inspection at least twice a shift. As in the case of crushing machines, the mechanical condition requires close attention. Where separate motor drives are used, each motor should be metered once a month. Journal inspection twice a shift is also necessary. Oversize returns require special attention, and where such returns are reduced to a minimum, on account of the enlargement of screens due to excessive wear, prompt replacement of screens should be made. Similarly, excessive amounts of return should be prevented by the careful readjustment of rolls, breakers, or other crushing appliances.

Tonnage control of crushing appliances is important in reducing the power requirement of each machine to a minimum. Each machine should receive a flow well up to its maximum capacity without incurring an overload. This necessitates the periodic adjustment of feeding appliances and the making of flow determination. Screening and classifying appliances are dependent for efficient work upon the careful control of the quantity of material fed to them. Maximum capacity is not as important as for crushing machines, and overload greatly diminishes efficiency. The screening and classifying capacity should be in excess of requirements, and, where flow determinations show overloading, additional equipment should be added.

Each group of coarse-concentration appliances should be treated as a unit and the products systematically sampled and examined. Flow determinations should be made, and from them the pulp dilution and clear-water requirements measured. When the saving of water is necessitated by reason of scarcity or cost, the study of the adjustments of the machines should be thorough. It is evident that initial operation requires frequent sampling and testing of the products until the adjustment of each machine has been properly made. With coarse-concentration machines, dip samples can be taken and examined under a magnifying glass, and in most cases sufficient information will be obtained for making adjustments. The work of a unit should, however, be quantitively ascertained by flow determinations and samples. Input and output quantities, together with inflowing and outflowing metallic values, are necessary before the work of the unit can be determined. As in the case of the crushing units, a quantitive estimate is not required at short intervals. Power determinations are also made, and the same careful examination of the mechanical condition is necessary. A similar procedure is carried out for the fine-concentration appliances.

New 60-In. Gyratory Crusher

What is claimed to be the world's largest gyratory crusher has recently been manufactured by the Traylor Engineering and Manufacturing Co., of Allentown, Penn. The dimensions of the crusher's principal parts are: Height (foundation to top of hopper), 17 ft. 8 in.; diameter (hopper), 19 ft. 6 in.; length of shaft, 21 ft.; diameter of shaft, 40 in.; size of receiving openings, 60 x 190 in.; diameter of driving pulley (rope sheave), 7 ft.; eccentricity, 2 inches. The weights of the principal parts are: Shaft, 56,000 lb.; shaft (assembled), 62 tons; head, 60,000 lb.; top shell (two pieces), 108,000 lb.; middle shell, 100,000 lb.; bottom shell (a single casting), 95,000 lb.; bottom shell (with lining), over 105,000 lb.; spider, 60,000 lb.; crusher complete, about 800,000 pounds.



TRAYLOR 800,000-LB CRUSHER

The capacity of the crusher will be from 2500 to 3000 tons per hour, crushing to a 8- to 9-in. product. When running under full load the crusher will require about 350 hp. Running light it will consume 75 hp. Lubrication will be by forced feed, by which a continuous oil circulation will be maintained through the eccentric. The oil will be circulated by a pump situated in the bottom of the crusher, and the system will contain about 9 bbl. of oil.

The gears are of cut steel, the spider is of the Hewes type, and a special construction protects the shaft bearings and eccentric from dust. Among the special features of the machine are the self-aligning eccentric and the fact that the shaft is rigid and compact and that the machine can be readily stripped for repair. It will be used to handle the product of steam shovels at a limestone quarry. The material will be dumped into the receiving hopper from 12½-ton cars, eight of which make up a train. The crushed limestone will deliver to a 48-in. belt conveyor, running at 500 ft. per minute.

The crusher was built in 3½ months, and the parts were assembled for shop test in three days. The design and development of the machine have been largely in the hands of Richard Bernhard and L. J. Hewes, chief engineer and Chicago district manager, respectively, for the Traylor Engineering and Manufacturing Co. The company is planning to build a still larger machine as soon as steam-shovel operations at the quarries are developed to handle the greatly increased tonnages required.

South Dakota 1918 Mineral Production

According to the annual report of the State Mining Inspector, the production of gold and silver in South Dakota for 1918 showed a decrease of $814,860 over the previous year's output. The total for the year was as follows:

SOUTH DAKOTA MINERAL PRODUCTION FOR 1918

Source	Tonnage Treated	Yield
Homestake	1,628,630	$5,923,652 91
Trojan	107,373	530,642 33
Mogul-Ofer	33,750	169,974 82
Golden Reward	6,542	36,588 76
Bismarck	5,120	18,864 76
Miscellaneous	235	5,300 00
Placer		1,400.00
Totals	1,781,650	$6,686,423 75

The Homestake company shipped tungsten ores and concentrate valued at $281,474.57. The Bismarck company received $2282.18 for ores of this class; and lessees and smaller producers received $3550, making a total for the tungsten production of $287,306.75.

Mica was shipped to the amount of 249 tons, valued at $10,464.01. Lithia ores recovered amounted to 1500 tons, with a value of $82,500. Copper ores to the extent of 641 tons, and having a value of $9156.81, were sent to the smeltery; most of these ores were taken from the property of the Maloney Blue Lead Copper Co., near Keystone.

Lead-silver ores and concentrates shipped aggregated 159 tons, having a value of $6521.39; and 916 tons of pyrites, having a value of $7200, was sent to market, all of which was taken from the Olaf Seim mine, near Deadwood. Gypsum and gypsite recovered had a value of $15,160; coal, $39,237; kaolinite, $8000; beryl, $270; columbite, $280, and limestone and structural materials, $180,000; making a grand total for all mineral production of $7,362,519.71.

The average number of persons employed in the mineral industry was 2049, excluding coal mines and quarries. There were no fatal mine accidents.

Condition of Bordeaux Market For Sulphur

In *Commerce Reports* for May 5, 1919, Vice-Consul V. W. O'Hara, of Bordeaux, France, says that investigation into the local market discloses that there is at present no market for sulphur products, and, in fact, the same condition appears to hold for all of France in any large commercial way. This is due to the fact that the French government controls the buying and distribution of these products.

In commerce, sulphur products are used in this section mostly in connection with the vine-growing and wine-production business. In regard to copper sulphate, the government has purchased a large quantity at a high figure, nearly enough for next season's needs for all of France, and, it appears, will not let down the bars for importation until it disposes of its contracted stock.

Sulphur is, and will continue to be until July 31, 1919, under government control. Purchase and distribution are made through L'Office Central des Produits Chimiques Agricoles, 42bis Rue de Bourgogne, Paris (VIIe). Sale of either lump or refined sulphur, or of both, might be made to this organization for immediate delivery, and only after government control is relinquished will general commercial interests attempt to import this article, as a small order would not be worth while and a large quantity would undoubtedly be requisitioned. Orders could, however, be taken now for future delivery if the question of prices were readily arranged. The needs of the Department of the Gironde are about 8000 tons annually.

Lump sulphur was quoted on the local market at the end of February at 40 fr. per 100 k. (220 lb.) bulk, minimum 3000 tons (no import tariff). The product, however, is used in the refined state and was quoted on the local market at 60 fr. per 100 k., c.i.f. Bordeaux, in double sacks, minimum 2000 tons (import tariff, 3 fr. per 100 k.). The only refinery in this region is the Compagnie Europeene de Traitements des Minerais, Quai de Brazza, Bordeaux, a branch of a San Francisco firm, but it is now under requisition by the French government. There are several sulphur refineries at Marseille and Cette.

Relatively, a large amount of sulphur was imported from the United States before the war, the American product being as good as and obtainable at a better price than that imported from Italy.

Cadmium in the War

A report on cadmium in 1918, prepared by C. E. Siebenthal, of the U. S. Geological Survey, describes the minor but interesting uses of this metal in the war. The war interest in cadmium centered mainly in its employment as a substitute for tin, and its use in bronze telegraph and telephone wires.

The large quantity of tin used in making food containers for rationing the American and Allied armies, combined with the lack of shipping and the loss of several cargoes of tin, produced a critical scarcity of tin in this country and led to Government control of its distribution, as well as to a campaign for its conservation. One method of saving tin is to substitute cadmium for it in solder. In the last year of the war the Government and certain large concerns began experiments with cadmium solders as a means of saving tin. The results of these experiments were promising, but the demand for tin decreased, and the armistice was signed before cadmium solders became widely used.

Cadmium was used by European nations during the war for some strictly military purposes, but little exact information is available to show those purposes.

The first of the belligerent nations to make large use of cadmium as a substitute for tin in solders was Germany, which from the beginning of the war was cut off by the blockade almost entirely from the world's sources of tin. The great scarcity of tin in Germany is indicated by the fact that over 30% of the cargo of the submarine "Deutschland," on her return trip in July, 1916, consisted of pig tin. Solders containing 10% of cadmium were used in Germany early in the war, and some were reported to contain as high as 30% of cadmium and only 2% of tin, instead of the customary 40 or 50%. Nickel was also scarce in Germany; it made up a large part of both the cargoes carried by the "Deutschland"; and in Germany cadmium-plating may have been substituted for nickel-plating where possible.

About 600 tons of cadmium accumulates annually in this country as dusts and residues, byproducts of the lead and zinc industries, and from these byproducts about 100 tons of metallic cadmium is recovered. If all the cadmium dusts and residues were treated, the output of metallic cadmium would be small in comparison to the 19,000 or 20,000 tons of tin annually used in this country in solder, even if due allowance is made for the fact that 1 lb. of cadmium can replace from 3 to 5 lb. of tin.

The output of metallic cadmium in the United States in 1918 was 127,164 lb., as compared with 207,408 lb. in 1917, and the output of cadmium sulphide in 1918 was 51,702 lb., as against 50,169 lb. in 1917. The average value per lb. for metal and for sulphide was $1.48 and $1.36 in 1918, as against $1.47 and $1.41 in 1917. The exports of cadmium in 1918 were 62,320 lb., of which 30,440 lb. was sent to France and 20,000 lb. to Japan.

The market for metallic cadmium was not strong in the first half of 1918, and considerable stocks accumulated. Production was somewhat curtailed before August and almost stopped for the remainder of the year.

Petroleum in March and February

A comparative summary of the quantity of crude petroleum produced and marketed, imported, consumed, exported, and held in storage in the United States in February and March, 1919, and in March, 1918, prepared by C. C. Osbon and E. Russell Lloyd, of the U. S. Geological Survey, is given herewith. The statements with respect to fields east of the Rocky Mountains are based upon reports filed by about 200 pipe-line, marketing, and refining companies, only such refineries being included as receive crude oil by private pipe lines or tank cars directly from the wells. Statistics relating to California and to imports and exports were compiled from secondary sources. This statement indicates the general trend of conditions in the crude-petroleum industry of this country. The data are subject to revision in subsequent statistical reports.

The quantity of crude petroleum run from wells and producers' field storage tanks, and delivered to pipe lines, marketing companies, refineries, and other consumers in the United States in March, 1919, amounted to approximately 30,412,000 bbl., an increase of 3,901,000 bbl., or about 13%, compared with February, 1919, and of 873,000 bbl., or nearly 3%, compared with March, 1918. The average daily rate in March, 1919, was 981,032 bbl., a quantity greater by 34,210 bbl., or a little more than 3%, than the average daily rate in the preceding month, and by 28,162 bbl., or nearly 3%, than the average daily rate in the corresponding month of last year. It is noteworthy that the general trend of production in March, 1919, compared with March, 1918, was upward in all the oil fields except Lima-Indiana, where there was a slight decline in average daily rate of production. Credit for the greatest increase is due to the Gulf Coast field, which added about 16% to its daily average. The corresponding increase in California was about 6%, and the Illinois field, which has been declining in production for several years, increased its daily output to the extent of nearly 11%, compared with February, 1919. Declining production in some of the Oklahoma pools was a little more than offset by the flush production in the northern Texas and Louisiana areas of the Mid-Continent field.

Approximately 98% of the oil included in the following table was actually brought to the surface in the United States in the months specified, the remaining 2% consisting of runs or tank-car shipments from field storage. Data concerning the quantity of oil run into field storage are not available.

TABLE I. MARKETED PRODUCTION OF DOMESTIC CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

Field	March, 1919	February, 1919	March, 1918
Appalachian	2,453,000	2,185,000	2,178,000
Lima-Indiana	282,000	274,000	291,000
Illinois	1,166,000	940,000	1,190,000
Mid-Continent	14,629,000	13,211,000	14,697,000
Gulf Coast	1,890,000	1,441,000	1,826,000
Rocky Mountain	1,168,000	990,000	1,048,000
California	8,824,000	7,470,000	8,309,000
Totals	30,412,000	26,511,000	29,539,000

PETROLEUM CONSUMPTION

It is estimated that 28,212,000 bbl. of domestic crude petroleum was delivered in March, 1919, to refineries and other consumers of crude oil and used for the manufacture of petroleum products and for fuel, or exported. This quantity is greater by 1,053,000 bbl., or about 4%, than the quantity so delivered or consumed in February, 1919, but less by 3,341,000 bbl., or 12%, than the consumption in March, 1918. However, the average daily rate of consumption was 910,065 bbl., a decrease of 59,901 bbl., or nearly 7%, compared with the daily rate in February, 1919, and of 107,774 bbl., or about 12%, compared with the rate in March, 1918.

The following table, computed from marketed production and stocks, includes approximately 99% of the total quantity of domestic crude oil consumed or exported in the months referred to, the remainder representing oil used by producers in drilling and pumping.

TABLE II. CONSUMPTION OF DOMESTIC CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

Source of Oil	March, 1919	February, 1919	March, 1918
Appalachian	2,359,000	1,993,000	2,110,000
Lima-Indiana	251,000	226,000	312,000
Illinois	580,000	418,000	1,232,000
Mid-Continent	13,553,000	15,356,000	16,070,000
Gulf Coast	1,251,000	1,103,000	2,190,000
Rocky Mountain	1,209,000	964,000	920,000
California	9,009,000	7,099,000	8,719,000
Totals	28,212,000	27,159,000	31,553,000

Although the United States leads the other countries of the world in the production of crude petroleum, the quantity obtained from domestic sources is inadequate to meet the demand, and a large volume is imported, chiefly from Mexico. Table III shows that the imports of crude petroleum in March, 1919, were materially greater than those of the corresponding month last year.

Although the export trade of the petroleum industry in the United States consists chiefly of refined products, a substantial volume of crude oil is being exported for the manufacture of petroleum products in Canada, Cuba, and other foreign countries, as shown by Table III.

TABLE III. IMPORTS AND EXPORTS OF CRUDE PETROLEUM (a)
(Barrels of 42 Gal. Each)

	January, 1919	February, 1919	March, 1919	March, 1918
Imports				
Source				
Mexico	3,899,376	3,655,542	3,492,800	2,557,141
Other countries	25	84	981	2
Totals	3,899,401	3,655,626	3,493,781	2,557,143
Exports				
Destination				
Canada	270,554	131,622	178,228	169,045
Colombia	......	5,952	......	4,762
Cuba	39,886	....	39,394	35,007
Mexico	1,018	53	628	357
Other countries	27,561	45,876	144	47
Totals	339,019	183,503	218,394	209,218
Excess of imports over exports	3,560,382	3,472,123	3,275,387	2,347,925

(a) Compiled from the records of the Bureau of Foreign and Domestic Commerce.

Data are not available concerning the quantity of Mexican crude oil held in storage in the United States. If, however, the consumption of Mexican oil keeps pace with importation, Table IV indicates the total quantity of petroleum exported and delivered to refineries and other consumers in this country.

TABLE IV. TOTAL CONSUMPTION OF DOMESTIC AND IMPORTED CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

	March, 1919		February, 1919		March, 1918	
Kind	Total	Daily Average	Total	Daily Average	Total	Daily Average
Domestic	28,212,000	910,065	27,159,000	969,964	31,553,000	1,017,839
Imported	3,493,781	112,702	3,655,626	130,558	2,557,143	82,488
Totals	31,705,781	1,022,767	30,814,626	1,100,522	34,110,143	1,110,327

Diamonds in the United States*

The importation of diamonds into the United States shows a marked change during the war period. Prior to 1914 about two-thirds of the stones imported were classed as "cut, but not set," whereas only about one-third of the total value was classed as "uncut."

The diamond cutting of the world was carried on prior to the war chiefly in the Netherlands, Belgium and France, and that industry was, of course, entirely suspended in Belgium, in considerable part in France, and also materially affected in the Netherlands. As a consequence, the value of cut diamonds imported into the United States dropped from $27,000,000 in 1913 to $18,000,000 in 1914 and $9,000,000 in 1915. By 1916 the uncut diamonds began plainly to take the place of the cut diamonds in the importations, and in 1918 for the first time showed a greater value in imports than those classed as "cut, but not set." In the eight months ended September, 1918, the imports of uncut diamonds amounted to $10,424,000 and the group "cut, not set," to $6,501,000.

The recent great increase in importations from England occurred almost exclusively in uncut diamonds, which that country had apparently drawn direct from her South African colonies and sent in the uncut form

---

*Abstracted from *South African Mining Review*, March, 1919, p. 132.

to the United States, which has of late actively developed the diamond-cutting industry.

The value of the diamonds in the United States at the present time is apparently more than $1,000,000,000. As early as 1900 a distinguished American diamond expert estimated that $500,000,000 worth of diamonds were owned in the United States, and a compilation just made by the National City Bank of New York shows that the value of diamonds imported since 1900 is $506,000,000.

This alone would bring the total value of the diamonds of the country above the billion-dollar line, but when it is remembered that $175,000,000 worth of the diamonds imported since 1900 came in the uncut state, and that their value was doubled by the cutting process, which occurred within the country, it is apparent that the value of the stock is considerably more than $1,000,000,000, ignoring the further fact that prices of diamonds have increased materially during the war. It is considered probable that fully one-half of the world's stock of diamonds is now in the United States.

Production of Corundum and Emery In 1918

The production of corundum and emery in the United States in 1918 was much smaller than in the two previous years, according to statistics just compiled by F. J. Katz, of the U. S. Geological Survey. The quantity of corundum and emery mined was 10,139 short tons. The quantity of crude emery and corundum marketed was 8702 short tons, valued f.o.b. mines at $95,248. The output was 45% less than that in 1916 and 52% less than that in 1917. The output in 1916 and 1917, however, was abnormally large and was stimulated by the demand created by the war, which required enormous quantities of abrasives for making munitions and other articles needed for military use, and prevented the importation of foreign corundum and emery, the former chief source of supply. Though the employment of substitutes and the increase of imports in 1918 reduced the demand for the domestic abrasives, the output was many times that of normal years before the war.

Corundum was mined in small quantities by two operators in Jackson and Macon counties, N. C.; emery was mined by seven or more operators in the Peekskill district, N. Y., by two in Virginia, and one operator in Macon County, North Carolina.

Gems in Maine

By F. F. Burr*

The history of gem mining in Maine dates from the discovery of clear crystals of colored tourmaline at Mount Mica, in the town of Paris, about a century ago. Since that time, the quantity of gem material produced must have been, in the aggregate, large. There is, however, no way of estimating this accurately. It is fairly apparent, however, that the output of gems from this and other localities has never approached what it might have been. Lack of systematic mining methods has been the chief handicap under which the gem business has labored from the start. A few producers and dealers have been enterprising enough to overcome the difficulties to some extent, and have developed a fairly satisfactory business.

It is impossible to give anything but an approximate estimate of gem production in Maine, and no figures at all are available for the rough material. Cut gems to the value of about $6000 have been reported for 1918, but this figure is known to be too low. The material cut includes tourmalines, colorless, pink, green, and blue-green; beryl, colorless, green, bluish, and yellow, and very rarely pink (caesium beryl); topaz; quartz, amethystine, colorless, rose and smoky; and a small amount of amazonite. An occasional garnet of gem quality is found, and I have seen at least one gem cut from the beautiful and rare purple apatite of Auburn.

Practically all of the gem stones come from Oxford, Androscoggin, and Sagadahoc counties. Discoveries are in many cases merely incidental to operations for feldspar. It cannot be said that the possibilities in any locality are exhausted, as the workings are in all cases scarcely more than surface scratches.

A Campaign To "Get the Returned Soldier and Sailor Home"

The special committee on soldier and sailor employment of the Chamber of Commerce of the United States has issued a special bulletin that suggests an inter-communicating network of commercial organizations designed to facilitate the placing in jobs of men released from the service. Commercial organizations are urged to assume responsibility for seeing that measures are taken to finance the return of discharged men when they have not funds with which to pay their transportation.

"The case of the discharged soldier who is not inclined to go home, but to seek employment elsewhere," says the bulletin, which is issued at the request of Arthur Woods, special assistant to Secretary Baker, in charge of soldier employment, "seriously complicates the whole problem of soldier employment. His motives for not returning home may be of the best and due to a desire for a better chance than his old home and his old job offer him. This is only what we would hope for him, but he is returning at a time when new opportunities are perhaps not numerous. His ambitions must not be killed or discouraged, but he should be brought to realize that he is more highly appraised by his former employer, that his chances of advancement with his old concern may be, as a consequence, much better, and that at any rate he should first reëstablish himself for the interim in his home town, either in his former position or another one, and let the future care for itself.

"All considerations, patriotic, economic, and social, clearly place the responsibility for taking care of such cases with the commercial organizations of the country, who represent the employers. It is the business men who must employ the men, and it is the business men who will feel most acutely the effects of any continued increase in unemployment.

"It will be necessary that definite measures be taken to finance the return of a soldier to his home, when he has, in fact, spent the mileage allowance given him by the Government on discharge for this purpose, and the committee urges that commercial organizations assume responsibility for seeing that this is done. Several methods of meeting the expense suggest themselves. If the soldier is to return to his previous place of employment, his previous employer may be induced to advance funds for his traveling expenses. A Chamber of Commerce itself may assume responsibility for financing the return, where necessary, of soldiers who belong in its community, or the Chamber of Commerce in the town where the soldier is may undertake to finance his return home. The soldier, of course, should pay his own way if he has the funds, or his return might be financed in the form of a loan to him. On the other hand, arrangement may be made with some welfare organization or society."

---

*Geologist, Central Maine Power Co., Augusta, Maine.

Research Fellowships in Idaho

In coöperation with the U. S. Bureau of Mines and the Idaho Bureau of Mines and Geology, the University of Idaho offers in the School of Mines a number of fellowships. These fellowships are open to college graduates who have had good training in mining, metallurgy, or chemistry, and who are qualified to undertake research work. The income of each fellowship is $720 a year for the 12 months beginning July 1st, 1919.

Fellows will register as students in the University of Idaho and become candidates for the degree of master of science in mining or metallurgy. Their class work will be directed by the heads of the departments of instruction, but the greater part of their time will be spent in research work under the direction of the Bureau of Mines staff resident at the university. The purpose of this work is to undertake the solution of definite problems confronting the mining and metallurgical industries of the State of Idaho. For 1919-20 the following subjects are being considered: (1) Flotation, with especial reference to differential separation of various minerals; (2) availability of Western wood oils for flotation purposes; (3) treatment of the complex gold-silver ores of southern Idaho; (4) ore-dressing problems; (5) mining problems.

Applications, with certified copy of collegiate record, statement of professional experience, and names and addresses of three references, will be received up to June 1, 1919, and should be addressed to the Dean, School of Mines, Moscow, Idaho.

"Public Utility" Housing Societies

According to the London *Daily Telegraph* of Mar. 25, state aid will be accorded to "public utility" societies in Great Britain that propose to erect houses for the working classes only, says a consular report. This assistance will be given in two forms—loans and subsidies. A society may borrow from the state to the extent of three-fourths of its required capital at 5½% interest, the principal repayable in 50 years. The subsidy granted will be approximately 40% of the charges for interest and repayment of principal. After the loan has been repaid, a society may be called upon to devote any profits in excess of 6% toward repaying the whole or part of the subsidy received from the national exchequer. Provision is also made to prevent undue profits from sales of houses erected. One-fourth of the capital will be provided by the employers of the workers for whom the houses are built. Money may be borrowed privately if desired, but the government subsidy will be granted independently of the capital loaned, whether procured from the state or from other sources. These liberal terms are limited to housing schemes to be completed within a period of two years.

It is proposed to charge only a moderate rent, i.e., sufficient to cover costs of repairs and interest on the borrowed capital. The average cost of erection per cottage, with fittings, was at first estimated at $3400, but this has been reduced to about $2675 for a six- or seven-room cottage. A special feature of the utility societies' scheme is the provision made to educate the working classes in the care and upkeep of the new cottages.

Publicity for Mining Districts*

By George A. Laird

With the gradual disappearance of the prospector, it is apparent that steps must be taken to encourage prospecting or to create a campaign of reliable publicity for districts which may be worthy of consideration but are not properly brought to the attention of the mining public.

The larger companies, with a force of field engineers, are frequently offered prospects which do not come up to their requirements, but which might be worth consideration by smaller companies or by individuals. Field engineers are, through the compulsion of professional ethics or by terms of contract, prohibited from discussing their work in a given district, and idleness results, as the property has been "turned down."

Personal paragraphs in the technical bulletins and magazines frequently state that "Mr. So and So has recently made an examination in the This and That District," but the report made is confidential, and the item is of no interest to the profession other than that Mr. So and So has (presumably) received a fee.

Mr. So and So has doubtless obtained some general information which he gladly divulges to his immediate friends—can divulge to anyone—which might be of great interest to the rank and file with whom he has no communication.

It is proposed that engineers, particularly the members of the Mining and Metallurgical Society of America, submit to the secretary, to be published in the *Bulletin*, a short summary of their observations which are not of a confidential nature, a concrete example following:

Field Observations

"In February, George A. Laird visited the Old Hat Mining District, Pinal County, Ariz. The property examined, about 20 miles south of Mammoth, consists of a remnant of Devonian limestone which shows replacement deposits of lead carbonates with silver.

"There is little development in the immediate vicinity, the overburden making prospecting difficult."

Or:

"The Lightning Ridge opal fields, New South Wales, were visited. While not of a nature to encourage a company going into the field, it is of sufficient interest to warrant a day or two as a side trip."

Or:

"Mr. So and So recently paid a visit to the Bull Con District, where conditions in general do not warrant a visit excepting under specific instructions to examine and report."

This last-mentioned item cannot be considered as a direct "knock." There are dozens of districts where such a statement would hold good.

Many times the principal obstacle to prospect development is the prospector himself, but equally as often

---

*Abstracted from the *Bulletin* of the M. M. S. A., Mar. 31, 1919.

it is because the property does not meet the special requirements of the person requiring the engineer's report.

The general scheme proposed is therefore to publish, in addition to the "personals," an observation column, which implies a fee and definitely states something from which engineers may profit.

The Experimental Treatment of Complex Ore

The following data have been abstracted from a report received by the New Hazelton Gold and Cobalt Mines Co., of New Hazelton, B. C., from the ore-dressing and metallurgical laboratories of the Canadian Department of Mines, at Ottawa. The ore is a complex one, containing molybdenum, cobalt, nickel, arsenic, and gold; and tests were made to determine a scheme of treatment and to forecast possible results from actual operations.

The shipment, which weighed 53,228 lb., was found to contain MoS_2, 1.40%; MoO_3, 0.18%; Co, 1.12%; Ni, 0.60%; As, 8.98%; and Au, 1.24 oz. The object of the test work was to concentrate the valuable materials in the ore and also obtain a separation as far as praticable. As the cobalt, nickel, arsenic, and gold were intimately associated, it was feasible to adopt water concentration and also to obtain a separation and concentration of the molybdenite by flotation.

In the first test the ore was crushed to 20 mesh and concentrated on a Wilfley table to remove the cobalt, nickel, arsenic, and gold. Two products were made, a concentrate and tailing. The tailing was re-ground in a Hardinge mill to 60 mesh and the molybdenite concentrated by means of the Callow pneumatic flotation process. The flotation tailing was re-run over the Wilfley concentrator to remove any cobalt, nickel, arsenic, and gold remaining.

In the second test the ore was crushed to 40 mesh and concentrated on a Wilfley table to remove the cobalt, nickel, arsenic, and gold. Two products were made, a concentrate and tailing. The tailing was re-ground in a Hardinge mill to 60 mesh and the molybdenite concentrated by flotation in a Callow unit. The flotation tailing was re-run over the Wilfley concentrator, and the tailing from the table was considered final and allowed to go to waste.

In the third test the ore was ground in a Hardinge mill to 60 mesh and the molybdenite first floated in a Callow unit. The flotation tailing was concentrated on a Wilfley table to remove the cobalt, nickel, arsenic, and gold, and the tailing from the table pumped to waste. This test was run to obtain a comparison of results between tabling followed by flotation, and flotation followed by tabling.

The actual extractions made on the carload of ore were as follows:

In Table Concentrates: Cobalt, 72.6%; nickel, 87.5%; arsenic, 84.9%; gold, 83.5 per cent.

In Flotation Products: Molybdenite, 54.4 per cent.

These extractions should be improved upon in practice where a closed circuit could be maintained and losses due to handling and slime overflow reduced to a minimum.

As the molybdenum is of secondary value as compared to the other metals present, it is advisable to remove as much as possible of the cobalt, nickel, arsenic, and gold before flotation is practiced to recover the molybdenite. Most of the minerals can be removed at 40 mesh; and, as it is necessary to grind the ore to 100 mesh to recover the molybdenite, it would not be wise to float first and table afterward. The loss in cobalt, nickel, arsenic, and gold due to fine grinding would not compensate for the higher extraction of the molybdenite.

From the test work conducted, it is apparent that the procedure to follow on the concentration of this ore would be: The crude ore should be crushed in a jaw-breaker to 1½ in. or 1 in. and ground in a wet ball mill in circuit with a classifier to about 40 mesh, and concentrated on tables of the Wilfley type; the table tailing re-ground in a ball or tube mill to 100 mesh, in circuit with a classifier; and the molybdenite floated in an oil-floation unit. The tailing from the flotation unit should be concentrated on slime tables or vanners.

Oil in the Simi Valley, Southern California

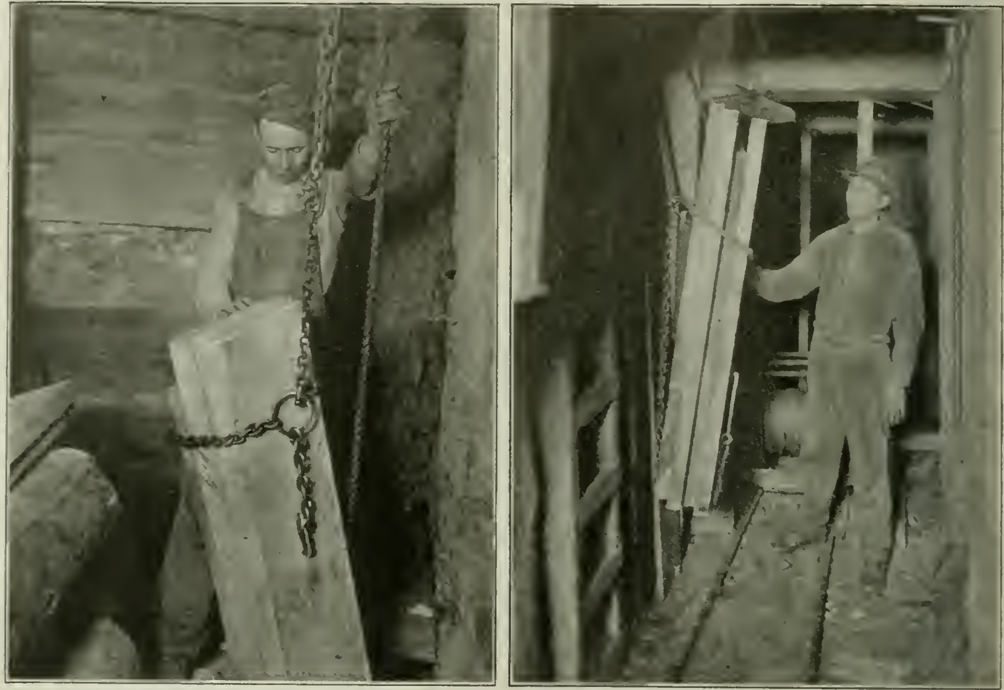
Recent successful explorations for oil in the Ranger district, in Texas, afford a striking example of achievement due to persistence combined with science, and another example, not so striking, perhaps, but nevertheless instructive, is seen in the similar successful work done in the Simi Valley, Ventura County, Calif., 30 miles northeast of Los Angeles. The first wells sunk in Simi Valley were drilled in 1900 along a fault, or "break," close to an oil seepage about 2½ miles north of Santa Susana, and were not promising. Later, on the advice of geologists, a test hole was sunk on an anticline in Tapo Canyon. The test gave good results; a well was brought in at a shallow depth, and the Tapo Canyon field was thus discovered. Since then two companies have been operating in this field, and have put down about 50 wells, only a few of them failures. The oil is of high grade, but the aggregate output is relatively small.

The geology and structure of the Simi Valley region have recently been mapped and described by W. S. W. Kew, of the U. S. Geological Survey, in a report entitled "Geologic Structure and Oil Resources of the Simi Valley, Southern California," published as Bulletin 691-M of the Survey. The report contains a map showing the geologic formations exposed at the surface in this region and cross-sections showing the structure or form of the beds underground. These sections, which were derived from an examination of the beds exposed at the surface and from logs of wells, show how and where the beds are folded and broken.

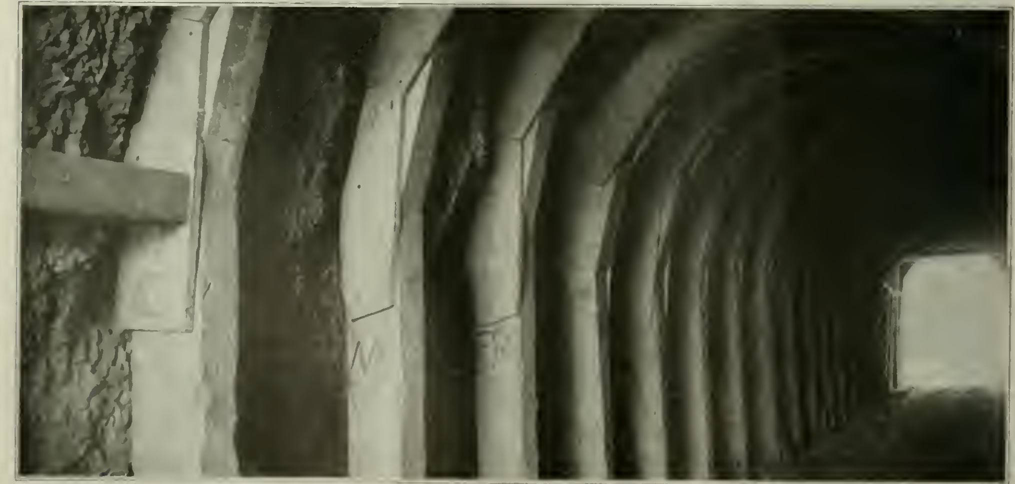
Mr. Kew suggests that oil may be obtained in other parts of the region and recommends that a test hole be put down on an anticline in Las Llajas Canyon, near the south side of the Santa Susana Mountains, where there are oil seeps and where the geologic conditions are similar to those in the Tapo Canyon field. He also suggests that it is possible that the Tapo Canyon field may extend further west.

The Aluminum Ore Co., East St. Louis, Ill., will soon put into operation a steamship service for the purpose of carrying bauxite from South America to either East St. Louis or the company's Baltimore plant. The company has three steamships of 3500 tons' capacity each, to be delivered in the near future for this service. It has not yet been decided, according to C. B. Fox, manager of the East St. Louis plant, which of the company's plants will be enlarged.

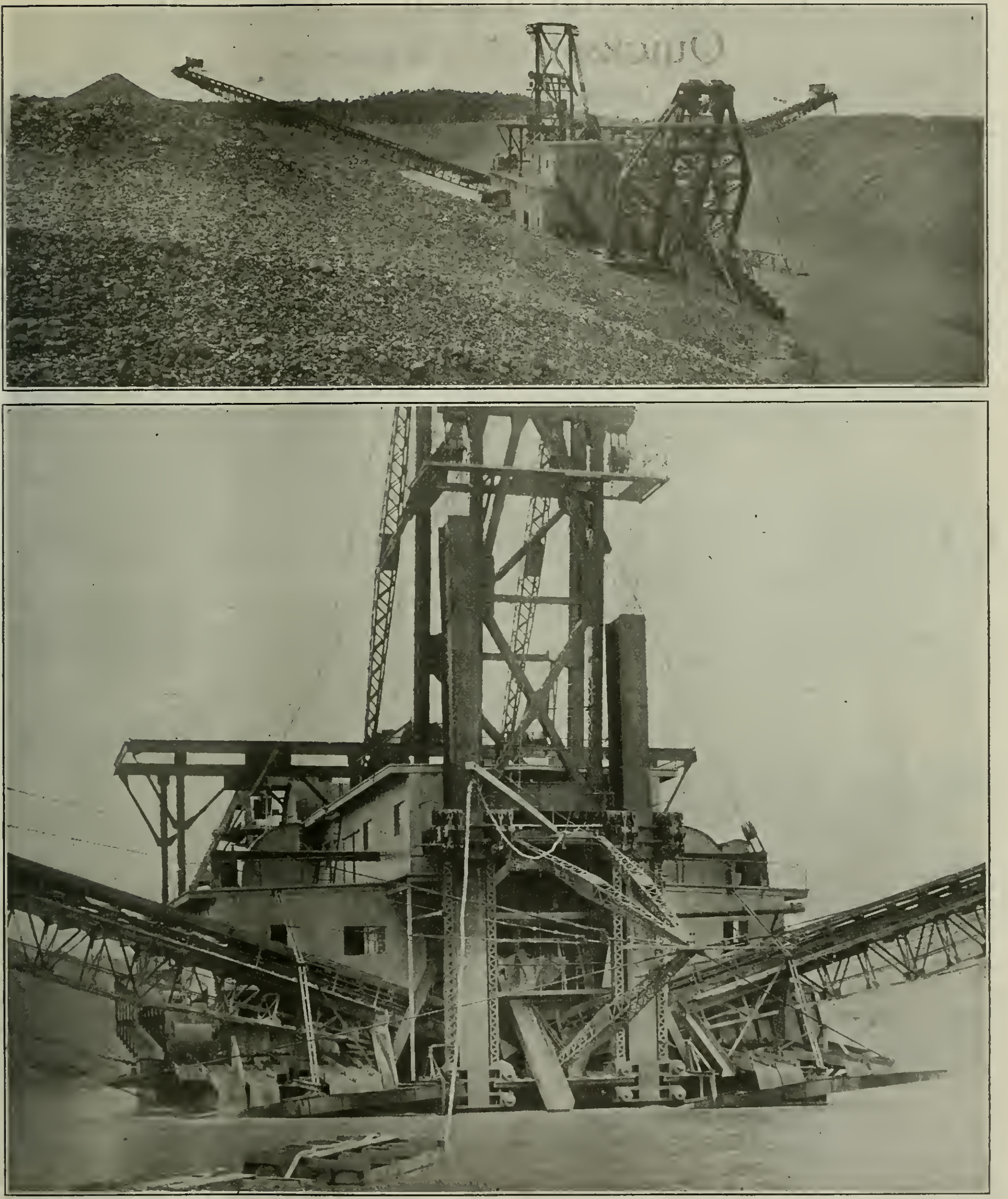
Photographs From the Field



WRONG AND RIGHT WAYS OF LASHING TIMBER FOR HOISTING OR LOWERING
Illustration at right shows the use of a successful timber hook. Published through the courtesy of the *Anode*.



METHOD OF TIMBERING A WAGON-ROAD TUNNEL AT VIRGINIA CITY, NEVADA



YUBA NO. 16, ALL-STEEL, TWO-STACKER DREDGE IN THE YUBA RIVER, CALIFORNIA, DREDGING GOLD-BEARING GRAVEL AND RECONSTRUCTING THE RIVER CHANNEL

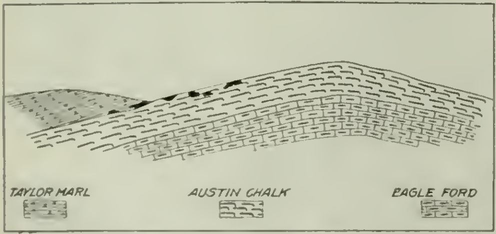
This dredge is equipped with 18-cu.ft. California-type buckets, and digs 80 ft. below the water line. It was designed and built by the Yuba Manufacturing Co., and is owned and operated by the Yuba Consolidated Gold Fields. The dredge began digging Apr. 1, 1917. The upper view of the dredge shows the bow gantry and approximate full length of the digging ladder, carrying 100 buckets, digging at shallow depth. Approximately the full length (225 ft.) of the starboard tailing stacker (inactive) and the upper end of the port tailing stacker (active) are shown. The lower view shows the stern gantry, steel spuds—one lowered, the other raised—and the position on deck of the two tailing stackers, which stand at approximate right angles to the hull. The attachments controlling the spuds at the head of the gantry are shown in detail; also the safety platform and spud case-keepers, whose tops reach the point of connection of the tailing stacker supports. The electric power cable is plainly to be observed in the foreground, carried by floats built for the purpose.

The Anticlinal Theory and Some Quicksilver Deposits

By WILLIAM H. EMMONS*

The following article is a review of "The Anticlinal Theory as Applied to Some Quicksilver Deposits," a bulletin by J. A. Udden, University of Texas, Bureau of Economic Geology and Technology, Division of Economic Geology, No. 1822, Apr. 15, 1918. Dr. Emmons points out that the theory should be of considerable aid as applied to the prospecting of certain areas where the structural conditions are favorable. Ore has been found in the fissured and faulted parts of anticlines, domes, and arrested monoclines. The relation of structure and ore deposition is one of the important subjects that is of direct assistance to the prospector in making discoveries and to the miner in following out the extension of deposits in process of working.

OPERATORS, especially those holding leases, have been pleased to find that the rocks forming the gentle anticlines of northern Texas are highly saturated with petroleum in the Ranger, Duke, and other districts near by. It is surprising to learn, however, that the Terlingua quicksilver deposits of Brewster County, Tex., show a similar relation of deposits to the structure. The anticlinal theory of accumulation seems to apply in Texas, whether the mineral deposits are metallic cr nonmetallic.



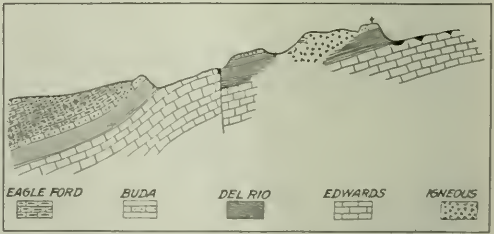


FIG. 1 DIAGRAMMATIC SECTION WEST OF CHISOS MOUNTAINS, BREWSTER COUNTY. KNOWN OCCURRENCES OF CINNABAR ARE INDICATED IN SOLID BLACK. FIG. 2. DIAGRAMMATIC SECTION EXTENDING FROM SOUTH—SOUTHWEST TO BREWSTER COUNTY, TEX. KNOWN OCCURRENCES OF ORE-BEARING ROCKS ARE INDICATED BY SOLID BLACK

In Brewster County, western Texas, Cretaceous limestone, shale, and marl are cut by Tertiary intrusives and in places overlain by tuffs and flows. Rhyolite, basalt, and phonolite are present. The richest cinnabar deposits so far encountered have been found at the contact between the Georgetown limestone (which is the upper 50 ft. of a thick limestone usually referred to as the Edwards) and the overlying Del Rio clay. The next richest horizon is the contact between the Buda limestone and the overlying, less penetrable flags and shales of the Eagle Ford. In the Eagle Ford itself, which in this region measures at least about 600 ft. in thickness, and consists of beds rapidly alternating from compact limestone to black shale, the distribution of ore frequently shows a direct relation to these alternations. Even in the thin layers of these beds it has been found that pockets of cinnabar frequently underlie layers of shale.

CINNABAR DEPOSITS TERMINATE UPWARD AGAINST SHALE

Turner[1] long ago showed that some of the large cinnabar deposits in the Lower Cretaceous limestone terminate upward against shale. Professor Udden shows that the position is much the most common one. The cinnabar replacements of limestone are along fractures and fissures, and are grouped along anticlines or near their crests. This discovery should be of great aid in prospecting the country, for the area where the softer shales have been removed would probably reveal cinnabar and its alteration products, practically at the surface. The country is arid and decomposition is slow. A mineral so resistant to weathering as cinnabar would be removed from the outcrop only slowly. So far as is known to me, this is the only place where the oxychlorides of mercury terlinguite, eglestonite, and montroydite[2] have been reported.

In general the greatest amount of ore has so far been found in fissured and faulted parts of anticlines, domes, and arrested monoclines. Professor Udden suggests as probable the hypothesis that the mercury vapors rose through the cracks and fissures in the limestone, and were halted below the shale at the highest points, that is, at or near the crests of anticlines. Possibly bituminous matter in the anticline had a bearing on precipitation. He notes that all of the shales are more or less bituminous and contain organic matter. This may have aided in the precipitation of the quicksilver fumes as sulphides. Oil has been found associated with the ore in the Eagle Ford in sufficient quantity to aid materially in its reduction in the furnace, as detailed on p. 9 of Professor Udden's paper.

There are many examples of deposits of sulphide ores of metals less volatile than mercury that are localized in anticlines or saddle reefs, and that have apparently been deposited by ascending thermal waters. The saddle reef, or anticlinal type, is common in the eastern hemisphere. Examples are found at Bendigo and Castlemaine, Victoria; Hargraves and Broken Hill, New South Wales; at Mysore, India; at Rammelsberg, Germany, and at many other places.

---

*Professor of geology at the University of Minnesota and director of the Minnesota Geological Survey, Minneapolis, Minn.

[1] Turner, H. W., "The Terlingua Quicksilver Deposits," *Econ. Geol.*, Vol. 1, p. 265 to 281, 1906.

[2] Hill, B. F., "The Occurrence of Texas Mercury Minerals," *Am. Journ. Sci.*, 4th ser., Vol. 16, p. 251, 1903.

In North America, deposits of sulphides concentrated at the crests of anticlines are found at Philipsburg and Elkhorn, Mont.; at Tombstone, Ariz., and in the Kelly district, New Mexico; at the Clover Leaf mine, Black Hills, S. D., and in the gold measures of Nova Scotia. Although some of the deposits named appear to represent folded bodies that once were tabular, or replacements of beds that were once tabular, many of them seem to be concentrations from rising solutions where localization was controlled by structure. To this class the Terlingua deposits evidently belong. This district is the only one known to me that contains mercury deposits which are clearly related to anticlinal folds.

Nipissing Mining Co., Ltd.

The report of operations of the Nipissing Mining Co., Ltd., for the year ending Dec. 31, 1918, shows that the production amounted to 3,701,416.38 oz. of silver, of a net value of $3,973,196.63. The profit on operations amounted to $2,596,095.65, or 64.25% of the gross value of production. Total shipments to Dec. 31, 1918, were 52,945,197.24 oz. of silver, for which a net return of $32,253,226.44 has been received.

The high-grade mill treated 1073 tons and the low-grade mill 80,274 tons. The method which has been used heretofore in the treatment of high-grade ores, and which gave satisfactory results for seven years, is an amalgamation process, using a large quantity of mercury. The price of mercury before the war was $33 to $39 per flask of 75 lb. Demand for war purposes raised the price to $130 per flask. This increased the cost of the process to such an extent that it was decided to discontinue amalgamation and rely on cyaniding alone, after giving the ore a preliminary treatment with bleaching powder in the tube mill. The necessary apparatus for this process was installed in the low-grade mill at a small cost, and in August, 1918, the old high-grade mill was shut down. The new process is working smoothly and will be used as long as it shows a saving over amalgamation. The bullion shipped averaged 998 fine, and amounted to 190 tons. Residue shipments were 2157 tons, assaying 9.03% cobalt. The demand for this material is good, at much higher prices than have been received heretofore.

In the low-grade mill the ore is crushed by stamps in cyanide solution and goes to the roughing tables without classification. The tailing is classified; the sand is recrushed in tube mill; and the overflow from the classifier goes to the fine-sand tables. The tube-mill discharge is returned to the classifier; and the tailing from the fine-sand tables is cyanided. By this method 48% of the silver in the ore is recovered in the form of concentrate, 40% as precipitate from the cyanide plant, and 12% goes to waste. The concentrate is re-treated with the high-grade ore in the high-grade mill, and the precipitate from both treatments is sent to the refinery, where it is converted into bullion. This process gives a better extraction and at less cost than can be obtained by cyanide alone on the quality of ore now being produced. Due consideration must be given to the question of the value of the cobalt in the concentrate.

The ore reserves as of Dec. 31, 1918, showed a total of 123,837, of an average content of 48.5 oz. of silver per ton.

The dividends declared and paid during 1918 amounted to $1,215,000. The treasurer's report shows that the company has a net surplus of $3,441,702.54.

Monthly Copper Production for 1919

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

Production of the United States by months since the beginning of the year was as follows:

January	135,733,511
February	111,649,512
March	102,040,460

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce, and includes Kennecott production from its Alaskan mines.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Granby, Cananea, Braden, Cerro de Pasco, and Chile. As a matter of record, however, the individual figures are given after the total. We also report the copper output of the Boleo and Katanga companies, which does not come to the United States.

MONTHLY CRUDE-COPPER PRODUCTION, 1919

	February	March	April
Alaska shipments	5,176,033	1,471,398	1,471,398
Arizona:			
Arizona Copper	3,360,000	2,800,000	2,400,000
Calumet & Arizona	6,612,000	4,602,000	3,822,000
Cons. Ariz. Smelting	1,000,000	720,000	770,000
Inspiration	6,600,000	6,700,000	6,900,000
Magma	1,211,175	1,000,212	....
Miami	4,462,578	4,551,115	4,489,748
New Cornelia (*a*)	2,014,000	1,980,000	2,000,000
Old Dominion	2,360,000	2,574,000	2,385,000
Phelps Dodge	7,410,000	6,434,000	6,560,176
Ray	4,150,000	3,792,000	3,650,000
Shattuck Arizona	376,166	2,452	*Nil*
United Verde	2,850,000	*Nil*	*Nil*
United Verde Extension	1,239,120	*Nil*	*Nil*
California:			
Mammoth	1,506,000	1,475,000	1,386,000
Michigan:			
Calumet & Hecla	9,263,868	9,652,053	8,554,113
Other Lake Superior (*b*)	6,500,000	6,500,000	6,500,000
Montana:			
Anaconda	12,400,000	13,900,000	13,750,000
East Butte	633,560	1,700,230	1,347,580
Nevada:			
Mason Valley	947,336	*Nil*	*Nil*
Nevada Cons	4,150,000	3,650,000	3,763,000
New Mexico:			
Chino	3,552,676	3,770,000	3,498,747
Utah:			
Utah Copper	10,335,000	8,366,000	9,420,000
Eastern smelters (*b*)	1,400,000	1,400,000	1,400,000
Total reported	99,509,512	87,040,460	....
Others, estimated	12,140,000	15,000,000	....
Total United States	111,649,512	102,040,460	....
Imports: Ore and concentrates, etc	13,824,200	10,146,979	....
Imports in blister, etc	33,369,626	49,564,536	....
Grand total	158,843,338	161,751,975	....
British Columbia:			
Granby Cons	2,610,737	....	....
Mexico:			
Boleo	1,807,680	2,039,520	....
Cananea	3,000,000	3,200,000	3,000,000
Phelps Dodge, Mexican properties	1,775,000	1,900,000	1,702,000
Other foreign:			
Cerro de Pasco	4,586,000	4,838,000	2,780,000
Chile	5,376,000	4,568,000	....
Katanga	3,877,890	3,262,800	....
Backus & Johnston	1,642,898	2,144,825	....

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery (*b*) Estimated.

"Nothing Is So Local as not to be of some general benefit."—(Lincoln). Thrift and War Savings Stamps not only bring individual or community prosperity; they bring national prosperity.

Labor and Gold Mining in South Africa

An excerpt from an address delivered by Sir Evelyn A. Wallers, president of the Transvaal Chamber of Mines, at the annual meeting of the Chamber of Mines, Mar. 24, 1919. Labor unrest, decrease in labor efficiency, and the increase in the cost of mining and milling supplies hove adversely affected the gold-mining industry in all parts of the world. What is being thought about this situation and what is being done in other gold-mining countries are of vital interest to our own gold miners. The address is a well-balanced statement of conditions in the most important gold-mining area in the world. The difficulties in South Africa find a somewhat similar parallel is our own gold-mining areas, and the gold-mining industry there, as well as here, is in urgent need of careful fostering if it is to continue to hold the important place that it has won among the great and essential industries.

TODAY we are assailed on every side with new formulæ for the solution and removal of industrial unrest and discontent, and many schemes are put before us of a more or less revolutionary character and of varying degrees of danger and complexity. There may be, therefore, a tendency for the issue to become confused, and, for those of us who are honestly trying to find a way out, to feel that we are in a kind of labyrinth. In that condition of mind, we might fall into the error of thinking that there is some rapid and drastic method of upheaval which will achieve what we all desire; in other words, that a short period of feverish thinking and doing will solve the problems. I am convinced this is not the case and that there is no short-cut.

Our salvation, employer and employed, lies in the apparently simple yet really very difficult work of building, piece by piece, with great persistence and infinite patience, upon the basis of steadily developing mutual understanding and desire for mutual good will. Let us make no mistake about it, gentlemen. Any suggested panacea for our troubles, whether it comes from employer or employed, that leaves out this essential factor, will never prevail; and it is just in so far as capital and labor in this industry have realized this great truth, and the measure in which we have jointly carried it into effect, that we shall find the reason for any degree of improvement in our industrial atmosphere that may have been achieved.

I believe the more complex the situation appears, and the more diverse the solutions that are offered, the more necessary is it for us to get a firm hold of this simple principle that must be in our hearts as well as in our heads—a constantly deepening sense of responsibility in industry to one another and to the community. The joint efforts in this direction of the workmen in this industry, their representatives, and ourselves, have doubtless on many occasions failed to produce the results hoped for and desired by all concerned, but, nevertheless, without doubt we have progressed along this line, and all betterment has sprung from it.

The first and very important step was the initiation of frequent round-table conferences, where facts, opinions, and views are frankly and openly discussed and set out for analysis. Here is to be found the beginning of understanding, the commencement of a knowledge of one another, and, what is perhaps more important, a knowledge of ourselves, and here, also, is the start made in removing—even though it be but a little—that appalling mutual distrust and suspicion. Personal and direct contact, and consequent proper understanding between employer and employed, is undoubtedly the secret of success in any business enterprise, and is one of the great difficulties with which we are faced in a large industry like ours. It is clearly physically impossible under modern industrial conditions. But this important fact emerges, however, and it is one upon which I, personally, hold very strong convictions: that is, if the men who are responsible for and have been placed in charge of the administration of industry show clearly that their line of thought and conduct is based on the broad principles I have mentioned, that influence will permeate the whole of their organization, and they will attract to them, and see that they get in the various degrees of management of their departments, men who similarly hold and practice those principles. And, unfortunately, the opposite will also prevail if men who are in positions of final authority have lack of imagination, and insufficient human regard for those who work with them, continuing to think of them simply as cogs in the industrial wheel. They are a menace to the community, because the tone they set and the influences they necessarily exert have far-reaching results. Our responsibility as employers, therefore, is great.

DANGER OF EXTREMISTS

And as it is with extremists who may exist among employers, so also is it with the similar type of man who may exist among employees. His line of thought and action is also extremely inimical to the interests of his fellow workers and of the community as a whole; he persists in an endeavor to discredit the intentions and actions of the employer who is out to do the right thing; he is, as far as can be seen, against all moderation, and he advises his fellow workers that salvation is only to be found in extreme and revolutionary methods, regardless of discipline and of law and order.

I have referred publicly on many occasions to the extremists among employers and employees, and I make no apology for doing so again, because I feel that they constitute the real danger. They are the definite obstruction to well-ordered, well-considered progress; they seek to obscure the identity of interest that in fact exists, and the coöperation between employer and employed that must be realized if really good industrial and social conditions are to be secured. And these things cannot and will not be obtained except as a result of everybody pulling his weight in the boat. It is foolish for us to imagine otherwise.

The aspirations on the part of workmen the world over toward reasonable working hours, the maintenance of good wages, and a definite and improved status in industry are perfectly legitimate and right, and every thinking man in the employing and managing sections of the community recognizes that fact.

That capital, for the most part, has been in the past wanting in the realization of its responsibility in these respects, and in other even more important aspects, is unfortunately true; indeed, the industrial and social atmosphere, in Europe especially, and perhaps here, too, in a measure, is sufficiently eloquent evidence of that fact. But the only useful purpose we can serve by looking back is to realize our errors. The period of enlightenment that has come has surely illumined the minds of both employers and employed, enabling us to see clearly enough, not only that these things are right and must be done, but also that what will make the doing of them possible is more thoughtful, better-organized and more scientific management on our part, and better work, increased loyalty, and greater effort on the part of those who work with us. There lies the way, I am convinced, to the working hours and the wage; to the educational and social conditions that will provide reasonable leisure and comfort, that will eliminate the fear of unemployment that at present wrongfully hangs over the heads of many men and women, and that will make possible the replacement of the material loss and destruction due to the war, and the successful shouldering of the present great burden of debt.

HOURS AND WAGES

Working hours and wages in industry must naturally be taken together and considered broadly as one question. It may be that in our industry there is somewhat less pressure on this question, because our wages and general 48-hour week, together with our holiday scheme on pay for all employees, and other working and living conditions, are probably in advance of most industries in other parts of the world. But it is, nevertheless, a fact that there is considerable pressure on other industries in this country for fewer hours, accompanied by either the maintenance of, or an increase of, the existing wage; and as most industries in the Union—and its prosperity as a whole—are allied to or alternatively rest upon the successful carrying on of the mining industry, it is vitally necessary for us, in the interest of all, to study the question with the utmost care. It seems to me that the extraordinarily high and far-reaching demands that are being put forward on behalf of the employees of some industries cannot have received the thorough consideration of the unions that are urging them, because I know that in the unions there are very many men who are keen students of industrial and social problems. It is therefore inconceivable to me that they will fail to realize the extreme danger of acting as if there were an unlimited margin in any industry, or in the wealth of the community, from which increases in wages and reduction in production, through shorter hours, can be met.

A recent statement by the Right Hon. J. H. Thomas, M.P., the leader of the British railway men, on this same subject must have been widely read and commented on. You will remember that he said:

" . . . People who tell you there is unlimited wealth somewhere, which you will collect if you can only find the key, are leading you on a false path. The truth is that the only wealth is the wealth we produce, and unless we keep that fact clearly in mind we are going headlong to disaster."

That is a strong statement, but, I think, a very true one, because increased wages clearly must be met out of increased production or increased efficiency.

It is sometimes argued that shorter hours mean greater production; and it is without doubt that the long hours worked in industry in years gone by were wrong and unsound in the extreme. Marked improvement has, however, been made since then, and obviously, with a continued reduction of working hours, a stage is reached when any further decrease means a reduction in production per man employed. In most industries, of course, an increase in wages is followed by an increase in the cost of commodities produced, and a vicious circle is then entered where further rises in the cost of living follow upon increases in wages. And, besides the effect of an increase in wages in itself automatically producing an increase in prices, it must always be remembered that the commercial community, when the cost of the goods it sells or its own working costs increase, usually adds somewhat more than this increased cost to the price at which it retails the goods to the community. The figures just published by the Cost of Living Commission show this very plainly: whatever increase took place in the cost of living of the individual merchants, in the working costs, and in the cost of their goods to them, it appears plain from these figures that considerably more than the equivalent was obtained from the community, more particularly by the wholesale merchants.

It may be suggested that to prevent such exactions the government or the community should undertake all the services at present rendered by these individuals, but I am sure that this procedure would not meet the difficulty. Instead of excessive individual profits we should then run a great risk of waste and inefficiency ensuing. The correct procedure, to my mind, is, while maintaining the initiative and efficiency (in individual businesses) which are admittedly obtained by the present system, to provide government with the necessary assistance that would enable producers and consumers to eliminate the unnecessary middlemen organizations which, in too great a measure, interpose themselves between the two, and by legislation to prevent the exploitation of the community.

For reasons which will be clear when considering the effect of increases in wages on the gold-mining industry, it is peculiarly important from the point of view of that industry that unnecessary increases in prices of commodities should be prevented, whether in the case of the stores purchased by the industry itself or in the goods consumed by its employees. Increases in the prices of the latter produce a demand for higher wages, the effect of which will presently be discussed. I state elsewhere that the increased cost of the stores consumed by the mining industry at the present time, as compared with their cost before the war, was about £4,000,000 per annum. No doubt the greater part of this is unavoidable increase due to war conditions (some of it being caused by necessary increases in wages in other countries), but an appreciable portion is an increase due not so much to profiteering on the part of manufacturers (certainly not the mining material merchants), but to inter-trading between agents. The more one considers the effect of profiteering and high cost of living on the industry, the more evident it becomes that the interests of the gold-mining industry and its employees are more identical in these respects than the interests of the employers and employees in almost any other industry.

Reverting again to the vicious circle in which increased costs of commodities follow upon each increase in wages, it is probably true that when purely internal trade only is concerned, and there are equal real wages throughout the country, this process could go on for a long time without serious injury, and possibly without greatly affecting production. When, however, the trade in question is largely an export trade, then clearly, unless the workers in the competing countries are employed under equivalent conditions, large increases in wages and costs will speedily destroy that trade. And even more clear than this export trade position is the position of an industry like the gold-mining industry where extra costs cannot be "passed on," owing to the fixed price of gold. If our increased wages are not met by increased production of efficiency, they must clearly be provided out of some existing margin of profit—or they cannot be paid. Were it possible to increase efficiency and the rate of production per unit employed, such a margin might be created.

Equally clear is the position of our mining industry on the question of fewer working hours. We know that it is necessary in underground working to get through certain definite tasks each day in order that the round of mining operations may be completed. In our underground work, as you know, natives are employed on the breaking of the rock, and they are not permitted to commence work until the working places have been examined by the European gangers to insure safety, and, further, the native workmen have to cease working before the end of the shift and in sufficient time to allow of charging up and blasting. The result, therefore, is that their actual working time on drilling the rock which must be broken in order to maintain operations is surprisingly short.

I would not say for a moment that we have yet done all that it is possible to do in the way of improving our efficiency of administration and the utilization of explosives and stores, but our margin in this respect is probably not great. But the point, therefore, is this—that unless our decreased working hours and our increased wages are accompanied by increased production and efficiency, they clearly have to be met out of the dividends paid to shareholders in our industry. It is a fact, however, that a considerable portion of the Rand shareholders' dividends are, unfortunately, either practically or actually non-existent, and it is not necessary for me to elaborate that point; and even taking the industry as a whole you will find on investigation that it is now paying under 2½% on the capital that has been invested in it.

Happily, the substantial increases in wages, the reduction in working hours, and the war bonuses, etc., paid during the last few years have not, so far, resulted in the closing down of any mines; but so far as our information goes at present we have certainly pushed matters in the interests of our employees to the limit that is justifiable for their sake and for the sake of the community as a whole; and I shall presently give you some figures which indicate the significant and great reduction in working profits earned and dividends paid by the gold-mining industry.

In some cases the position has been partially met by working only the richer ore in the mines, or by working it in a greater proportion than would otherwise have been done, thus shortening the life of the industry. This is a serious state of affairs, to which I have referred before on many occasions, and is, I am sure, clearly realized by our employees and the community generally. I am convinced, therefore, that on these important questions of working hours and wages we must all proceed with extreme caution and moderation, and I submit that we are today able to do so because, on the whole, our conditions in these respects are good.

Industrial Unionism and Control of Industry

A feature of the labor movement today which is coming into considerable prominence, and to which I should like to refer for a moment, is the indication by some leaders of trades unions that what is known as industrial unionism is the right objective for workmen and that following it in sequence will come the control and management of industries by the employees in those industries. Those views are usually accompanied by the opinion that the employing and managing sections of the community should be "eliminated." I have had the opportunity of discussing these questions with trade unionists who support them, and I have read as much as I have been able to about them during the past six months or so. I am bound to say that I doubt if the views current at the present time on these subjects have been thoroughly digested by those who put them forward, and I hold to my view that neither side—neither capital nor labor—can carry on without the other, that there is definite identity of interest, and that justice and common sense will prevail in the joint working of that interest. The question of industrial unionism or an amalgamation of unions is, naturally, a matter for the unions themselves to decide; but I imagine the breaking down of old-established barriers between craft unions is a subject that will require a good deal of thought and attention on the part of workmen, and take a good deal of time.

The initiative by which industries are started and expanded is, as a rule, the initiative of capital and the employer, and without it, I venture to think, any country would be in a state of stagnation. The system upon which industry is based is undoubtedly susceptible of much abuse, and has, indeed, produced in many cases conditions that have been unfair to workmen, but although it has worked badly in those instances, it has nevertheless worked, and is, and will prove to be, I firmly believe, capable of such improvement as will provide, for all concerned, proper and just conditions of living, if employer and employed together proceed on well-considered lines. The substitutes that have been put forward for the existing basis upon which industry works have always, it seems to me, been stated in somewhat vague and uncertain terms, and the comment that has been made upon them is, I think, fair comment, nemely, that a new heaven and a new earth cannot be achieved by a rapid process of "house-breaking followed by jerry-building."

The Lesson of Russia

Is it not a fact beyond dispute that today in various parts of Europe to some extent, but particularly in Russia, is being carried out an experiment on a huge scale of extreme social and industrial revolutionary methods? And with what tragic results to all concerned! Those unfortunate people, living and working under conditions that must have been monstrously unjust, and with hundreds of years of similar oppression behind them, were genuinely seeking to find a way out. The leaders who eventually arose were the wrong ones, and step by step the full extent of the calamity has been realized, until today the condition overshadowing all others resulting from chaos is the starvation that breeds madness—and that in countries teeming with population and extraordinarily blessed in natural resources. Surely we should believe that it is not for nothing that this tragedy is being worked out, but rather that it is for the purpose of impressing upon us all, employers and employed alike, certain lessons that stand out in the most vivid and striking manner.

Distribution of Wealth

While on this subject generally, there is another point that I would like to refer to briefly, and that is the contention on the part of some of the leaders of the labor movement that the distribution of wealth among the inhabitants of South Africa—I presume the white inhabitants are referred to—is extraordinarily unfair and unequal. I have no doubt the amassing of huge fortunes by individuals in this or in any other country that may have happened in the past will be taken care of by taxation or other means in the future, but let us look at the facts that emerge clearly from a perusal of the Income Tax Commissioner's figures in this country. You will find that, whatever is the position elsewhere, this particular idea of the unequal distribution of wealth is much exaggerated, so far as South Africa is concerned, because, as you will notice, if the excess over £300 of all South African incomes, including the incomes of companies, is taken and distributed over the whole adult European male population, the result of that distribution would be an addition of approximately £105 per annum to the then existing income of each. And this calculation leaves out of account the single woman, who is surely entitled to her share, and the native inhabitant of this country, who also must not be overlooked.

Unemployment

As regards the problem of unemployment, it appears to me that the question should be considered in two sections; first, unemployment which arises in normal times, and, second, that which will occur through the "carry over" from war to peace. The gold-mining industry, if it has a reasonably adequate supply of native labor, is in the satisfactory position of maintaining the number of Europeans who were employed under normal conditions (prior to the war), and, indeed, would be able to provide employment for an even greater number than that indicated if it had in its employ also an increased force of native workmen. As regards the second class of unemployment—unemployment following the war—this is clearly a national question, and like the necessity of an unemployment insurance fund, must certainly be dealt with by the state and community as a whole.

Industrial Conferences

I do hope that the necessary series of industrial commissions and conferences will take place, with equal representation of employers and employed; because in completing my remarks on these vital subjects I would reaffirm with all earnestness to you, and to the men with whom we work, the belief that it is possible to achieve by coöperation between employers and employed all the good results that are promised by the advocates of extreme and revolutionary schemes, and to do so without destroying and disorganizing industry and the peace and prosperity of all. And the starting point and the basis are to be found along the lines of the principle I put to you at the beginning of this address, and to which—I fear after considerable digression on my part—we return: that is, the development of mutual good will and the realization of joint responsibility.

Fortunately we were able to start the method of round-table conferences—the initiation of conciliation and reference boards—some years ago, and from what I have said you will realize that in my view the fact that we are perhaps somewhat ahead of industries in other parts of the world in regard to working hours, working conditions, minimum rates of pay, and holidays to all employees is entirely to be attributed to that beginning in mutual understanding and the realization of one another's difficulties and points of view. The greater part of our time throughout the year has naturally been employed in the adjustment and settlement of those industrial matters, and I do not purpose to refer to all the particular pieces of work in detail. Broadly speaking, there has been a steady improvement in conditions right along the line.

Since the adoption of the board-of-reference principle, there have been a great number of meetings of these boards of reference and conciliation, and, on the whole, the principle has worked well. Owing, I think, largely to the want of proper understanding of the details of the agreement between the unions and the Chamber, a few instances arose during the year where employees ceased work without submitting the matter in dispute to a board, as required by the agreement. As a result, we held a conference consisting of a large number of representatives of the executives of the various unions affiliated with the South African Industrial Federation, at which the point was fully discussed. We wished to ascertain definitely whether the unions desired to continue this valuable board-of-reference principle, and the representatives of the various unions unanimously reaffirmed that boards of reference should be held before any drastic action, such as a strike, took place. Since that conference there have been, perhaps, one or two instances where work has been stopped in the same way, but there are clear indications that the position has become better understood, and that in future the agreement will be carried out.

Apart from the great usefulness they have attained in the settlement of disputes, one has been impressed with the great educative value of these reference boards on employer and employee alike, a result that is bound to ensue when men sit down with a sincere desire to achieve a fair settlement and thereby gain not only greater knowledge of one another's difficulties but increased mutual respect.

The Year's Operations

The cessation of hostilities has not brought about any immediate relief to the gold mines so far as war costs are concerned. At each successive annual meeting of the Chamber since the outbreak of the war, I have set out briefly the burden of costs borne by the industry as compared with pre-war conditions. The year 1918 has shown a marked increase in that burden, which at a moderate estimate amounts to not less than £6,000,000 per annum, made up as follows:

Increased cost of mining supplies	£4,000,000
Increased gold realization charges	400,000
War bonus and increases in wages	1,000,000
Allowances to employees on active service	200,000
War levy	400,000
Total	£6,000,000

The effect of these increases on the prosperity of the industry was also more marked in 1918 than in any previous year. The dividends declared by the Witwatersrand Gold Mines in 1918 amounted to only £5,144,077, compared with £8,073,436 in 1914. Analyzing the dividends declared as between the Far East Rand mines and the remainder of the Witwatersrand, the heavy fall in dividends becomes still more evident. In 1914, of the total dividends declared, £8,073,436, the sum of £6,357,933 was by mines other than those of the Far East Rand. In 1918, those same mines declared dividends of only £1,929,430—a hopelessly inadequate return on the capital invested in them.

The working profits have decreased from £11,553,697 in 1914 to £7,500,270 in 1918, and from 9s. to 6s. per ton. Working costs have increased from 17s. 1d. in 1914 to 21s. 7d. in 1918, and the total costs from £21,943,692 in 1914 to £26,848,547 in 1918. It is true that this increase in working costs (most of which are expended on the Witwatersrand), coupled with the distribution of war expenditure on supplies, separation allowances, and other charges, has resulted in the unprecedented prosperity of the community, and we have certainly thus expended in working costs an additional sum of at least fifteen millions sterling during the period of the war, assuming equal tonnages treated. It is, however, a short-sighted view which considers that the elimination of a reasonable profit to the shareholder by the distribution of that profit in costs is really a satisfactory position, more especially when it is remembered that in many cases the continuation of operations by the mines has been possible only by a policy of extracting the richer ore in too large a proportion, thus shortening the lives of the mines, and, in the long run, the life of the community. The output for the Transvaal, at £35,768,688, unfortunately shows a further reduction of over two and a half millions compared with the previous year.

Our efforts to obtain some relief from the Union and Imperial governments have been, so far, unsuccessful. The report of the Gold Production Committee appointed by the Imperial government was, to say the least of it, disappointing from our point of view, and might fairly be thought to indicate a distinct want of appreciation on the part of the committee of the peculiar difficulties and disabilities of the gold-mining industry of the empire. Although the continuance of the gold mines at full pressure was urged, and undoubtedly was of the greatest importance during the war, no relief of the heavy burdens peculiar to the industry will apparently be granted.

It is difficult to bring home to the public that gold mining, far from being an exceedingly lucrative industry, associated apparently in the minds of many people with huge fortunes, is an industry extraordinarily unfavorably situated at a time of rising prices, and therefore an industry which, if its energetic continuance is desired, must be specially fostered and encouraged at such periods.

Canadian Mining Institute

The British Columbia branch of the Canadian Mining Institute is being reorganized by H. Mortimer-Lamb, secretary-treasurer of the Institute, who is making a tour of the province. It is proposed that the existing single provincial organization be divided into four distinct branches, representative of Vancouver Island and district, Victoria and district, Nelson and district, and Prince Rupert and district. Each will be charged with responsibility in connection with the promotion of the best interests of the mining industry within the limits of its territory.

Attention also is being given the matter of the annual Institute meetings, which hitherto have taken place in Eastern Canada. As it has been difficult for many Western members to make the transcontinental trip for a meeting of two or three days, it is proposed that there shall be an annual meeting in the West.

Trail Smeltery Ore Charges

The management of the Consolidated Mining and Smelting Co. has issued a circular under date of Apr. 23, 1919, announcing a reduction of ore treatment rates at the Trail Smeltery. It reads as follows:

> To Lead Ore Shippers:
>
> Schedule B. lead-ore rates, provides for adjustment of the base rate up or down on the increase or decrease in the prices of coke or labor as follows:
>
> On the price of coke, 25% of the increase or decrease per ton.
>
> On the price of labor per shift, 1½c. per ton for each 1c. charge per shift.
>
> The last adjustment was an increase effective Aug. 1, 1918, as outlined in our circular of Aug. 27, 1918, which amounted to 80c. per ton.
>
> The price of coke has advanced since then 40c. per ton, which indicates an increase of 10c. per ton of ore.
>
> The price of labor has decreased since then .3646c. per shift, which indicates a decrease of .55c. per ton of ore.
>
> The prevailing base rate of $8.30 per ton will be reduced, effective Apr. 15, 1919, 45c. per ton, or from $8.30 to $7.85 per ton of ore.

Since the beginning of the year 54 mines have shipped ore to the Trail Smeltery. The total number of tons of ore shipped for the period is 117,964. During the week ending Apr. 21 last, a total of 7420 tons was shipped to the plant. Following are the shipments from the various districts for the year to date: Boundary district, 22,832 tons; East Kootenay, 111,120; Nelson and Salmo, 446; Rossland, 38,825; Slocan and Ainsworth, $366; American Mines, 186, and miscellaneous, 113.

Oil Development in New Guinea

As the discovery of oil in commercial quantities in Papua would be of considerable advantage to British naval and mercantile interests, negotiations have been proceeding between the commonwealth and Imperial governments for expediting the development of the oil fields on a mutual basis. The Minister for Home and Territories recently announced that a satisfactory arrangement had been reached whereby each government will contribute £50,000 for testing areas where oil is believed to exist. British experts are to visit Australia and Papua.

French Imports of Spelter, according to the *Ironmonger*, amounted to 2416 metric tons in January, 1919, compared with 1433 metric tons in January, 1918, and 3408 metric tons in January, 1917. Zinc ore imported in January of 1919, 1918, and 1917 amounted to 4989, 2640, and 2519 metric tons, respectively.

Correspondence and Discussion

The "Big Bend" Situation

The Mexican situation is at present attracting general public attention; but there is one phase which has received only an occasional half column in the local papers and does not seem to reach the deeper news channels. I refer to the "Big Bend" border situation.

The "Big Bend" is the elbow formed by the Rio Grande River. It is part of the boundary between the United States and Mexico, is about 60 miles east of El Paso, Tex., and extends to within approximately 60 miles west of Del Rio, Tex. It is covered on the American side by the counties of Presidio and Brewster, and on the Mexican side by the states of Chihuahua and Coahuila. The boundary line here lies from 30 to 100 miles south of the Southern Pacific R.R. This railroad is the dividing line that separates this country from the rest of civilization. Once one leaves the railroad going south, he is in the wilderness and cut off from the outside world, and until he once more gets in contact with this artery of civilization he is out of touch with the world. These conditions lend themselves propitiously to the creation of the existing situation.

It is here that some of the ammunition (contraband) sold to the Mexicans is sent across the line. It is here that the Mexicans bring their stolen silver bullion and other loot to exchange for money, or—what they much prefer—clothes, ammunition, and food. Do not understand from this that the American Government is not cognizant of these conditions; it is, and is patrolling this bit of boarder, in a most efficient manner, with United States cavalry; but there are several hundred miles of this frontier. It is very rough; it is barren and arid, and long distances intervene between watering places. Also, it is unsettled and largely unfenced. Nevertheless, the vigilance of the American soldiers has materially lessened this traffic. The Mexicans resent this and retaliate by making raids to gather horses and cattle from the United States side, and, when opportunity offers or necessity drives, to kill and rob the lone ranchman or traveler.

Twice within the last six weeks such raids have occurred, and here is the interesting part: As soon as they were discovered by the Americans—and this was within a few hours after the raid occurred—a punitive expedition was dispatched to recover the loot. The marauders were found, and on both occasions a skirmish ensued in which several bandits were killed (fortunately no Americans were hurt), and after the smoke cleared away the stolen stock was recovered and returned. Another interesting fact is that one of the raids was, according to common report, headed by a Villista leader and the other by a Carranzista colonel.

Within the last six weeks an armed force has made incursions into Mexico in quest of outlaws, and on both occasions some of the raiders were killed. Far be it from me to decry or criticise these actions. I think that they are necessary under the existing circumstances, but it is too bad that these conditions exist. I have mentioned only two of these occurrences, but the outlawry has been going on for the last three years.

Existing conditions are to be attributed to the fact that the lawless element of Mexico has been passing backward and forward across the border ever since the Mexican trouble started, and the marauders have been, little by little, practicing their bad habits on the United States side of the line. In their own country all is fish that comes to their net; no person or property is exempt from their depredations, if they are able to despoil the victims and escape with the loot. At first they found that they could use the same tactics on this side. When they discovered a good horse or an unprotected individual they took the former or robbed and sometimes killed the latter. And all factions on the Mexican side are apparently equally guilty, both Villista and Carranzista adherents—the opportunity is all that they required.

So far as I can see, there is only one way to stop this, and that is to strike at the root of the trouble and restore law and order in Mexico. As it is, it is only the lawless ones that cause this trouble, but it is equally the fact that all parties bearing arms at this time in Mexico are lawless.

Twelve years ago I was in this same vicinity on the Mexican side of the line, and my person and property were as safe as they would be in any part of the United States. Today, were I to cross the line I would be extremely lucky if I were not killed within 24 hours after crossing the border. Z. Z.

El Paso, Tex., Apr. 26, 1919.

Occurrence of Gold in Sulphide Ore

In the *Journal* for Nov. 24, 1917, in the article on "Solving the Ore-Treatment Problem at the White Caps Mine," by John G. Kirchen, reference is made to the occurrence of the gold in the sulphide ores from that mine. As recorded in that article the conclusions reached regarding the occurrence of the gold were as follows: (1) The gold is not in a free state; (2) the gold is not in the form of a telluride; (3) the gold is possibly in the form of a manganese compound.

Work was undertaken in 1917 at the Mackay School of Mines to determine, if possible, how the gold does occur in this ore. It was necessary to discontinue the investigations of the problem before all the tests were completed, owing to the war work assumed by the metallurgy department. The following tests were run on high-grade ore from the White Caps mine. This ore assayed $275 in gold and ½ oz. silver to the ton. The ore had a pronounced cellular structure and consisted chiefly of the minerals quartz and calcite. The ore also contained smaller amounts of pyrite, stibnite, and realgar. Small bunches of stibnite crystals found in the vugs seem to indicate that this mineral was one of the last to be deposited. A black mineral, probably stibnite, also coats some of the pyrite and quartz.

After crushing the ore to pass a 115-mesh Tyler sieve, panning does not reveal free gold, noticeable under microscopic examination. Gold has, however, been obtained by several tests, which tends to prove that it does occur in the metallic state, very finely divided and coated by the sulphide minerals. These tests will be briefly described:

In the first test a small sample of minus 115-mesh ore was carefully panned. It was noted that a black scum first formed, and this was removed for a special test. No sharp line could be drawn between concentrates and tailing, and therefore the last of the material remaining in the pan was considered as concentrates. After treating the concentrate, very fine particles of gold were noted under the microscope. The scum proved to be mostly sulphide minerals; and after a treatment with nitric acid small particles of gold were noted under the microscope. In both instances the gold observed was so fine that it would pass a 200-mesh Tyler sieve.

In the second test about 10 gm. of material was removed from a specimen piece with a hammer. This material was fairly coarse, and, without further crushing, was panned. No free gold was noted. The material was then treated with nitric acid to remove any possible coating on the gold; and, on microscopic examination, several very fine particles of gold were observed. These particles were all under 0.033 mm. in their largest dimension. They were all free from any gangue minerals. The test seems to indicate the occurrence of the gold in either the vugs or in the sulphides and shows that it is coated with some mineral which obscures its identification in the untreated ore.

A third test was then run to ascertain what proportion of the gold could be dissolved by aqua regia in the fairly fine ore. A sample crushed to pass a 115-mesh sieve, and assaying 13.36 oz. of gold, was used in the test. After treatment with aqua regia the residue assayed 0.10 oz. of gold. A fourth test was run to ascertain whether or not caustic soda would remove the coating on the gold. A sample was placed in a bottle with a strong caustic-soda solution and a few glass rods to act as a grinding medium. After rolling, the material was panned and a few particles of gold were noted.

A fifth test was run with the object of amalgamating some of the gold if possible. A small sample was ground for several hours in an agate mortar with a little water, caustic soda, and mercury. After correcting for possible gold in the mercury used, it was found that 6% of the gold in the original sample had been amalgamated. A test run for a shorter time without any caustic soda indicated only traces of gold amalgamated. Specimens of ore polished and etched with nitric acid have shown what appear to be small particles and thin flakes of gold occurring in the vugs in the ore. Careful tests for tellurium and selenium were made on the ore and also on the flue-dust from the roasting furnaces, but no definite reactions for either element were obtained. Analyses for manganese in the ore indicated only 0.016% manganese.

No tests were made on this ore to ascertain the possibilities of dissolving the gold in the original ore by means of cyanide solution, but as this point was mentioned in the article to which reference has been made, it might be of interest to note the result of tests which were conducted on sulphide ore from the Dexter White Caps mine in the same district. The ore from the two properties is similar in general appearance and mineralogical composition. I found that with fairly strong solutions 33% of the gold could be dissolved on treating the raw ore, but the consumption of cyanide was prohibitive, being as high as 28 lb. per ton of ore treated. I also found that, with very weak solutions, as high as 52% of the gold could be dissolved, with a consumption of cyanide of 6.6 lb. of potassium cyanide per ton of ore.

As the result of these tests I conclude (1) that the gold in the sulphide ore occurs as native or metallic gold and is not in the form of a compound; (2), that it is extremely finely divided and is coated with some black mineral, probably a sulphide of antimony; (3) that failure to observe the gold under ordinary examinations, and also the circumstance that relatively little gold is found after careful examinations, is due to the facts (as brought out in the tests) that the gold is coated and is so fine as to make its recovery or detection extremely difficult without a most careful microscopic examination.

Walter S. Palmer.

University of Nevada, Reno, Nev., Apr. 15, 1919.

The Lyons Fair

The fourth annual fair at Lyons has been consistently and persistently advertised, and has been designed to replace the German fairs, which were so successful up to the beginning of the war.

The Lyons fair consists of a multitude of little booths filling all the public squares and parks. The booths are 15 ft. square, and are set in long rows. It is necessary to go up and down several steps in going from one booth to another.

One thinks of a fair as intended to attract visitors, and it is therefore something of a shock to see signs on many doors reading as follows: "The public is respectfully informed that this exhibit is open only to engineers, chemists, and plant managers." Another says, "Only those in a position to buy an expensive automobile are invited to inspect our exhibit."

A pretentious "exclusive representative" of American industries has catalogues of 61 manufacturers, arranged on shelves; and not a single catalogue is in French! The Canadian exhibit is well arranged and includes an interesting collection of minerals. Much business has resulted, but of course cannot be completed under present importation restrictions.

By far the largest part of the fair covers soap and perfume, toilet articles, and similar items. Only one American auto, the Overland, is in the section devoted to these machines, where there are 50 French machines. Paint is noted for its absence; and in view of the present deplorable appearance of the structures in France, that country should offer a wonderful field for paint manufacturers. It is true that much of the building is of stone and brick, but all the remainder requires freshening. I had hoped to see the silk exhibits, but the same secrecy (or, rather, conservatism) prevails, and admission to the Hotel de Ville, which is devoted exclusively to silk, is granted only upon presentation of a pass.

Probably by this time next year shipping conditions will be so improved that it will be worth while for American exhibitors to be represented here, particularly as it is proposed to build a series of suitable fair buildings. Hotel accommodations are utterly inadequate, and many visitors are unable to make satisfactory arrangements. Such accommodations as are available are unsatisfactory and expensive. All of this will, no doubt, be remedied next year. **Mark R. Lamb.**

Lyons, France, Mar. 15, 1919.

Details of Practical Mining

A portable thawer equipment offers a means of relief from some of the conditions that are met at mines where extreme cold prevails. The uses for such a device in the mining field are many, and in addition to the suggestions made it will be found that a thawer can be employed in many other ways.

The method of lowering dynamite into blast holes described in a following article may be more adaptable to quarry practice, but contains the suggestion that may be a pertinent one for open-pit operations where dynamite is used in deep holes. The manner of holding the dynamite stick and the device for subsequently accomplishing its release are both effective. The device might be safer, as suggested, if made of wood, but the same durability cannot be expected as would result if the holder is made of iron, or, better still, of copper or some ductile metal.

The slight expense connected with the installation described in the article "Ventilation for Prospects" makes it possible for the small operator to afford proper air circulation through his prospect shaft, and so not only add to the comfort and safety of the men but, in addition, to increase their efficiency.

Use of Thawers at Mines

In stripping or open-cut operations, when the work is carried on during the winter season, annoyance is often caused by freezing, which extends in a greater or less degree to all branches of the work. The exposed nature and the extent of territory usually covered by operations do not permit of much relief from this condition, and even though the work is continued through the day and night shift, the delays caused by freezing of equipment consume considerable time, and the total loss from this source mounts to a formidable figure at the end of a season's work.

Flooding of tracks and switches, causing accumulations of ice, and the freezing of overburden, ore, or coal in cars, are some of the inconveniences incident to winter operations at open-pit mines. A number of methods of overcoming the difficulties are now available, but most of these are unsatisfactory and, at best, expensive. Among them are applications of hot salt solution, removal of the ice with picks and brooms, and the building of small fires.

The Hauck Manufacturing Co., 101 to 113 Eleventh St., Brooklyn, N. Y., has placed on the market the Hauk thawer, the use of which offers a successful substitute for all of the above-mentioned methods. In addition, the thawer may be used to good advantage in the thawing of overburden previous to drilling and blasting, trenching, and in other instances where a quick, continuous heat is required. The thawer is furnished with either a compressed-air type of burner or one of the hand-pump type. The flame is always under the perfect control of the operator, and the burner is built to withstand the hardest kind of service and severe weather conditions.

METHOD OF THAWING COAL CAR

Delays from freezing are likewise frequent, in underground mines, although not to such a degree as in surface operations. A downcast shaft, however, draws in considerable cold air, which is always noticeable directly in the shaft and for some distance in the vicinity of shaft stations. Owing to this cause, ice in and around shafts is not uncommon, and frequently it creates a condition which not only inconveniences operations but is dangerous as well. The Hauk thawer offers possibilities as a device for ice and snow removal about shafts.

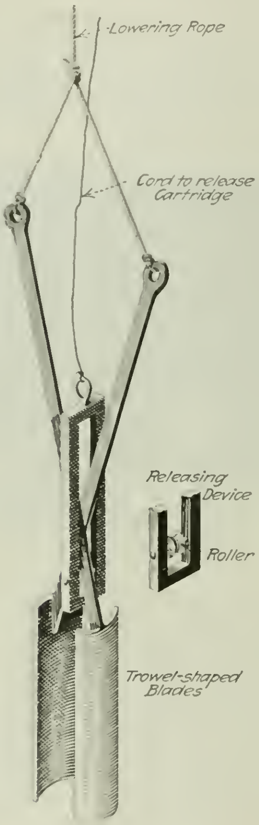
Lowering Dynamite Into Blast Holes*

The sketch on page 926 shows a holder device for lowering dynamite into blast holes which obviates the practice of dropping the sticks, as is frequently done in instances where the holes are of considerable depth.

The holder consists of a pair of tongs with the blades trowel-shaped to fit the cartridge. A rope which branches in a V to the upper end of each handle holds the jaws shut and prevents the cartridge from falling out. A second cord is employed to release the cartridge. It is attached to the upper end of a bar with a slot, through which passes the intersection of the jaws at their pivot. This slot allows the bar to slide upward when the cord is pulled. At the lower end of the slot is a roller which ascends in the inverted V formed at the pivot and spreads the jaws of the holder, releasing the cartridge. An improvement which might be suggested for this device would be to make it of hard wood rather than of iron. There are two dangers surrounding the use of a metal instrument. First, nitroglycerin may get around the pin where the jaws work against each other, and so cause an explosion by friction. Second, lowering of sticks repeatedly into the same hole may result in small bits of dynamite being rubbed off on the walls of the hole or small particles remaining on the jaws of the instrument, and these may be struck between the iron and the rock surface in hauling the device from the hole.

---

*Abstracted from Technical Paper 111, U. S. Bureau of Mines.



HOLDER FOR LOWERING DYNAMITE INTO BLAST HOLES

Ventilation for Prospects

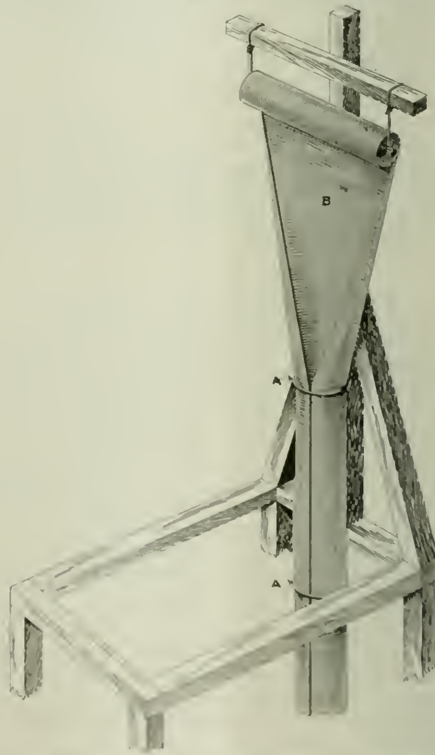
By Charles E. Dutton[*]

In recent years there have been deaths from gas in metal mines in which men have been employed in old workings. In the cases coming to my notice from Butte, Goldfield, and Arizona, the accidents could probably have been avoided by the taking of proper precaution. Since carbide lamps have come into extensive use, metal miners have become prone to forget the candle's warning. A shaft that has been closed for any length of time should be swept out with fresh air before being entered.

Often shafts and other workings in isolated districts have poor natural ventilation. When a prospector or engineer shows up to look such a prospect over, his investigation must generally be limited until he can clear out the bad air. Usually he does not care to go to undue expense, or waste much time in doing this.

Under such circumstances, a home-made cloth air-pipe will be found useful. A bolt of cotton cloth, which can be found at any camp having a store; a needle, a spool of linen thread, some baling wire and a pair of pliers are all that is needed to make the device, which is shown in position in a shaft in the accompanying illustration.

In the sketch, the section from the upper ring *A* to the bolt *B*, hung on the cross-piece, acts as a sail and will catch any breeze from three directions. In case the wind comes from the rear, the bolt should be turned around. If sinking is in progress, the pipe may be lengthened in a few moments by sewing up another five-foot length, inserting another ring, and readjusting the bolt overhead. If the shaft is in a ravine, and no breeze is moving, or if the device is used in a winze, a blacksmith-forge blower can be connected to force air below. If used in a tunnel from the portal, it can be hung from the roof or side wall. In fact, it will be found a useful accessory to any prospect. When no longer needed, the pipe may be rolled up on the bolt, and held ready for another emergency.



CLOTH AIR-PIPE USED FOR VENTILATING OLD PROSPECT SHAFTS AND SIMILAR WORKINGS

---

[*] Goldfield, Nevada.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief Hearings

St. Louis has been added to the places already selected for hearings before the War-Minerals Relief Commission. This action was taken to make it more convenient for some claimants residing in Arkansas. The initial hearing will be held in St. Louis, beginning at 10 a.m. on June 10. The next hearing will be at Little Rock, and from there the commission will visit the other points previously designated for hearings, and which already have been announced. The commission is calling particular attention to the fact that all claims must be filed in Washington on June 2, if they are to receive consideration.

A number of hearings will be conducted in Washington before the commission leaves. On May 13, the commission heard the presentation of the claim of Henry B. Maxwell, of Hampton, Tenn., who has made claim for $10,000. A further hearing on the claim of the Chestatee Pyrites and Chemical Co. was conducted May 14 and 15. Owing to the fact that the report of the Government's mill engineer is not ready, a further hearing will be held May 28. The Oneida Mines Corporation, of Duluth, which has a manganese claim for $231,363, presented evidence to the commission on May 16. Audley H. Stow, of Bluefield, W. Va., who has a manganese claim for $25,647, was heard May 17. The National Pyrites and Chemical Corporation, of Pyriton, Ga., has been promised a hearing in Washington in the first week of June. The National Refractories Co. has been given the choice of a hearing in California, during the trip of the commission, or in Washington after its return.

During the seven-day period ended May 15, the larger demands received were filed by the following claimants: Porter, Allen, Nesbit and Nance, Radium, Colo.; Payne and Thomas, Nederland, Colo.; Whitehorse mine, Philipsburg, Mont.; Leavell and Curtis, El Paso; Butte and Plutus Mining Co., Butte; Pillsbury, Crowder, and Kay, Chico, Calif.; Eugene Stevens, Boulder, Colo.; J. J. Appel, Philipsburg, Mont.; J. H. Cook, Batesville, Ark.; Logan Rives, Batesville, Ark.; Gallagher and Grasselly, Peoria Flat, Calif; E. B. Clark, Seattle; C. E. Groce, Blythe, California.

War Materials Sales

During the week ended May 9, the sales of surplus war materials amounted to $77,901,960.18, a large figure as compared to the amount realized from the sales of the preceding week, which was approximately $1,500,000. The larger part of the figure represents sales made through the Ordnance Department, which reported a sales total of $45,883,995.74 for the week, over half of which was realized from the disposal of ammonium nitrate, of which the Government had a large quantity and which was made surplus to the War Department when munition manufacturing ceased.

It is planned to convert the ammonium nitrate into dynamite, and the Department of Agriculture has purchased a large quantity for $10,320,000, which, when converted into dynamite, will be used in clearing land for agricultural purposes, and will also be extensively used in the building of better roads. Large quantities were also sold to the Allied Nitrate Commission and the Importers' Association, which, it is planned, will be used for similar purposes in foreign countries. The Ordnance Department also sold $15,000,000 worth of copper.

Nitrate Importations

The War Trade Board announced on May 19 that on and after July 1, 1919, nitrate of soda and nitrate of potash may be imported into the United States without restriction under a general import license when coming from countries with which general trade is authorized.

Importers are advised that any shipments of nitrate of soda or nitrate of potash which arrive prior to July 1, 1919, will not be released for entry until such date, except under individual import licenses as now required, and that such licenses will be issued only in accordance with the present rules and regulations governing the importation of these commodities.

The Iron and Steel Industry During the First Four Months of 1919

The iron and steel industry, for the first four months of 1919, comprising the production and marketing of iron ore, pig iron, and steel, has, on the whole, shown little change in volume, as compared with the corresponding period of 1918, according to E. F. Burchard, of the U. S. Geological Survey. Considering that in 1918 the nation was involved in a war the end of which could not be foreseen, that the demand for iron and steel products for war purposes was at its height, and that in 1919 war orders were suspended and construction activities for the most part held in abeyance awaiting price adjustments to follow the declaration of peace, the showing of early 1919 seems favorable indeed, and should foreshadow increased activity as soon as open market conditions become better established. In the meantime, however, a further slowing up is to be expected.

LAKE SUPERIOR IRON ORE

In the Lake Superior iron-ore districts the stocks of ore at the mines Jan. 1, 1919, were about 23% less than those of one year earlier, and on the Lake Erie docks they were about 10% less. The navigation season having opened earlier in 1919 than in 1918, it has been possible to ship down the Lakes a greater tonnage of iron ore thus far in the present season, so that a total of approximately 1,412,000 gross tons was moved to Apr. 30, compared with 236,000 tons at the corresponding date in 1918. This has restored the balance of ore on the docks at the Lake Erie ports, so that there is no danger of shortage. Better railway facilities in the spring of 1919 have made it possible to forward 4,266,000 tons of iron ore from the Lake Erie ports to inland blast furnaces up to Apr. 30, 1919, compared with 2,642,000 tons to Apr. 30, 1918.

Prices of the standard grades of iron ore from the Lake Superior districts, delivered at Lake Erie ports, have been reduced 20c. a ton, on account of a cut of 20c. per ton in the vessel carrying charge. This represents a reduction of 3 to 3.5% in cost to the consumer at Lake Erie ports. The iron mines are reported to be in good condition to produce a large season's output, but the demand for ore on Apr. 30 was comparatively light.

DAILY PIG-IRON PRODUCTION DECLINES

In the first four months of 1919 a total of 11,811,000 gross tons of pig iron was made, compared with 11,232,000 tons in the corresponding period of 1918. The daily average production of pig iron, by months, has shown a steady decline from 106,500 tons in January to 82,600 tons in April, 1919, and the number of furnaces in blast in January was 350, compared with 212 at the end of April. The downward curve of daily average production in the first four months of 1919 is just the reverse of that in January to April, 1918. With so many blast furnaces idle, the curve may show a still further depression before the next upward swing. Prices of pig iron on Apr. 30, 1919, were $7.25 per ton lower than in October, 1918, and $4.25 lower than on Jan. 1, 1919. These prices represent reductions of about 20% and 12% respectively.

STEEL

The production of steel ingots from Jan. 1, 1919, to Mar. 31, 1919—later figures are not available—was approximately 8,475,000 gross tons, compared with 7,588,000 tons in the corresponding period of 1918, an increase of nearly 12%. Prices of 4-in. steel billets on Apr. 29 were quoted at $38.50 per ton, compared with $43.50 Jan. 1, 1919, and $47.50 on Nov. 11, 1918. The unfilled orders of the United States Steel Corporation on Mar. 31, 1919, amounted to 5,430,572 gross tons, compared with 9,056,404 tons on the corresponding date 1918, a decrease of about 40 per cent.

Surplus Iron and Steel Stocks

Plans for the disposition of surplus stocks of iron and steel in possession of the War Department were arranged at a series of conferences held between representatives of the Director of Sales and committees representing the American Board of Scrap-Iron Dealers and the steel industries of the United States.

The meetings were called so that the Government might obtain the views of the leading representatives of the steel industry, in order that their ideas might be utilized in formulating a policy for the disposal of the Government's surplus iron and steel. Government representatives emphasized the statement that they wanted to sell in such a way as to affect industry least and at the same time realize the maximum return for the Government.

It was the consensus of opinion of the meetings that all steel and steel scrap material should be disposed of by means of sealed proposals, to be accompanied by a certified check for 20% of the amount of the bid made, which amount would be applied against the last shipment, intermediate shipments being made with sight-draft bill of lading. This method, in their opinion, would be productive of the best results to the Government, and was eminently fair to all bidders. As a result of a discussion as to whether or not sales should be made "on ground" or "f.o.b. cars," the latter arrangement was determined upon as the best for the Government to follow, for, by so doing, more bids would be secured and at more favorable prices. An out-of-town bidder would not know how much it would cost to place the material on cars, and without such information would not be in a position to make an intelligent bid.

The totals of not only scrap, but of semi-finished and finished material, as well, were shown, and it was conceded that the entire quantity was much smaller than had been anticipated. For the purpose of comparison it was reported that the country consumed in 1916 about 12,000,000 tons of purchased scrap, so the present surplus of approximately 605,000 tons would represent only a small percentage of the 1916 consumption.

Removal of Import Restrictions Upon Emery

The War Trade Board announces that all existing restrictions upon the importation of emery and emery ore have been removed, effective May 13, 1919, and that shipments of such commodities may hereafter be entered under General Import License PBF-37, described in W.T.B.R. 726, issued May 8, 1919.

Shipments of emery and emery ore now in the United States, entered under import licenses which were issued upon the condition that such emery or emery ore would not be used for consumption until a period of 60 days had elapsed from the date upon which the restrictions against the importation of emery and emery ore were removed, are released for immediate use, and such condition need not be further observed by the holders of such licenses.

Tariff Revision

Although Republican leaders are practically agreed that the extra session of Congress is not the opportune time to attempt general tariff revision, they are ready to urge the safeguarding of such industries as were not highly developed in this country before the war, but which have assumed important proportions since foreign supplies were restricted. The Democrats do not expect to oppose bona fide protection of this character. The best example of this class of industry is that engaged in the manufacture of dyestuffs and other coal-tar products.

It is admitted that a tariff alone will not afford practicable protection to the dyestuffs industry, and efforts are being made to devise a licensing system to augment the tariff. Administrative difficulties are great in the carrying out of licensing, and there is grave doubt as to whether any satisfactory plan can be evolved. If a practicable plan should be devised, it would apply to other commodities as well, it is believed. Strenuous efforts are to be made, for instance, to preserve the potash and magnesite industries which have been developed in this country during the war.

Consolidation of Bureaus

The War Trade Board announces that, effective May 12, 1919, the Bureau of War Trade Intelligence has been merged into the Bureau of Enemy Trade. Such work of the Bureau of War Trade Intelligence as is still being carried on will be conducted in the future by the Bureau of Enemy Trade.

Bureau of Mines To Dedicate New Buildings

The Bureau of Mines, Department of the Interior, during the week of Sept. 29, 1919, will formally dedicate its new million-dollar laboratories and workshops in Pittsburgh, Penn., at which time Government officials, together with the governors of the principal mining states and the leaders in the mining industries and miners' organizations, will be present to take part in the dedicatory ceremonies.

One feature of the dedication will be a great, national "safety-first" meet, which will be participated in by teams of miners from various sections of the country. There will be contests in mine rescue work and in first aid to the injured, and, as there is considerable rivalry among the teams of the different mining companies, it is expected that these competitions will require at least two days for decision. On Sept. 30 the elimination contests will begin at Forbes Baseball Field at Pittsburgh, and will continue until only the winning teams are left for the final championship contests, which will take place on Oct. 1, immediately after the elimination trials are completed. It is hoped that the coal operators in the Pittsburgh districts, employing thousands of men, will declare a holiday on the day of the final contests. At the last national "safety-first" meet, which was held in 1911, more than 18,000 miners were present. The contests are to be open to all teams from the mining and metallurgical industries of the United States.

Other events of importance will make the dedication an occasion for a notable gathering of engineers and scientific men. The different laboratories of the Bureau have been completely equipped for the investigation of various problems relating to increased efficiency in the mining and metallurgical industries. Visitors will be invited to the electrical and mechanical workshops and laboratories of the Bureau and also to the petroleum, gas, and coal laboratories, the testing gallery of the mine safety section, and the industrial gas-mask division.

Another point of interest will be the experimental mine of the Bureau at Bruceton, Penn., 12 miles from Pittsburgh, where an actual explosion of coal dust in the mine will be staged for the benefit of those attending. The dedication will cover three days, Sept. 29 and 30, and Oct. 1.

Bureau of Mines Chiefs in Salt Lake City

SALT LAKE CITY CORRESPONDENCE

A gathering of the chiefs of the various substations of the U. S. Bureau of Mines in the Western states was held in Salt Lake City May 7, to meet Dorsey A. Lyon, of the Bureau at Washington, who has been in this city inspecting the work of the local station and making visits to smelting plants and mining properties in this section. The object of the meeting was a discussion of means to further better coöperation between the Bureau and mine operators. In a speech, Dr. Lyon pointed out that the Bureau holds the same relation to mining as the Bureau of Agriculture to farming.

The report of work for April at the University of Utah station shows the month to have been an active one. New Cottrell treaters and electrical equipment were installed and found to be satisfactory. Small-scale tests on complex lead-zinc ores of the state gave such good results that further experiments will be made in the larger rotary kiln—maximum capacity 300 lb. per hour—and in Cottrell treaters. Muffle tests were made on complex ores from Utah and surrounding states; also tests on pure silver minerals in a small-scale rotary electric furnace.

Work on the lower-grade alunite from the southern part of the state was continued; also on ore-dressing and roasting problems, done in coöperation with several mining companies. Work on concentration and flotation tests for quicksilver ores was begun. Tests of oil shales were made at a local plant, indicating that satisfactory results may be obtained; also, investigations concerning the smoke problem of Salt Lake City.

Edward L. Dufourcq

Edward L. Dufourcq, whose tragic death in Mexico was recently reported in the *Journal*, was a member of the class of '90 at Columbia, Arts, and of '92, School of Mines. He practiced mining engineering from the time of his graduation, his chief interests being in Mexico. He was a member of the Delta Kappa Epsilon and Tau Beta Pi fraternities. Mr. Dufourcq contributed the section on "Gold Amalgamation and Cyanidation" for the "Mining Engineers' Handbook," published about a year ago and edited by Prof. Robert Peele. He was a member of the American Institute of Mining Engineers, Mining and Metallurgical Society of America, and the American Museum of Natural History (to which he had given some rare mineral specimens), and was assistant general manager of the Teziutlan Copper Co. in Pueblo, Mexico, and president of Las Minas Pedrazinni, Arispe, Sonora, Mexico.

EDWARD L. DUFOURCQ

On Dec. 1, 1918, Mr. Dufourcq left for Mexico, to go to the mines at Teziutlan. On Apr. 15 of this year, a little after 6 p.m., he was riding with the mine superintendent from the town of Teziutlan to the mine, travelling on a gasoline motor car used on the railroad, when both were shot by bandits. The superintendent and Mr. Dufourcq were wounded, the latter falling from the train. Both were taken by the bandits. The superintendent was finally released. He requested that Mr. Dufourcq be released, but was informed that he would not be given up till morning. At 3:30 a.m. on Apr. 16 Mr. Dufourcq died of wounds. At about 9 a.m the next day his body was found, robbed of all belongings.

The body was shipped from Mexico, and a funeral service was held at Christ Church, Broadway at 71st St., New York.

Return of Minnesota Iron Range Members of the 27th Engineers

A "welcome-home" dinner, held at the Hibbing Public Library, Hibbing, Minn., was given to returning Minnesota iron range members of the 27th Engineers on May 8, by Oscar B. Warren, general manager of the Meriden Iron Co. Three of the men comprising the Minnesota contingent are employees of the Meriden company. The roster comprised: Company A—John Edwin, Nashwauk; Clifford Nichols, Hibbing; Odin Rudstrom, Chisholm. Company B—Herman Adams, Aurora; Richard O. Hocking, Hibbing. Company C—Fred Flink, Nashwauk; Frank Kline, Eveleth; Howard Rutherford and Jacob A. Stampe, Hibbing; Ray Segog, Duluth; O. C. Torvund, Ely. Company D—Kenneth Gregory, Keewatin; Joseph Sorby, Chisholm. Headquarters Company—Frank Manley, Hibbing. The menu follows:

ASSEMBLY ROLL CALL
MENU
ZERO HOUR 7:30 P.M.
ROLLING BARRAGE
à la Memories
From 40 Hommes
8 Chevaux.
No interference from
M. P.'s or R. T. O.'s.
You all know which trip?
OVER THE TOP FRUIT COCKTAIL
Heavenly Hash
FIRST WAVE SOUP
HAND GRENADES SHRAPNEL
MACHINE GUN BULLETS
DELAYED THANKSGIVING TURKEY
RIGHT dressing FRONT gravy
FRENCH ROLLS
AT EASE POTATOES
CAULIFLOWER
à la Officers' Mess
DUDS
Mustard Gas Dressing
EMERGENCY RATIONS
PUMPKIN PIE
Just as Mother Bakes
CONCENTRATED PHOSGENE
S. A. COFFEE SMOKE SCREEN PRODUCERS
——SURPRISE ATTACK——
GAS ALARMS
From All Members of the 27th
RECALL

In addition to those whose names appear on the roster, there were present B. W. Batchelder, general superintendent, International Harvester Co.; M. H. Barber, general superintendent, Cleveland-Cliffs Iron Co.; E. J. Maney, manager, Shenango Furnace Co.; F. P. Botsford, general superintendent, Pickands, Mather & Co.; D. E. Woodbridge, and O. B. Warren.

Most of the returned soldiers told of some of their experiences over seas, and the evening proved an interesting and instructive one. Mr. Warren and Mr. Woodbridge spoke briefly, and it was decided to hold another meeting at a later date for the purpose of forming a Minnesota Range Association of the 27th Engineers.

Canadian Industrial Commission

TORONTO CORRESPONDENCE

The members of the Industrial Relations Commission, who are making a survey of the dominion, have finished the sittings at Cobalt. There does not appear to be a wide gulf between the operators and the miners, the chief cause of dissatisfaction being the refusal of the mine managers to recognize the union, the reason being that the administrative head of the union is in a foreign country, and that it is an offspring of the Western Federation, which the managers refuse to recognize. The workers also spoke in favor of an 8-hr. day from collar to collar, and for an 8-hr. day for surface men, instead of nine hours. They also felt that as they were paying hospital dues they should have representation on the board. As Cobalt is the highest paid camp in eastern Canada, and as the prospects are that wages will be increased with the higher prices for silver, there is little cause for dissatisfaction. Drill runners are paid $4.75 an 8-hr. shift, with 25 to 50c. extra for sinking, and the other workers are paid in proportion. Only a few of the surface men come under the lowest rate, which is $3.75 a day.

Association of the 27th Engineers

A circular letter was issued to all former members of the Regiment under date of May 10, 1919. Numerous of these letters have been returned, owing to imperfect addresses. Any former member of the Regiment who has failed to receive this letter is requested to notify W. R. Ingalls, 115 Broadway, New York, who also desires to be kept informed of changes of addresses.

REPORT OF TREASURER

JAN. 1, 1919—APR. 30, 1919

Balance on hand Jan. 1 and subsequent receipts were as follows:

Balance on hand	$7582.49
Contributions reported in E. & M. J.	717.60
Interest on bank deposit	62.54
Membership dues	5.00
Proceeds from sale of wool	40.85
Loans to members of Regiment, repaid	75.00
Total	$8483.48

Disbursements were as follows:

Band instruments and music	$243.30
Assistance to men detained at Camp Merritt	565.00
Relief in cases of need	255.00
Loans to members of Regiment	75.00
Expended through Colonel Perry	451.62
Welcome home sign	8.00
Exchange on bank checks	1.21
Total	$1599.16

The balance on hand May 1, 1919, was $6884.32.

A commemorative medal has been made, one of which will be sent to each former member of the Regiment. These are now ready for distribution and will be mailed as soon as the roster can be checked for the correction of defective addresses. A history of the Regiment is being prepared, and as soon as published a copy will be mailed to each former member. After these expenses have been paid there will remain in the treasury a substantial sum. Following a conference with the Advisory Committee it was decided to husband this fund for the assistance of former members of the Regiment who find themselves in real need. W. R. INGALLS,

Treasurer.

Ralph S. Edmondson, vice-president of the Abrasive Iron Co., with a plant at Harrison, N. J., and main office in New York, lost his footing and fell under the wheels May 16 when trying to board a Jersey Central train at the main station in Elizabeth. Both his legs were crushed, necessitating amputation in the Elizabeth General Hospital.

Mr. Edmondson was 1st lieutenant in Company A, 27th Engineers, throughout the campaign in France, and during part of the time was commanding officer of the company. His feet have been amputated just above the ankles. He is resting comfortably in the hospital, and it is expected that he will be able to return to business.

Editorials

Congress in Extra Session

CONGRESS convened in extraordinary session on May 19. More than the usual number of urgent questions are to come before this Congress, of which the most important are the ratification of the peace treaty and action on the creation of the League of Nations. Many matters which vitally affect the welfare of the nation await decision. The fate of the railroads and the telegraph and telephone lines must be settled. The shipping problem, national prohibition, the woman's suffrage amendment, a peace-time naval and military policy, the revision of the war-revenue law, the institution of a budget system, the welfare of discharged soldiers, laws to suppress the spread of Bolshevism, repeal of the war powers granted to the President, restriction of immigration for a period of years, revision of the naturalization laws and the deportation of alien undesirables are some of the weighty problems that press for solution. Among the questions of interest to the mining industry, and which may reach a hearing and possible settlement at this session, are the oil- and mineral-land leasing bill, and tariff and labor legislation.

The American Mining Congress plans to ask for a permanent upbuilding of a few war essentials in a National Resource Bill, which will include only substances not profitably produced except by Federal aid, protective or otherwise. It is also the purpose of this organization to draft legislation aimed to modify the drastic provisions of the Sherman Anti-Trust Law and to create a Federal commission through which combinations not in restraint of trade may be legalized and placed under Government control.

Across the Atlantic

LOVE of adventure sends men away from their firesides to the four quarters of the earth. Soldier, sailor, pioneer, and miner are alike impelled by this force. Whether it is the storming of a trench, the chase of a submarine, the clearing of virgin land or mushing through the far stretches of northern Alaska in search of the elusive placer, there will always be men who are willing to take the chance, and not for the money that is in it but out of the pure joy of novel accomplishment and through desire for new things and the passion to escape the humdrum of ordinary pursuits. Roosevelt hunted big game in Africa; Cecil Rhodes opened up a vast land, and history is replete with stories of men who have overstepped the superficial boundaries of ordinary existence and have accomplished what they wanted to do.

Not many years ago the crossing of the Atlantic upon wings would have seemed a dream. It has actually been accomplished. Men of our Navy have coolly calculated the undertaking in a manner similar to the solution of any engineering problem. Distance, weather conditions, plane construction, communication, control instruments, flight details, and the insurance of the maximum opportunity of rescue in case of mechanical difficulties were all figured to a hair. The thing was done. The accomplishment is a triumph to the man who sits at his desk and figures out his problem, and, with confidence in his calculations, is courageous enough to act. More than that, the success of the men of the Navy is an inspiration to every engineer. All honor to the men who did the trick, from the humblest worker in the shop to the lucky fellows who crossed the Atlantic!

Trade Relationships

IN A RECENT address to the Sixth National Foreign Trade Convention at Chicago on Apr. 24, Eugene Mayer, Jr., after making a plea for a "live-and-let-live policy," said:

"But a certain caution in international trade relationship is still imperative. Even if we now join a concert of nations for the purpose of preventing war and for the settlement of international disputes, we may not safely assume a complete fruition of our every hope. I think every country will be justified in endeavoring to assure its economic integration to the greatest extent that is possible. The war has taught us the value of certain key industries. We should demand the preservation of those industries, and should endeavor to secure the supplies and materials necessary for their maintenance, and we should be equally willing to contemplate other countries doing the same thing."

It will take time for the lessons of this war to sink in, and we should keep these lessons before us, lest in the midst of diverse discussion we overlook them. It is wisdom to make our country as nearly a self-contained unit as possible. The base of such a structure is founded upon the availability of raw products. We have the technical skill. We have finances. We can build manufacturing establishments. The need for the development of a national policy having for its objective the encouragement of those industries which are in a position to insure the supply of basic raw materials is of vital moment.

The Treatment of Bolshevism

FROM some of the numerous outpourings on the subject of Bolshevism we cull the following paragraphs:

"The aim of the Bolsheviki is communism and equality for everybody. We may find out eventually that Bolshevism is not the proper means for attaining our end. We will then act accordingly and somehow reach communism by opportunism, but always work toward communism.

"We believe that ultimately everything must be socialized. Everything must belong to the state, and no one must own anything. A person may have anything he wants simply by asking for it. That is our Utopia, which we may not reach for a long time, of course."

There is a delightful vagueness about all this, as well as a singular disregard for sound reasoning. A perspective based upon history and an understanding of sociology and economics is the best corrective for loose thought. At present the hold that Bolshevism has attained is due largely to the ignorance of the individual, who is swayed by the thought that, just beyond, there is some unusual fulfillment of human desires, obtainable not by the ordinary route of hard work and good living, but by some short-cut that is devoid of effort and sweet in taste. Each of us cherishes illusions of one kind or another, but Bolshevism, communism, or any other "ism" of like kind is a delusion of a vicious nature. That it will ultimately work itself out, in those countries where it appears to have secured a foothold, just as a plague runs its course, goes without saying. In the meantime it is best handled in a manner similar to that called for in the treatment of a malignant disease—by quarantine of those affected by it.

Thrift and Investment Protection

DURING the period of the war all countries, particularly those engaged in hostilities, having been in need of an excessive amount of money to finance their activities, conducted campaigns of saving. The campaigns met with remarkable success, as witnessed by the number of small investors in government securities and the growth of deposits in the savings banks.

The education that produced these results was needed perhaps more in the United States than in other countries, for here thrift had previously been a matter of no special public interest. Remarkable as the results have been, it is probable that the necessity and the practice have not prevailed long enough to become a habit in those to whom the idea was novel, and, unless spurred on or assisted, many will let their savings go and soon be back to the old hand-to-mouth existence, with no thought for the morrow.

Aside from the personal benefits derived from saving, which are really a national concern, our Government will be in need of large amounts of money for many years to some. This money must be derived from taxes, and the taxes will be derived largely from incomes. It is therefore imperative that the Government do all that it may to encourage further saving, and, what is still more important, it should protect, as far as possible, those who have saved.

The British government is fully alive to the situation and is continuing its control of new capital issues. The Investment Bankers' Association of America has made a survey of the situation and is strongly in favor of publicity, supervision of new issues, and the oversight of promises made by venders of securities.

In this connection there are in the statutes of many Western states the so-called "blue-sky" laws, which are intended to protect the investors of those states against fraudulent promotions by domestic and foreign corporations. These laws have to do with speculative investments. They require that vendors make a full statement of the affairs of the companies whose securities they offer for sale. If the representations meet with the requirements of the laws and the approval of officials, a statement is made to the effect that, so far as the state officials have been able to determine, the business is legitimate. In Montana and Arizona the requirements preceding approval go a little further. In these states the commission must be satisfied that "in its judgment the project promises a fair return on stocks, bonds, or other securities by it offered for sale."

There is a limited amount of protection in these laws, but they still come far from giving that full protection that is desirable, and the old saying that "a fool and his money are soon parted" still holds good to some extent in spite of them. Mails cannot be censored except as to actual falsehoods. It is the half-truths, insinuations, comparisons, that are perhaps more effective in drawing out savings than are misrepresentations. It is this class of advertisements and "news letters" passing through the mails that do a damage which the "blue-sky" laws cannot prevent.

Many of those who have been active in the framing of "blue-sky" laws have had in mind making absolutely safe all investments in publicly issued stocks, which were not to be sold unless they were sound investments. It is almost impossible to attain such a standard. Many types of business are speculative and always will be. The stocks of mining, manufacturing, lumbering, agricultural, and many other companies come within this class. Such business is necessary to the welfare of the nation, and should be curbed only where fraud is evident, or where those solicited cannot afford to take the risk involved. Nor can it be regarded a wise provision that the question as to whether the business appears to be one "promising a fair return on the stock" be left to a commission. Such a provision should scarcely be exercised except by one who is a specialist in the business under consideration.

Perhaps it would be well to follow the British plan, which makes sure that the investor has in his possession, or can secure, all necessary authentic information in respect to the investment, and then leaves it to him to decide how risky or safe the business may be. Before Congress adjourned Secretary Glass asked for national legislation in this direction, but the matter went no further.

The British system, operating under the Companies' Act of 1907 and subsequent amendments, requires the issuance of a prospectus, or submission of information equivalent to that which should be found in a prospectus. The act applies to associations of more than 20 persons. The prospectus must be signed by the directors or proposed directors. It must contain the memorandum of association, and data concerning the location of office and properties, purposes, and share capital and to whom it has been so far issued; the kinds of shares and to whom each has been issued and for what consideration; remuneration of directors, their names and addresses; number of shares to be subscribed before any are allotted, and provides that none are to be allotted until that number has been subscribed. Previous stock transactions must be mentioned. In addition, there are included the names and addresses of persons who have sold and intend to sell property or good will to the company, together with details as to what consideration was paid to them. Commissions, preliminary expenses, and promoters are all carefully covered; also the interest of directors in the promotion, and their compensation. The auditors must be named, and specific statements made as to voting rights of the shareholders. The directors or those who sign the prospectus are legally responsbile for any losses incurred by purchasers through misstatements or misrepresentations.

The aim of the British practice is to secure all information possible, to make those who furnish it legally responsible for its accuracy, and then to make it accessible to those who are asked to buy shares. If the intelligence of the purchaser is not sufficient to enable him to protect himself with this information in hand, the government gives him up as hopeless.

This manner of extending protection places no burdensome restraint upon legitimate adventures. It has the merit of reaching all those whom the "blue-sky" laws of the United States endeavor to protect, but, further than this, it places clearly before all of the public the inside workings of questionable enterprises. It is to be hoped the present Congress, with its many important duties, may find sufficient time to devote to national "blue-sky" legislation.

In the present readjustment it is well to remember the young professional man. Lawyers, doctors, engineers, and others surrendered their immediate prospects and served the flag in whatever capacity the opportunity offered. They are now returning to take up their professions where they can. The older men, who in the majority of cases have resources, can bridge over the period of reëstablishment without material discomfort, but it is different with the younger man. He is particularly in need of encouragement. It is up to the capitalist, the company, the corporation, and other employers to give more than ordinary consideration to his claims.

When the price of silver was released from its cage it soared buoyantly upward. For a while it looked as if silver at $1.29 per ounce would again become a reality; and may be so; although at present the price has dropped to $1.10 and appears to be steady at that figure. The immediate outlook is good for a continuance of the higher price. This means prosperity to the silver miner. Undoubtedly there will be greater opportunities for the employment of more miners in the silver-producing districts, and this will serve to take, in part at least, the surplus of miners from the copper and zinc mines. Some of the older silver camps will probably resume, resulting in the prospect of a widening market for mining machinery, supplies, and labor.

BY THE WAY

"Do'st thee see that there gert 'ugeous rock 'anging up there, m'son?" said Cap'n Dick. "W'y, dam-me, I've thought a good few times if 'twere to burst forth she'd scat us to shivers, an', dam-me, I naws bloody well that thee an' me'd rather be sittin' 'ere 'avin' a bit of a tell an' pullin' away on tha Peerless than 'ave singin' to tha 'ouse an' not 'ear un. An' all o' this 'ere starts me thinkin' 'long lines o' this 'ere Safety First. Back long we, feyther—an' min' you, m'son, 'e 'ad no use for these 'ere quiet go-by-tha-groun' chaps—'e'd say that wo't wuz h'everybody's business wuz nobody's business. and w'en there wuz sumthin' to be done, bes' bloody thing is to do it thysel'. But mos' of us, m'son, is w'ot tha rector, w'en 'e preaches, calls passive. I naws bloody well 'alf tha men in tha mine o've seen this 'ere boulder 'ave figgered on pullen daown, or blastin' h'out or sumthin', but, dam-me, they thinks as 'ow that job's h'up to someone h'else; so there she stays till one o' these days daown she'll come all by 'erself. W'ot's say, m'son, if we blast un naow?" D. E. A. C.

Noon came, and we were collected in the super's office as usual, and it was the electrician's time to tell a story. "Did you boys ever hear," he began, "of how I made the King of Siam pay me the salary he owed me?" "The King of Siam?" we exclaimed, incredulously. "Yes, the King of Siam, and this is a true story I am telling you," he insisted. "Tell away," we cried, indicating that we would believe it if it was as true as he said it was. "It was back in '95. I was a youngster then, and, having just got out of electrical school, thought I knew 'juice' from amperes to watts and from Franklin to Edison. I got a job erecting plants with a company that manufactured those old Brush arc machines, the only kind of lighting much in use then. I used to travel around the country, setting them up and breaking in the stationary engineers to run them. One day an order for a complete lighting outfit, including engine, generator, and all, came from the King of Siam, who had decided to have a few modern improvements in his palace. The boss asked me if I wanted to go over with the outfit, and I said 'sure,' and over I went. I had a bunch of natives for helpers and not a real mechanic in the crowd. I had a devil of a time building a boiler house, setting up the machine, and wiring the grounds and palace for those old-fashioned arc lights. I got a great reputation for being a wonderful man, though, and the Siamese women were all crazy about me, and they were some pippins, too. It was a great night, when for the first time the King and his subjects saw an electric light, and they cheered me like mad. The King right away offered me the job of Chief Electrician of Siam, and, not knowing any better, and being in love with one of the Queen's maids, I accepted the nomination. I was to have $500 a month, real money, in my new job, but nothing showed up at the end of the first month, and I was too polite to say anything, and worked right along at the job for another month. Still no salary; so with $1000 due me, more than I had ever had in my life before, I felt that the dignity of my position demanded an explanation. The King was most cordial, and finally I made out the interpreter's talk to the effect that my not getting any salary was an oversight that would be corrected at once, so I backed out and returned to the power house to dream about what I would do with all that cash. The next day I expected to see the King's Treasurer sure, but nothing stirring, so I got sore and hatched up a little scheme to get my money. That night at 8 as usual I started up the machine and switched on the lights, and everything was lovely and lively around the palace. At 8:10 I pulled the switch and closed the throttle, and things were livelier still in the palace. Pretty soon the King's Chief Messenger came running to the power house with a torch and said some Siamese talk to this effect: 'His Majesty sends to you his most gracious respects, and why is there no light?' 'Return them respects to His Grace,' says I, 'and inform him that there will be lights again when I get my salary.' Well, sir, in ten minutes the King's Treasurer was at the power house with my money, and the lights and the merry night life of the palace went cheerily on. The Queen's maid had began to look a little dark to me, though, so in a few days I finished breaking in a native electrician and left them to work out their own salvation. It was great fun while it lasted," he finished.

"We believe you!" we exclaimed, as the admonitory 1 o'clock whistle blew.

Personals

A. H. Toenges, formerly of Flat River, is now at Washington, Missouri.

Arthur Thacher has returned to St. Louis after a trip to New York and Boston.

Edwin J. Collins, of Duluth, is examining some copper properties in the Ray district, Arizona.

William C. Davis recently examined the Church-Union mine, in El Dorado County, California.

Clarke Sullivan and **W. T. Lundy** have opened engineering offices in the Mills Bldg., in San Francisco.

George W. Marks has gone to Mohave County, Ariz., to develop a new silver prospect for St. Louis interests.

James F. McCarthy, of Wallace, Idaho, president and manager of the Hecla Mining Co., is in San Francisco.

Samuel Shapiro, mining engineer, 53 West 113th St., New York, has left for Georgia to examine a gold property.

Ollie F. Lodtke, recently returned from service, is now at Lucerne, Wyo., as geologist for the Vinegar Hill Zinc Company.

Mark R. Lamb was in southern Illinois investigating modern coal mining and tipple equipment in the interest of French clients.

George L. Shook has been appointed superintendent of the Port Henry, N. Y., blast furnace of Witherbee, Sherman & Co.

A. P. Watt, consulting mining engineer to the Bureau of Mines, is in Washington in reference to the war-mineral relief claims.

W. J. Olcott, president of the Oliver Iron Mining Co., has returned to Duluth, from an extended vacation in Florida and Carolina.

Capt. W. H. Comins has returned from the front and is again in charge of the National Lead mine at Flat River, Missouri.

P. S. Haury, of San Francisco, has received the appointment of mill superintendent for the Blair Mines Co. at Silver Peak, Nevada.

H. A. Wheeler has returned fo St. Louis from the North Texas oil fields, where he has been examining oil properties for St. Louis clients.

A. H. Burroughs, Jr., has become associated, as mining engineer, with Maj. H. H. Armstead, and is now on his way to Talache, Idaho.

E. E. Hunner, general manager of the Hanna Ore Mining Co., has returned to Duluth from a meeting of company officials held in Cleveland.

H. K. Sherry, formerly general superintendent of the Wisconsin Zinc Co., is with the Canadian Johns-Manville Co., stationed at Asbestos, Quebec.

W. C. Jackson, J. M. Callow, and **John H. Watson**, of Salt Lake City, have been making mill tests at Clifton, Ariz., for the Arizona Copper Co., Limited.

Frank A. Kennedy, mining engineer, Duluth, Minn., and associates have taken over a group of silver-copper properties in the Seven Devils district, Idaho.

George L. Collord, general manager of the operations of the Shenango Furnace Co., and **F. A. Demms**, auditor, inspected the Minnesota mines of the company on May 14.

G. Chester Brown has been appointed chief mine inspector of California, being promoted from the position of first deputy inspector, which he has held continuously since 1915.

George P. Filling, formerly blast-furnace superintendent of the Northern Iron Co., has been appointed manager of the Philadelphia office of Freyn, Brassert & Co., engineers, Peoples Gas Bldg., Chicago.

Ray St. Germaine, formerly assistant general superintendent of the Vinegar Hill Zinc Co., in the Wisconsin district, is now located at Tulsa, Okla., where he will manage the oil properties of the Vinegar Hill Company.

Charles McKinnis, of Wallace, Idaho, manager of the National Copper Mining Co., has gone to Ranger, Tex., where he has secured an oil lease and is preparing to sink a well.

G. E. Stowell, of the Oregon Bureau of Mines and Geology, is at the Northwest Station of the U. S. Bureau of Mines, where he is just completing a series of flotation tests on the refractory gold-silver antimony ores from the Ben Harrison mine, Whitney, Baker County, Oregon.

Ralph Arnold, who has been working on oil problems in the U. S. Bureau of Internal Revenue, has given notice of his intention to resign within the next few weeks, as he wishes to return to private practice.

S. L. Rawlings, general manager, and **C. V. Drew**, mining engineer, of the Cerro de Pasco Copper Corporation, were expected to arrive in New York about May 22 after an extended visit to the company's properties in Peru.

Louis D. Huntoon, secretary of the Mining and Metallurgical Society of America, and **F. Kingsbury Bull**, Pawtucket, R. I., were late visitors to Ray, Arizona., in connection with exploration work on the Ray-Broken Hill property.

Heath M. Robinson, formerly a member of the U. S. Geological Survey, has recently resigned from that organization and is now employed by F. Julius Fohs, consulting oil geologist, with headquarters at 60 Broadway, New York City.

Lieut. R. J. Goodwin has recently been discharged from the infantry and is now metallurgist for the Florida Mountain Mines Co. This company is treating the stope fillings of the old Trade Dollar Mine, at Silver City, Idaho.

L. C. Graton, who before the war was professor of mining geology in Harvard University, will take charge of the copper division of the Industrial Unit of the U. S. Bureau of Internal Revenue on June 1, and begin to organize his working force.

A. H. Richards has been made superintendent of the copper smeltery at Garfield, Utah. Before becoming assistant superintendent at Garfield, he for several years held a similar position at A. S. & R. lead smeltery at Murray, Utah.

Frank Cameron, special investigator for the Bureau of Mines, who has been in France and Alsace, is expected to arrive in New York about May 26 to make a confidential report to Van. H. Manning, director of the Bureau, on the foreign potash situation.

William Frazier, superintendent of the Davis-Daly Copper Co., is seriously ill. **Maxwell Atwater**, general manager of the same company, is convalescing at the Mayo Brothers' hospital at Rochester, Minn., and is expected to be able to return to Butte within two weeks.

James Johnston, has resigned as mill manager, Nipissing Mining Co., Ltd., Cobalt, Ontario, with which company he has been for the last eight and one-half years. He has gone to England, and will engage in consulting work with **Charles Bibbers**, with offices at 120 Bishopsgate, London.

C. Roy Olson, formerly mill superintendent for the Pittsburg-Dolores Mining Co., Yerington, Nev.; the Brady flotation plant, Round Mountain, Nev.; and manager Tonopah Liberty Mining Co., has accepted the position of mill superintedent for the Como Consolidated Mines Co., Como, Nevada.

Hugh M. Wolflin has resigned the position of chief mine inspector of California to accept the position of superintendent of safety in the State Industrial Accident Commission, of which the mines division is a part. Mr. Wolflin was appointed chief inspector upon the organization of the commission in 1914.

Tom M. Owens, general mill superintendent of the Federal Mining and Smelting Co., Wallace, Idaho, who was reported as returning to Australia, his home, in the last issue of the "Journal," will again assume his former position with the Federal company after investigating the latest developments in the flotation process in Australia.

F. Cushing Moore, who has been associated with Clarence Cunningham as consulting engineer at the Hewitt and Van Roi Mines, Silverton, B. C., has severed his connection with the Cunningham interests and has left for Spokane, Wash. **L. F. Fogle**, former mill superintendent for the Consolidated Interstate-Callahan company in the Coeur d'Alenes, recently took charge of the Hewitt and Van Roi mills.

Capt. Edward Steidle has recently returned from Europe after 16 months' service, during which he was in the fight at St. Mihiel and for the last few months of the war was within the 10-mile zone. He was wounded twice, received the Croix de Guerre and has been cited for the D. S. O. Captain Steidle was originally attached to the 30th Engineers and later placed in command of the First Battalion of the 1st Gas Regiment. He was formerly with the Bureau of Mines as mining engineer in charge of the Utah and Nevada districts.

Obituary

John Biscomb, 46 years a resident of the Michigan copper country, died recently at his home at Isle Royale mine. He held mining captain positions at Old Dominion in Arizona; Tecumseh, now part of the La Salle; and Wyandot. He was 77 years old and was born in Cornwall.

A. J. Sharwood, well known in mining circles on the Rand, where he served under John Hays Hammond and afterward joined Messrs. G. & L. Albu as manager in Johannesburg of the General Mining and Finance Corporation, died in England recently after an operation. Mr. Sharwood was also connected with the British Aluminum Co. He abandoned his active mining connection about nine years ago, residing in England until his death.

Societies

American Institute of Electrical Engineers, Denver Section, held its annual meeting on May 17. The lecture of the evening was delivered by Albert C. Crehore, whose subject was "Progress in Atomic Theory."

Society of Chemical Industry, New York Section, held a meeting on May 23, when papers were presented on "The Chemists and the Brass Industry," by W. B. Price; "Shipping Containers," by Charles P. Beistle; "Liners for Shipping Containers," by B. Arkell; and "Paper Barrels and the Like," by A. H. Searle. An informal dinner was held before the meeting.

Teknik Club, of Denver, held its last dinner meeting of the season, on May 13, at the Shirley Hotel. A. B. Scott presented a paper on "The Gold Situation," and J. E. Conley described the manufacture of smokeless powder for naval guns. Following a discussion of the papers presented, officers were elected for the ensuing year. H. B. Lowden was reëlected secretary-treasurer. Fifty-two members were present.

Montreal Metallurgical Association was organized in 1915 to secure greater efficiency in connection with the manufacture of munitions and has now decided to continue on a permanent basis. It has a membership of 245. At a recent meeting the following officers were elected. President, G. P. Cole; vice-president, H. J. Roast; secretary, Capt. J. G. Ross; members of council, W. K. Gillespie, J. D. Paxton, E. M. Seale, G. R. Kendall, J. Haynes, E. C. Kirkpatrick, W. G. Dauncey, F. G. Gardner, B. A. McFarlane and T. R. Davidson.

Canadian Mining Institute, Ottawa Branch, held a meeting on May 9 to reorganize the local branch of the Institute, which was suspended during the war. Thirty members of the Canadian Mining Institute resident in Ottawa were present. The following officers were elected: Chairman, W. A. Carlyle, manager of the British America Nickel Corporation, secretary, H. H. Claudet, resident manager of the General Engineering Co., executive committee, A. W. G. Wilson, J. C. Murray, and L. D. Burling. Maj. Geo. C. Riley, of the Soldiers' Civil Reëstablishment Department, urged the need of providing employment for the professional and technical men returning from overseas. He stated that in two days the department had received applications from over 120 men of this type who were absolutely without work, but it had only been able to place 15 or 16 of them. A number of suggestions as to the best way of meeting the difficulty were made. In the course of a general discussion much emphasis was placed on the necessity of securing adequate remuneration for the professional and technical men in the government service.

Industrial News

International Motor Company announced an increase in the April sales of the Mack truck, 45% of which were of the heavy-duty type.

The United Filters Corporation, 65 Broadway, New York, has announced the appointment as manager of its Chicago office of C. B. Oliver, who has been identified with the company for several years. Mr. Oliver has been engaged for a number of years in solving filtration problems. The location of this office will still be in the Peoples Gas Building.

The Macomber & Whyte Rope Co., manufacturer of wire rope and wire at Kenosha, Wis., announces the opening of its New York Branch at 30 Church St., telephone Cortlandt 7436, under the management of E. E. Robirds, who has been with the company for 10 years, having been manager of the Pittsburgh and Chicago offices.

Walter A. Zelnicker Supply Company, in St. Louis, has just appointed F. X. Meehan as advertising manager. Mr. Meehan has been associated, in various executive capacities, with Fairbanks Morse & Co.; A. T. & S. F. R.R. Co. coast lines; and St. Louis Smelting and Refining Works of the National Lead Co. He was an active Four Minute Man during the war.

Westinghouse Electric and Manufacturing Co. announces the promotion of A. E. Hitchner to the position of manager of the mining section of the industrial sales department, with headquarters at East Pittsburgh, Penn. Mr. Hitchner was formerly with the Baldwin Locomotive Works and three years with the Link-Belt Co. on construction work. In 1912 he was sales representative for the Westinghouse company in the anthracite coal fields and in charge of the Wilkes-Barre office. In his new position Mr. Hitchner will handle the sale of all apparatus made by the Westinghouse company for use in the mining industry.

Chamber of Commerce of the United States announces that Homer L. Ferguson, president and general manager of the Newport News Shipbuilding and Dry Dock Co., of Newport News, Va., has been elected president as the result of a mail vote of the organization's board of directors. Mr. Ferguson succeeds Harry A. Wheeler, of Chicago, who declined reëlection. In addition to Mr. Ferguson, the following other officers were elected by the board: Vice-presidents: Eastern District, A. C. Bedford, New York; North Central, Joseph H. Defrees, Chicago; South Central, Thomas F. Gailor, Bishop of Tennessee; Western District (to be filled later). An executive committee was also elected in addition to the foregoing officers.

The French American Banking Corporation has leased the ground floor at 65 William St., New York City, and will open for business there about June 1. The corporation is an alliance of the National Bank of Commerce in New York, the First National Bank of Boston, and the Comptoir National d'Escompte de Paris, formed to foster trade between France and the United States. It was incorporated at Albany, N. Y., Apr. 29. It is capitalized at $2,000,000, with a surplus of $500,000, all paid in. The officers of the corporation are Maurice Silvester, president; Roger P. Kavanagh, vice-president and treasurer; John E. Rovensky, vice-president; F. Abbott Goodhue, vice-president, and Thomas E. Green, secretary.

American Blower Co. has announced that James Inglis, president, sailed from New York on May 15 as a member of a commission appointed to confer with European cotton interests on post-war conditions in the cotton industry throughout the world, with special reference to the proposed world cotton conference to be held in New Orleans next October. While connected with the War Industries Board, Mr. Inglis was chairman of a joint committee made up of several governmental departments whose purpose was to secure better baling of cotton and less wasteful methods of handling the cotton crop. Mr. Inglis is continuing his connection with the work, being transferred to the Department of Commerce. Mr. Inglis will also visit Belfast, Ireland, to confer with his associate in the blower business, Mr. Davidson, of the Sirocco Engineering Works.

International High Speed Steel Co., Rockaway, N. J., has transferred the executive and main offices from 99 Nassau St., New York, to the works at Rockaway, N. J., and requests that all communications be mailed to that address. In order to facilitate deliveries in less than carload lots to customers in the Metropolitan district, a branch office has been opened at Nos. 294-296 Lafayette St., New York City, where a warehouse has been secured. An extensive and varied stock of tool, alloy and high-speed steel, and also of the "Bulldog" brand of mining and rock drill steel, both hollow and solid, in hexagon, octagon, quarter octagon, round, and cruciform sections, in all sizes from ⅜ in. to 2 in. diameter, will be carried. The New York office and warehouse will be under the management of John T. Mungovan. Telephones: Rockaway, 147; Spring, 2332-2333.

Trade Catalogs

"Sockets to Harmonize." Cutler-Hammer Mfg. Co., Milwaukee, Wis. Folder; two-color; 3½ x 6; 4 pp. which emphasizes the harmony to be secured through the use of C-H push-button porcelain sockets with white enamel fixtures. Also lists the pendent and fixture types of push-button porcelain sockets, and is intended for distribution by jobbers and dealers.

Pipe-Threading Machines. Walter A. Zelnicker Co., St. Louis, Mo. Folder No. 263, containing list of special offerings, including used portable, hand-power pipe-threading machines which have been thoroughly overhauled, and 1250 steel tray bodies for miscellaneous use around manufacturing plants, as storage bins, sorting trays, mixing pans, transfer bins, skips, and similar devices made for the U. S. Government but the orders for which were canceled at the end of the war. Also a list of lamps and copying presses.

Headlights for Mine Locomotives. Ohio Brass Co., Mansfield, Ohio. Bulletin No. 202A; 6 x 9; 12 pp; illustrated. Describes "Imperial Incandescent Headlight for Mining Locomotives." Type MH, 8-in. reflectors made with both cast-iron and brass casings, with spring suspension for absorbing shocks and keeping rays of light on the track. A strong, steady, unvarying beam under the hardest service is furnished. Dimensions, weights, tables of specifications, and lists of switch and fuse equipment are included.

Reilly Water Heater. Griscom-Russell Co., 90 West St., New York. Bulletin 320; 6 x 9; 16 pp.; illustrated. Describes heating of feed water for boilers, showing economy of fuel, increase of boiler capacity, increase of effective condenser capacity, saving in cost of boiler maintenance and increased life of boiler. The statement is made that fuel savings and increase of boiler capacity will vary from 8% to 15%, and, furthermore, in round numbers, 1% less coal is required and maximum boiler capacity is increased 1% for every 11° the feed water is heated before being delivered to the boilers. Instructions are given on how to compute the savings resulting from the use of a proper feed-water heater. The bulletin contains a general description of the Reilly types D and C of feed water heaters, with ample illustrations and specifications.

"Melting Metal With Electrically Heated Pots," Cutler-Hammer Co., of Milwaukee and New York. Folder, 6 pp.; 3½ x 6 in., illustrated. Calls attention to the advantages of electrically heated melting pots over gas and gasoline, on account of cleanliness, elimination of open flame, greater efficiency, and ease of control. C-H electrically heated metal melting pots are made to melt down and maintain at the proper temperature all soft materials, such as lead, tin, solder, and babbitt. They are limited to a maximum temperature of 550 deg. F., and are made in standard sizes up to 150 lb. metal capacity. Two types are described—the floor type in 10 and 25 lb., sizes, and the bench type in 50, 100, and 150 lb. sizes. Automatic temperature control equipment can be furnished, which consists of a dynamic thermometer and the control panel. The bulb of the thermometer is immersed in the metal and the coil is set to the temperature desired. The action is such that the metal is kept between a minimum and a maximum temperature. Prices, dimensions, and other descriptive matter are included.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Converting—Muffled Ore-Converting Apparatus. Aron M. Beam, Denver, Colo., assignor to the American Continuous Retort Co., Denver, Colo. (U. S. No. 1,299,661; Apr. 8, 1919.)

Crushers—Frame for Jaw Crushers. William B. Easton, Chicago, Ill., and David Cole, El Paso, Tex. (U. S. No. 1,298,188; Mar. 25, 1919.)

Drills—Feeding Means for Drills. Lewis C. Bayles, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,299,814; Apr. 8, 1919.)

Electric Furnace Apparatus—For Ores or Minerals. Ingenuin Hechenbleikner, Charlotte, N. C., assignor to Southern Electro-Chemical Co., New York, N. Y. (U. S. No. 1,299,336; Apr. 1, 1919.)

Electric Furnace. William K. Booth, Chicago, Ill., assignor to Booth-Hall Co., Chicago, Ill. (U. S. No. 1,299,110; Apr. 1, 1919.)

Explosive Cartridge. Montague H. Roberts, Jersey City, N. J., assignor to Air Reduction Co., Inc. (U. S. No. 1,298,097; Mar. 25, 1919.)

Flotation—Device for the Aeration and Emulsifying of Pulp for Flotation. Charles Taylor, Nogales, Ariz. (U. S. No. 1,299,059; Apr. 1, 1919.)

Fuel—Apparatus for Burning Powdered Fuel. Arthur S. Mann, deceased, Schenectady, N. Y., by Eleanor D. Mann, administratrix, assignor to General Electric Co. (U. S. No. 1,298,530; Mar. 25, 1919.)

Gold-Washing and Accumulating Device. Roy C. Sawyer and John W. West, Pasadena, Calif. (U. S. No. 1,298,577; Mar. 25, 1919.)

Ingot Molds—Apparatus for and Method of Teeming Ingot Molds. Emil Gathmann, Baltimore, Md. (U. S. Nos. 1,298,034 and 1,298,035; Mar. 25, 1919.)

Iron Oxide—Method for Reducing. Horace W. Lash, San Francisco, Calif. (U. S. No. 1,296,973; Mar. 11, 1919.)

Loading and Conveying Apparatus. Frank Billings, Cleveland, Ohio. (U. S. No. 1,300,111; Apr. 8, 1919.)

Metal Briquet. Felix A. Vogel, New York, N. Y., assignor to General Briquetting Co., New York, N. Y. (U. S. No. 1,299,878; Apr. 8, 1919.)

Metal Oxides—Making metallic oxides. Theodore J. Vollkommer, Pittsburgh, Penn. (U. S. No. 1,300,522; Apr. 15, 1919.)

Mine Cars—Safety Stop for Mine Cars. Joseph Klansnic, Black Diamond, Wash. (U. S. No. 1,297,575; Mar. 18, 1919.)

Mine Tracks—Adjustable Clamp for Slide Rails in Mines. Henry Fread Heumann, Marissa, Ill. (U. S. No. 1,298,946; Apr. 1, 1919.)

Mining Machine. James A. Brantley, Sand Springs, Okla. (U. S. No. 1,299,905; Apr. 8, 1919.)

Molybdenum—Method of Extracting and Recovering Molybdenum from Its Ores and Concentrates. Henry Alfred Doerner, Denver, Colo. (U. S. No. 1,299,559-60; Apr. 8, 1919.)

Nickel Scrap and Sludge—Process for Treating. Woolsey McA. Johnson, Hartford, Conn. (U. S. No. 1,299,577; Apr. 8, 1919.)

Petroleum—Method for Refining Oil. Chauncey B. Forward, Urbana, Ohio. (U. S. No. 1,299,449; Apr. 8, 1919.)

Phosphate Rock—Method of Treating Gases. Ingenuin Hechenbleikner, Charlotte, N. C., assignor to Southern Electro-Chemical Co., New York, N. Y. (U. S. No. 1,299,337; Apr. 1, 1919.)

Potash—Method of Extracting Potash and the Like. Arthur Burton Andrews, Auburn, Me., assignor of one-half to himself and one-half to Herbert F. Kelley, Auburn, Me. (U. S. No. 1,296,035; Mar. 4, 1919.)

Potash—Process for Obtaining Water-Soluble Potash. William D. Richardson, Chicago, Ill. (U. S. No. 1,295,601; Feb. 25, 1919.)

Potassium Compounds—Apparatus for Recovering Potassium Compounds from Cement-Kiln Gases. Henry Blumenberg, Jr., Oro Grande, Calif. (U. S. No. 1,297,639; Mar. 18, 1919.)

Potassium Nitrate—Process of Making. Henry Blumenberg, Jr., Oro Grande, Calif., assignor to Chemical Construction Co., Los Angeles, Calif. (U. S. No. 1,297,640; Mar. 18, 1919.)

Potassium Salts—Apparatus and Processes for Recovering Potasium Salts from Cement-Kilns, Cement Mixtures, Waste Gases, etc. Henry Blumenberg, Jr., Oro Grande, Calif. (U. S. No. 1,296,462; 1,296,463; 1,296,464; 1,296,465; 1,296,466; Mar. 4, 1919.)

Refining—Process for the Refining of Metals. Joseph B. Murray, Brooklyn, N. Y. (U. S. No. 1,295,568; Feb. 25, 1919.)

Refractory—Process of Making Furnace-Lining Materials. Albert P. Meyer, Pittsburgh, Penn., assignor to Allen S. Davison, Co, Pittsburgh, Penn. (U. S. No. 1,300,631; Apr. 15, 1919.)

Roasting—Apparatus for Roasting or Drying Ores. Joseph Molnar, Goose Bill, Mont. (U. S. No. 1,296,834; Mar. 11, 1919.)

Separation — Ore-Separating Apparatus. George McElwain, El Paso, Tex. (U. S. No. 1,299,848; Apr. 8, 1919.)

Editorial Correspondence

BUTTE, MONT.—May 17

Miners' Phthisis will be the subject of extended study by the U. S. Bureau of Mines, according to Daniel Harrington, mining engineer in charge of safety work in the Rocky Mountain region for the Bureau. Incidental to this study will be a separate investigation as to remedial measures for the miner and underground worker in places where high temperatures prevail. This investigation is to be made largely by physicians from the public health service. Miners' consumption annually exacts a heavy toll in the Butte district, because of the prevalence of fine dust, which is inhaled and settles in the lungs, in time excluding the free passage of air throughout the lung cell, resulting in the development of tuberculosis.

SALT LAKE CITY, UTAH—May 16

Park City Mines Are Still Closed as the results of the recent strike, although the situation appears to be improving and the more conservative element among the miners is gaining ground. Miners in the Tintic section have asked for a raise in pay of 75c. a day and for an eight-hour day. Radicals have been at work here also, but in this camp there has been a greater disposition toward moderation. Mine owners have refused to meet committees in any way connected with the I.W.W. or kindred organizations, expressing themselves as preferring the alternative of a complete close down as at Park City. They state, however, that they are ready as individual managements to meet bona fide representatives of their own employees. The demands of the miners were formulated a little less than a week ago, and the camp is quiet, with work going on as usual. It is expected that conditions will settle soon.

Reduction of Freight Rates on Utah products is being sought, the mining and smelting interests joining in the effort and seeking to secure rates which would permit the removal of low-grade ores. Coal-mine operators and plaster and potash producers also are seeking relief. What is felt here to be unfair discrimination against Utah was brought by shippers to the attention of Max Thelen, Director of Public Service, U. S. Railroad Administration, at a meeting held May 7 in the offices of the traffic bureau. Freight reductions are said not to be likely in the immediate future, on account of high costs and lessened traffic after the war, but the director is stated not to be in favor of any increase at present.

WALLACE, IDAHO—May 17

Guggenheim Purchase Is Rumored of the Hercules, Tamarack & Custer and the Northport smeltery in a deal with the Day interests. The report now is that the deal was consummated several weeks ago when there was much publicity regarding the alleged negotiations. When the two mines resumed operations, after a suspension of four months with no apparent change in control or management, it was assumed that the deal was off. Now the report is that it was in effect consummated, but that the actual transfer has not been made. Reliable information is, of course, unobtainable, but the fact that the Days closed down tight last Christmas when the market for lead began to crumble, remained closed four months, and then started up when the lead situation was even worse than when they closed down, is significant.

DULUTH, MINN.—May 17

Shipments of Iron Ore from the Lake Superior district for April were 1,412,239 tons, as compared with 235,870 tons during the same month last year. The favorable balance for 1919 is not an indication of conditions but is entirely due to the earlier opening of navigation. Though the Steel Corporation is shipping at a normal rate, practically all independent operators are awaiting an improvement of the pig iron market before starting shipments. Despite many curtailments and some complete shut downs, the labor situation has remained good and no marked unemployment has appeared, as the open pits have been able to absorb the larger proportion of labor released. Wages have remained unchanged. Shipments for April, 1919, and April, 1918, were:

Dock	April, 1918	April, 1919
C. & N. W., Escanaba	.....	36,701
C. M. & St. P., Escanaba	.	34,716
D. S. S. & A., Marquette	5,222	.....
L. S. & I., Marquette	5,486	.....
C. & N. W., Ashland	.....	139,190
Soo Line, Ashland	.....	8,168
Great Northern, Superior	71,299	61,272
Soo Line, Superior	10,254	40,458
Northern Pacific, Superior	18,009	.
D. M. & N., Duluth	56,991	794,050
D. & I. R., Two Harbors	68,609	297,684
Totals	235,870	1,412,239

IRONWOOD, MICH.—May 17

Michigan State Tax Commission held hearings in the iron mining counties during the week, at Bessemer May 13, at Crystal Falls May 14, at Iron Mountain May 15, and in Marquette County, May 16. Valuations were placed on all mines, but the figures may be revised before being placed on the assessment rolls. Total for Gogebic County is about 15% greater than for last year. In round numbers valuations for individual mines are as follows, ore in stockpiles being included:

Mine	1918	1919
Ashland	$51,000	$70,000
Norrie-Aurora Group	13,899,000	12,588,000
Newport	6,909,000	7,996,000
Bonnie	760,000	659,000
Davis	78,000	447,000
Geneva	.....	225,000
Royal	175,000	201,000
Puritan	3,094,000	3,464,000
Ironton	482,000	1,520,000
Yale	321,000	589,000
Colby	905,000	839,000
Palms	.....	2,351,000
Anvil	.....	412,000
Keweenaw	883,000	1,414,000
Mikado	144,000	130,000
Pilgrim	136,000	140,000
Plymouth	6,177,000	8,000,000
Wakefield	4,500,000	5,500,000
Sunday Lake	632,000	632,000
Brotherton	184,000	289,000
Castile	139,000	125,000
Morgan	40,000	90,000

The total for 1919 is over 49,000,000.

PHOENIX, ARIZ.—May 16

Assessment on Arizona mining property within the time of statehood has been raised more than ten times and in percentage of state assessment from 31.7 to 58.63 of the whole. In 1912 the new state's mining property had a valuation of $15,145,084, the following year there was the remarkable jump to $140,488,648; in 1918 the assessment, based largely upon profits and intangible valuations, was $491,679,957. The intangible value system of assessment now is under fire in suits in the State Supreme Court, filed by the Inspiration and American Smelting and Refining companies. The former was dismissed by the high court for lack of state prosecution, but has been reinstated, under protest. A late decision of the Federal Appellate Court in San Francisco, denying the State of Arizona the right to tax the Standard Oil Co. for profits made on the basis of a product within the State of California, may have some bearing on the question.

KINGMAN, ARIZ.—May 17

In the Apex Suits filed against each other by the United Eastern and Tom Reed companies there has been stipulation that the latter shall have right to continue its winze in the disputed ground to an intersection with the Big Jim raise of the former, and, in the event a fault be encountered, Tom Reed shall have the privilege of raising or sinking a reasonable distance along the fault plane to show any relation there may be between the vein and the fault, though not to drift along the fault.

JOPLIN, MO.—May 17

New $60,000 Magnetic Separation Roasting Plant is being erected at Galena, Kan., by the Joplin Separating Co. It is the same type of plant as was erected by this company 19 years ago, just after it had taken out the original patents. After installing plants in many different mining sections in the country, the company sold the patents and has since restricted itself to the operating end. The company operated a plant in Joplin until two years ago, when it was forced to close by the city council, objection having been made to the fumes. The new plant is to have several improvements, including oil firing. The greater portion of the ore used is not less than 8% iron, and about 20% metallic zinc. Only a limited amount of this quality of ore is produced in the district, and it is not believed that the plant, which will have a capacity of handling 65 tons of ore daily, can be kept busy. However, another company is planning the construction of a similar plant immediately, and it may mean a market for some of the lower grade of zinc-iron ores that heretofore have been unmerchantable. The iron that is made in the separating process is lost.

DALLAS, TEX.—May 16

Texas Oil Production for quarter ended Mar. 31 is valued at $30,000,000, according to Controller Henry B. Terrell. This is from six to eight million dollars greater than during the previous quarter. The increase is due partly to discovery of new wells, but also to the gathering of more complete records by several revenue collectors, provided for at the last regular session of the State Legislature. These collectors listed over 200 new companies. Number of oil producers now on record at the controller's office is about 800. The House passed a resolution, subject to the approval of the Senate, authorizing the Governor and State Prison Board to exercise the option held by the state on Blue Ridge farm, Fort Bend County, where the Gulf Production Co. made the recent discovery of oil.

Texas & Pacific R. R. is planning to build branch lines to gridiron the oil fields of Central West Texas, to handle the great increase in traffic which has resulted from the tremendous development in the Ranger district in such a short time. Preliminary surveys have been authorized in the territory lying north, south, and west of the immediate Ranger neighborhood. A party of railroad officials has made a tour of this section, its personnel including Harry Bonner, president Missouri Pacific R.R., also director of the Texas & Pacific; J. H. McClement, member executive committee, Missouri Pacific and director Texas & Pacific; Bertram Cutler, director Missouri Pacific and representative Rockefeller interests, from New York City; C. E. Ingersoll, director Missouri Pacific and Pennsylvania R.R. and president Midland Valley R.R., from Philadelphia; and John G. Lonsdale, president National Bank of Commerce, St. Louis, and director Missouri Pacific. The party was accompanied by J. L. Lancaster, regional director of the Southwestern group of railroads, and others.

TORONTO, ONT.—May 19

Reports of Extensive Oil Concessions in Alberta having been made or considered by the Canadian government, which created much uneasiness and dissatisfaction in Western Canada, were set at rest by the presentation to the Canadian Parliament on May 12 of the correspondence relating to the matter. The papers show that in July, 1917, an application was made on behalf of the "Shell" Transport Co., of London, England, for exclusive oil and natural gas rights for the period of the war and five years after, with free right of way, freedom from customs duties, and other special concessions. The offer was rejected, as were two subsequent applications in the same interest. A greatly modified proposition was then submitted by the "Shell" people, offering to enter upon the undertaking in coöperation with the government, the company to find the funds and to divide the net profits with the government on a 50% basis. The matter was under consideration by the government for some months, during which many strong protests against the proposal were made, and finally, on Mar. 28, Hon. Arthur Meighan, Minister of the Interior, sent a communication to the representative of the company declining to entertain the scheme.

The Mining News

ALASKA

KENNECOTT (Kennecott)—Copper production, including that of Braden, during April was 3,528,000 lb., comparing with 5,852,000 lb. in March, 5,292,000 lb. in February, and 10,040,000 lb. in January. Production for April, 1918, was 5,794,000 lb.; in 1917 it was 7,180,000 lb., and in 1916 10,500,000 pounds.

ARIZONA

Cochise County

BENSON SMELTERY well advanced in construction and is to be blown in within 60 days. Enough ore pledged to operate plant for two years. C. E. Goetz, of Benson, promoter.

SHATTUCK ARIZONA (Bisbee)—April production was 57,360 lb. of lead. No copper, silver or gold was produced. Production four months ending Apr. 30 was: Copper, 1,000,844 lb.; lead, 736,274 lb.; silver, 44,129 oz., gold, 160.06 ounces.

ARIZONA MIDDLEMARCH COPPER (Pearce)—Struck rich copper ore at this property, nine miles west of Pearce. Drifted in ore for 35 ft. on 7th level; 8th level crosscut from shaft reached orebody and cut 10 ft. high-grade chalcopyrite, with ore still in face. Assays vary from 2 to 16% copper. Ore is on contact of granite and siliceous limestone on this level. Flotation mill running on ores from upper levels.

Gila County

McGILLIGAN GROUP (Payson)—Eight copper claims in Mazatzal district, purchased by Houghton, Mich., syndicate represented by Luther E. Warde.

Pima County

POCAHONTAS (Tucson)—Property in Comobabis, owned by Richey brothers, bonded to eastern company.

QUIJOTOA DISTRICT (Tucson)—Silver Virgin Co. organized to work silver deposit and install mill. A. B. Murchison, of Douglas, president; J. J. Adair, manager. Tom Day honded gold property to New York syndicate. Jack Pinder has taken over Portis gold-silver mine. Robert Mitchell developing claims. Lowell Gold, a Bisbee corporation, preparing to start mill in Horseshoe basin on gold ore.

SAN XAVIER EXTENSION (Tucson)—Work to be resumed at once. E. G. Bush shipping two carloads 38% copper ore a week to Twin Buttes.

Pinal County

LAKE SHORE (Casa Grande)—Being developed by drilling, with prospect of large operations. Owner Leonard also has working bond on old Vekol silver mine.

REPUBLIC (Casa Grande)—Purchased by George Tweedy, former manager of Bradbury interests in Mexico.

SILVER KING (Superior)—Sinking new 1000-ft. 3-compartment shaft to 1000 level started by Contractor William O'Neal, of Lowell. Issuing $500,000 bonds to pay for development.

Yavapai County

BIG BUG COPPER (Mayer)—Ordered new surface plant, compressor and drills.

ARGONNE (Mayer)—New company has purchased 23 claims from Frank Andrews, Guy Mosley, and W. A. Murphy. Price stated, $50,000.

COPPER AGE (Mayer)—New company organized by Frank Williams and Frank Thornton to develop property.

CALIFORNIA

Inyo County

MINNIETTA (Darwin)—Leased by A. F. Flynt and A. M. Grimm, of Los Angeles. Former producer.

Lassen County

WESTWOOD REGION attracting prospectors, and some development in progress. Red River Lumber Co. started work on several claims and is considering installation of machinery.

JUNIPER (Haydenhill)—Good ore disclosed by lessees. Idle for 20 years; former producer.

Plumas County

CRESCENT (Crescent Mills)—Philadelphia Exploration Co. reopened property, closed since last August because of high costs of gold mining. A. MacDonald, of Boulder, Colo., superintendent; Herbert Whiting, assayer.

WALKER (Portola)—Flotation mill treating 200 tons daily to be enlarged. To install aërial tramway. Recent exploration by diamond drilling. Controlled by Anaconda.

San Benito County

NEW IDRIA (Hollister) — Quicksilver mines resume operation after short closedown, account of low price of metal. H. W. Gould, San Francisco, manager. New rotary kilns recently installed will be put in operation. Closing down of mines in April was first suspension of operation of New Idria since 1853, when mine was opened.

Shasta County

CONTINENTAL SILVER (Igo) — Reopened by V. V. Apperson and associates. Cleaning out 500-ft. tunnel and laying new track. Idle for 20 years. Former producer. Adjoins Chicago mine, reopened a month ago.

Sierra County

GOLD EXPLORATION CO. (Downieville)—Salt Lake City corporation optioned Sovereign quartz mines in Ladies Canyon. Is considering extensive development. Former producers.

MICHIGAN

Copper District

CALUMET AND HECLA (Calumet)—Copper production for April as follows: Amheek, 1,490,311 lb.; Allouez, 355,480; C. & H., 4,361,645; Centennial, 114,652; Isle Royale, 993,073; La Salle, 17,000; Osceola, 950,579; Superior, 74,000; White Pine, 197,373.

Marquette Range

BARNES-HECKER (Dexter) — Shaft sinking has reached a depth of more than 600 feet.

CLEVELAND-CLIFFS (Ishpeming)—Installing five new electric air compressors to replace steam-driven machines at district mines. Princeton, Gwinn, and Francis mines at Gwinn operating, and Mackinaw-Gardner mine under development.

MINNESOTA

Mesabi Range

MUNROE (Chisholm)—Fire started in "C" boiler house spread to engine house and coal docks May 13, and caused loss of $20,000. One fatality.

CANISTEO (Coleraine)—Added 40-ton locomotive Brown-Hoist crane, with 55 ft. boom, to equipment.

GENOA (Eveleth)—Completed installation of electrical equipment transferred from Deacon mine, Buhl. Deacon abandoned as worked out in February, 1919.

SPRUCE (Eveleth)—Relining and enlarging of No. 4 shaft, completed at depth of 280 ft. Reinforced concrete used. Cutting new pump station. Original shaft sunk in 1894.

PETIT (Gilbert)—Republic Iron and Steel Co. increasing force. Bray mine of same company at Keewatin employing pump and timbering crews only.

SARGENT (Keewatin)—Big open pit of Wisconsin Steel Co. makes first shipment. Thoroughly modern equipment, including a large proportion of electrical machinery. Has 10,000,000 tons ore proved. Royalty 75c. per ton, with provision for minimum annual shipment of 200,000 tons.

LINCOLN (Virginia)—Fire May 8 destroyed carpenter and blacksmith shops. Interstate Mining Co., operators.

MISSOURI

Joplin District

CARL JUNCTION—Community drilling campaign started some weeks ago proceeding steadily. So far, no good strikes made. The Community Drilling Co. pays one-half cost of drilling.

CAROLINA (Joplin)—Started new concentrator at site of Gilt Edge mine, operated 12 years ago, 13 miles south of Joplin. Edwin Bancroft, Joplin, is manager.

PFAEFFLE-KELLY (Joplin) — Started new small mill on Shifferdecker land near Joplin.

MONTANA

Broadwater County

IRON MASK (Hassel)—New crosscut tunnel in 200 ft.; will cut silver-lead-manganese vein 800 ft. depth.

Jefferson County

BALTIMORE (Boulder)—Shipping silver-lead ore to smeltery.

COMET (Boulder)—Mill to be built to concentrate silver-lead-zinc ore. Shaft 1200 ft. deep.

FREE COINAGE (Clancy)—Shipment of 30 tons last week. Amalgamated Silver Mines Co.

LEGAL TENDER (Clancy)—Small shipments to smeltery. Picked samples assaying high in silver.

LIVERPOOL (Clancy)—Old mine developed 750 ft. deep to be reopened. New hoisting plant with electric power. Fryberger & Eichelberger in charge. Eastern capital interested. Shoot of high-grade silver blocked out between 600 and 750 levels.

ANGELICA COMPANY (Wickes) — Average of 50 tons ore daily from Mount Washington tunnel. Silver-lead.

Lewis and Clark County

MONARCH MINING AND POWER CO. (Elliston)—Lumber sawed on ground for compressor and ore bins. Survey for tram completed. Surveying for pipe line for power plant. Telephone line from mine to home office in Helena.

BLUE BIRD (Helena)—Company organized to develop property in Scratch Gravel hills.

HELENA MINE (Helena)—Contracted for 200 ft. drift north from shaft on 400 level. Silver-lead ore.

NOLAN (Ophir)—Mining silver ore for shipment from tunnel.

ARMSTRONG MINE (Rimini)—Shipping gold-silver-lead ore from tunnel.

SILVER MINES (Wolf Creek)—Development in camp increasing, owing to rise in silver price. Several good showings reported.

Silver Bow County

ANACONDA COPPER (Butte)—Purchased half interest in Kit Carson claim, adjoining Anglo Saxon on west and carrying westerly extension of Anglo Saxon fissure, recently cut on the 500 of the Orphan Girl, and showing milling ore 35 ft. wide carrying 12 to 16 oz. silver. Situated in "West Side" of Butte district. Orphan Girl tonnage will be materially increased soon. Nettie property, also owned by Anaconda, is in good silver ore. Showing of silver ore at Alice mine reported good. Copper production continues at better than 50 per cent.

BUTTE & SUPERIOR (Butte)—Eight feet new ore opened east on the 1900 level of Black Rock, outside of ground in controversy with Elm Orlu interests, carrying high silver-zinc contents. Reported as one of highest-grade ore disclosures made by company for any considerable tonnage, either in sight or indicated.

DAVIS-DALY COPPER (Butte)—Crosscuts from Colorado mine and Anaconda's Belmont working have "holed." Crosscut driven from the 2500 of Colorado for ventilation and affording exit has taken over a year's time under adverse conditions, it being necessary to drive 2000 ft. Ventilation has been chief problem, and connection with Anaconda workings will make property an "upcast," with strong current of air flowing throughout workings. No. 15 Sorocco fan will be installed at opening of crosscut on Anaconda level. Davis-Daly has opened 2½ ft. ore on 2300 level showing high in copper.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments for week ended May 8 were: Prince Consolidated, 22 cars; Virginia-Louise, 7 cars; Harney, 2 cars; Black Metals, 2 cars.

COMBINED METALS (Pioche)—Assessment of 2c. per share levied. Ore shipped to date has contents valued at $392,113.45, and yielded $75,178.23 net smelter returns, which has been spent in performing 4350 ft. of development. Ore reserves total 150,000 tons, averaging .04 oz. gold, 8.26 oz. silver, 8.27% lead and 18.15% zinc. Owing to intimate association of lead and zinc in a form preventing separation by concentration, planning to erect special process smeltery, to recover both metals simultaneously in marketable material, for use as pigments.

Mineral County

SIMON LEAD MINES (Mina)—Engaged in extensive development; expects to crosscut vein at 400 level. Ore tests and plans for mill incomplete. Situated 23 miles east of Mina. Ore, lead-silver, with some zinc.

Nye County

EAST DIVIDE EXTENSION (Divide)—Powerful surface equipment being installed to prospect at depth East Divide fissure.

NEW MEXICO

Grant County

HATCHET OIL AND DEVELOPMENT (Hatchita)—Incorporated with a capital of $250,000; to drill in southern Grant County for oil. R. A. Smith, W. C. Ammerman, E. S. Plumb, and others, interested.

CHINO (Santa Rita)—Have 12 steam shovels stripping overburden.

Luna County

BLACK CAP (Deming)—Case of Birchfield vs. Warren, Hoagland, Stickney to dispossess defendants from sections of Government grazing land in the Little and Big Florida mountains, claimed by Birchfield, decided in favor of defendants. Claims have been held by Birchfield since 1905. Property was worked for manganese by Warren and others during the war. It also carries vein of 10-oz. silver ore. Developed by 100-ft. shaft. Will continus development.

WEST & CASE (Gage)—New strike, 8-in. vein assaying high silver-lead contents and 0.04 oz. gold. Three miles south of railroad. Will have 30-ton car ready to ship June 1.

DODD-WARREN (Tres Hermanos)—Will put shafts in safe condition so examination may be made.

OKLAHOMA

Miami District

SILVER FOX (Baxter, Kan.)—Annual election of officers held. B. J. Conley, Kingfisher, Okla., president; Frank Childress, Galena, Kan., vice-president and manager. Mill operating since August, 1918, and company made good profit, despite poor zinc ore prices.

VICTORY (Picher) — Developed good lead property in new shaft put down on northeastern part of Commonwealth lease. A. E. Bendelari, manager.

Tulsa County

SINCLAIR OIL AND GAS (Tulsa)—Purchased Liberty Tower Bldg., corner Liberty and Nassau Sts., New York, for reported consideration of $2,100,000. Building is 31 stories. Present offices, 120 Broadway.

TEXAS

R. F. YOAKUM and associates will develop oil lease holdings in Central West Texas fields and reported will build refinery at Dallas or in vicinity.

Bexar County

HELVETIA COPPER CO.'S oil lands, situated 20 miles south of San Antonio, are reported to be producing oil. Well down 1600 ft.; casing became wedged, preventing seepage of oil into drill pipe, and therefore producing only six barrels daily. Expects to start further drilling when four churn drills arrive. Intend calling assessment of $1 per share, but treasury surplus at present sufficient for immediate needs. C. C. Prindle, president; R. H. Gross, of East Butte Copper Co., treasurer; W. A. Paine, president Copper Range Co., and R. M. Bennet interested. Company owns copper properties in Pima County, Ariz., with ore said to be of refractory nature.

Brazoria County

CROWN OIL AND REFINING (West Columbia)—Marmion No. 2 well brought in May 7 at depth of 2100 ft. Initial flow, 3000 bbl. a day, with considerable water. Well capped until storage facilities provided.

Freestone County

TYTHE OIL AND GAS, of Corsicana, leased large acreage near Fairfield recently. Other oil companies leased ground near by; drilling will begin soon.

Hardin County

NEW WELLS AT SOUR LAKE brought in as follows: Lake Graham Oil Co., 200-bbl. pumper; The Texas Co., well No. 113, 150-bbl. pumper.

Harris County

GULF PRODUCTION (Goose Creek)—No. 18 Wright-A well now making 500 bbl. a day, with air lift. No. 12 Stateland is dry at 3100 feet.

GULF COAST OIL (Goose Creek)—Gaillard No. 10 brought in at 2923 ft., flowing 175 bbl. a day, with 10% water.

Liberty County

REPUBLIC PRODUCTION (Hull)—Continue production from pumping wells following notification Sun Pipe Line Co. would take part of Republic's production in Hull field. Daily production of field for last week about 1000 barrels.

UTAH

Iron County

BIG FIVE MINING (Lund)—Coal land covering 320 acres and 25 iron claims reported sold for good price to California people. Land lies along route of proposed railroad of Old Capitol Petroleum and Fuel Co., to run between Lund on S. P. L. A. & S. L. R. R. and Cedar City.

Juab County

APEX STANDARD (Eureka) — Shaft down almost 700 ft. Well equipped. Southeast of Tintic Standard and east of Iron King.

CENTENNIAL-EUREKA (Eureka) — Reported some lead ore found on 2000 level. Deepest workings.

EUREKA BULLION (Eureka) — Strike on 800 level near Tintic Standard. J. M. Bestelmeyer, locater of Tintic Standard, manager.

EUREKA MINES (Eureka) — Strike made on 1000 level by lessees. Company doing work in search of this ore on 1100.

GODIVA (Eureka) — Preparations for deeper mining being made.

MAY DAY (Eureka)—Considering development to 1500 to 1800 ft. Arrangements probable to work through shafts of neighboring properties.

PLUTUS (Eureka)—Controlled by Chief Consolidated. Shows machinery and improvements valued at $500 in report to Board of Equalization.

TINTIC DRAIN TUNNEL (Eureka)—Tunnel starting from eastern side of Tintic Mountain, few miles southwest of Goshen and Elberta, in about 2600 ft. Monthly progress 175 to 200 ft., with force of 30 men working. To unwater large mining area, as well as provide irrigation. Jesse Knight interested.

TINTIC STANDARD (Eureka)—Net proceeds 1918 amounted to $638,944.

TINTIC MILLING (Silver City) — No action by directors in regard to installation of cyanide tanks and complementary equipment for treatment of gold ores. Recovery not great at present, and no ores carrying much gold accepted. Large tonnage of ore of this character not available in district.

Piute County

ALUMINUM POTASH COMPANY OF AMERICA (Marysvale)—Mine buildings being put up five miles north of Marysvale in Sevier Canyon. Mill to be built. Property includes Copper Butte claims. G. M. Winkleman, president.

Salt Lake County

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Narrow-gage road clear and ore shipments from South Hecla and Columbus-Rexall to begin immediately.

UTAH COPPER (Bingham)—Ore milled first quarter 1919 amounted to 1,526,500 tons, from which 28,971,089 lb. copper obtained. Extraction 71.70% and cost 13.72c. per lb. Total, with 36,016 lb. direct shipping ore added, 29,261,208 lb. Figures compare with 3,017,100 tons milled last quarter 1918, from which obtained 48,303,692 lb. copper; total—with 254,104 lb. direct shipping ore added—49,238,076 lb. copper, average extraction, 61.13% and cost 16.42c. Net profits, $181,324, as compared to $3,331,728 last quarter 1918.

CARDIFF (Salt Lake)—Most of surface snow off road up Big Cottonwood Canyon to mine, but passage of trucks not yet feasible, owing to slides.

Summit County

ONTARIO SILVER (Park City)—Pumps still working. Reported committee of employees to meet with management in regard to strike.

WASHINGTON

Ferry County

LAURIER MINING CO.'S property near international boundary has been leased by G. A. O'Neal and partners. Has yielded fair returns in copper and silver.

QUILP (Republic)—Shipping steadily about five cars weekly to Tacoma smeltery.

Okanogan County

GREAT METALS, M. AND M. (Nespelem) — Constructed 100-ton mill last year at falls on Nespelem River, about three miles from Nespelem, now reporting good recovery in re-treating old dumps for gold and silver. Water concentration and flotation used.

Snohomish County

SUNSET COPPER (Index)—Dewatering preparatory to resuming operations. For last two years has been most consistent shipper in Cascade region. Suspended operations few months ago when copper prices declined. Operates 150-ton mill. W. W. Pitt, superintendent.

CANADA

British Columbia

CONSOLIDATED M. AND S. (Trail)—Announced cut of 45c. per ton in treatment of ores. Change of rate based on change in wage scale and price of coke.

Ontario

MILLER INDEPENDENCE (Boston Creek)—Planning 100-ton mill.

ADANAC (Cobalt)—Arranging to treat low-grade ore in Temiskaming mill.

FOSTER (Cobalt)—Resumed operations after short shutdown.

TEMISKAMING (Cobalt) — Negotiating for Cochrane property, adjoining.

PALMER PAINE (Gowganda)—Formed to operate T. C. 177, a well-known claim near Miller Lake-O'Brien.

CLIFTON PORCUPINE (Porcupine)—Formed to operate Porphyry Hill, which shipped number of cars of profitable ore from narrow vein.

DAVIDSON (Porcupine)—Developments satisfactory. Ore from new vein put through five-stamp mill.

M'INTYRE (Porcupine)—Sinking to 1350 feet.

KEELEY (South Lorraine)—To be reopened. Worked spasmodically for years.

MEXICO

NEW RAILROAD, to traverse section of northern Mexico between Cuatro Cienegas and Sierra Majada, about 110 miles, according to report, has been under construction for several months. It is a government project, primarily intended to give employment to natives. Line is expected to be in operation by next December. It is an extension of the branch line of National Railways of Mexico, which runs from Monclova to Cuatro Cienegas.

RENEWAL OF CONCESSIONS which were granted under the late President Diaz, but cancelled under the Carranza government for non-fulfilment of contract, have been applied for to the Department of Commerce and Industry. The concessions were granted to Americans and other foreigners for the installation of hydro-electric plants and development of water-power resources. Complete survey of available sites and amount of horsepower to be generated is planned by the government.

Sonora

DOS CABEZOS (Nuevas Cases Grandes)—Property leased by Frank Wheelan, of El Paso. Will start work at once. Owned by W. E. Pearson, idle four years.

PROMONTORIO (Alamos)—Has opened 14 ft. ore on 400 level. Treating 50 tons daily in Lane mill, producing 10 tons concentrates. Ore is silver-lead. Completed truck road to Alamos, eight miles. Carlos Grosbeck, manager.

SAN MANUEL (Alamos)—Made first payment on purchase price of $50,000; getting good grade ore on 200 level. Amos Yeager and others, of Nogales, Ariz., new owners.

PERU

Junin

CERRO DE PASCO (Morococha)—April production, according to cable advices, was 2,780,000 lb. blister copper.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver		May	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
15	4.6575	1.11	53⅞	19	4.6506	1.09	53⅛
16	4.6538	1.11⅛	54	20	4.6200	1.08⅜	52⅞
17	4.6525	1.10	53½	21	4.6200	1.04⅝	51

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
May	Electrolytic	Spot.	N. Y.	St. L.	St. L.
15	15.85	†72½	5.00 @5.05	4.70 @4.75	6.10
16	16.10	†72½	5.00 @5.10	4.75 @4.80	6.12½ @6.17½
17	16.10	†72½	5.10	4.85 @4.90	6.15 @6.20
19	16.35	†72½	5.25	4.90 @5.00	6.20 @6.25
20	16.35	†72½	5.25	5.00 @5.05	6.25 @6.30
21	16.35	†72½	5.25	5.00 @5.05	6.25 @6.30

† Government price.

The above quotations are our apprsaisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
May	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
15	77½	77¾	81	237	234	24⅜	24⅜	35¼
16	78	78¼	81½	242	237½	24⅜	24⅜	35¾
17	....	....	...	..	..	.	. .	...
19	79¼	79½	82	246½	242½	24⅜	24⅜	36
20	79½	79¼	82	245	241½	24⅜	24½	36
21	79⅜	79½	82	239	237	23½	23¾	36

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—May 21, 1919

This week was noteworthy for further sharp advances in copper, lead, and zinc, and the transaction of large business in each of these metals, but particularly in copper.

The flurry in silver passed away, and the price relapsed. The causes for the recent advance centered in London, in which market there was buying for coinage purposes and speculative short-covering. The Orient was not a buyer. A recent event that has passed without notice was the raising by the Indian government of the value of the rupee from 18d. to 20d. If the Indian government could previously be a buyer of silver at about $1 per oz., apparently it is in a position to buy now at an advance of about 10% without disturbing exchanges.

At a recent meeting in the office of the Director of Sales, War Department, it was reported that the several branches of the War Department had the following supplies of scrap brass and unused munitions: 31,907 tons of brass in the form of ingots, rods, sheets, etc.; 33,000 tons of field artillery cases; 1000 tons of cartridge cases; and 2939 tons of brass scrap. Some of this material is high grade brass and some of it is leaded brass.

Ocean freights to British ports remain at 1c. per lb. and trans-Pacific freights at $15 per ton.

Copper—Very large business was transacted this week, larger than in the previous week. As heretofore, this was mainly for domestic account, and was mainly with wire-drawers. However, some brass-makers bought relatively small quantities. The bulk of the business was for May-June delivery, but there were more July contracts written than in the previous week, and some sales were made for August delivery. The common custom among the selling agencies now is to enter into two months' contracts, and July and August business is regarded as forward business, for which premiums are asked. However, sellers are not united in such a construction, and a considerable part of the July business of this week was taken on the same terms as May-June.

Some export business was done this week, especially for shipment to Japan, whither shipments are naturally made from Tacoma. The British market is below our parity. At the beginning of the week copper was reported sold in London at £80½, which would correspond to about 15½c. here. Later £83, equivalent to a little less than 16c., f.o.b., New York, was quoted. At the close, London quoted spot at £83, and futures at £82.

In this market the week began with copper firmly on the basis of 16c., delivered, regular terms, or 15.85c., cash, New York. The largest part of the sales was made at that price, and the volume of business done on Thursday was so great that all producers advanced ¼c. on Friday. Although the volume of business fell off somewhat, it remained so large that a further advance of ¼c. on Monday was considered to be justified, and business aggregating millions of pounds was done on the basis of 16.35c., New York. During Tuesday and Wednesday, however, the inquiry waned distinctly, and, although producers were very firm in their terms, the market seemed to have rather a tired look.

The Japanese buying of copper in this market has been mysterious. It is well known that the cost of producing copper in Japan has increased very seriously, but the statistics of production and exports show that Japan must have begun this year with a large stock of copper, and we know the Japanese producers have been underselling us in England.

Some of the important copper mines of Australia have been closed, owing to inability to operate profitably under present conditions. There is a considerable accumulation of electrolytic copper at Port Kembla and stocks of crude copper elsewhere.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 18¾c. per lb. f.o.b. mill, carload lots.

Tin—There is nothing new to report with respect to the domestic market.

Lead—In our report of last week we recorded the firmer tendency in lead, even then exhibited by advanced quotations. This resulted primarily from increased demand for the metal. The largest producers had been standing aloof, leaving the market to the rest of the producers, some of whom led the way in depressing prices by their offerings so long as demand was dull. With improving demand, they changed their minds, and, withdrawing their pressure, the price advanced quickly. However, there was not a general acquaintance with the situation, and some large business was accepted by one or more producers on Friday morning at 5c., just before the A. S. & R. Co. raised its price to 5.10c. On May 19 the A. S. & R. Co. again raised to 5¼c., and has sold freely at that price, although other producers have asked a little more and have obtained it on some small business. A contributory factor to the advance was probably the feeling that such lead as is still held by the Government would cease to be a menace.

Business in lead this week attained considerable proportions. The manufacturers of blue-lead products were large buyers, and some purchases were made by cable manufacturers. The consumption of lead by the corroders has been pretty good right along.

The situation with respect to Mexican lead has been relieved by some substantial sales for export.

Zinc—This market advanced sharply, partly on speculative buying and partly on buying by consumers. Galvanizers and brass-makers were rather conspicuous by their absence, but some sales were made to sheet-rollers and there were some sales for export. A rather fair business in high-grade zinc was done, sales of this metal being made at 6⅝@6¾c. The report that the Government was offering high-grade zinc at 6¾c. became a disconcerting factor, however, and was regarded as curious, in view of the pending negotiations between the Government and the producers for the latter to take over the stocks, which negotiations were regarded as being close to consummation.

Speculative interest in the zinc market was reflected by the premium of about 0.5c. that was paid for forward deliveries.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—31@32c. per pound.

Antimony—The sharp advance in this market was a consequence of the rise in the price for silver, the Chinese and Japanese producers advancing their prices, although the stocks of the metal in this country are still believed to be considerable. At the close we quote spot at 7⅞@8c. Futures are not freely offered, but 7⅞c. is quoted nominally.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Supplies in this market are still short. We quote $82. San Francisco telegraphs $78, strong.

Silver and Platinum

Silver—The market for silver this week has been unsettled and reactionary, selling down from 53⅞ to 51d. Buyers have held back, looking for still further decline. India has not responded to the advance, and therefore sufficient support to sustain the higher prices has not been forthcoming.

Exports for the week ended May 17 were 956,000 ounces.

Mexican dollars at New York: May 15, 84; May 16, 84; May 17, 84; May 19, 83; May 20, 82; May 21. 79½.

The general stock of money in the United States on May 1, 1919, totaled $7,614,699,260; of this, $3,092,430,916 was in gold coin and bullion, $311,018,930 in standard silver dollars, and $243,896,606 in subsidiary silver. The money in circulation on May 1 was $5,863,288,091, or $54.64 per capita. On May 1, 1918, the per-capita circulation was $50.37.

Platinum—Refined ingot is quoted at $105.

Palladium—We quote $115@120, sales being reported at both these figures.

Zinc and Lead Ore Markets

Joplin, Mo., May 17—Blende, per ton, high, $40.40; basis 60% zinc, premium, $38; Prime Western, $37@36; sludge and flotation, $35@32; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $35.29; calamine, $23; all zinc ores, $35.

Lead, high, $62.80; basis 80% lead, $55; average settling price, all grades of lead, $55.10 per ton.

Shipments the week: Blende, 12,438; calamine, 236; lead, 1573 tons. Value, all ores the week, $531,190.

The forced closing down of mines, on the account of the low price of spelter and zinc ore, is creating a disconcerting influence upon producers. Some who are still trying to make expenses assume that it would be better to cease mining entirely. A general closing down during harvest is talked about. After that, if the metal and ore outlook does not improve, many intend to quit the business. The large majority of Missouri mines have long ago been abandoned, and may never again be opened. If the Oklahoma field is closed the same fate may befall that part of the district.

Platteville, Wis., May 17—Blende, basis 60% zinc, $39 base both for premium grade and high-lead grade.

No sales of lead ore are reported. Shipments reported for the week are 1991 tons blende, 30 tons galena, and 726 tons sulphur ore.

For the year to date the totals are 37,771 tons blende, 1857 tons galena, and 4628 tons sulphur ore. During the week 2676 tons blende were shipped to separating plants.

Other Ores

Manganese Ore—Charles Hardy reports the following: "While it is possible to dispose of spot lots of manganese at around 50c. per unit delivered, furnace, it seems almost impossible to enter into any contract for future delivery. Some time back, however, we were told of very low prices ruling for Indian ore, but these low prices were not borne out by offers received from abroad. The lowest quotation that we have come across during the week for Indian ore for shipment was 65c. per unit, while the Brazilian ore is quoted at 32c. per unit, f.o.b., and this price with the present freights prevailing would be far in excess of 65c." Stocks are still high at buyers' works.

Molybdenum—Some dealers report no inquiry, while others report a little. We quote 65@75c.

Tungsten Ore—There was a fair inquiry, and some business was done. Chinese ore was quoted at $6.50@7; for Bolivian ore, $9@10 was asked, but no business in that ore was reported.

Other Minerals

Pyrites—Spanish pyrites is quoted at 20½c. per unit for furnace ore, c.i.f. New York or other Atlantic port.

Iron Trade Review

PITTSBURGH—May 20

In practically all finished-steel products except tin plate there is a distinctly marked improvement in buying. Orders are small individually, as formerly, and buyers show their lack of confidence in prices by placing orders only for material that is urgently needed. This however, represents a healthy condition from the standpoint of producers, who are beginning to become sanguine and to hope that in the near future there will be heavier mill operations. Until a week or two ago, there had been a constant decrease in operations, due to the gradual exhaustion of old orders. The increase in new buying may possibly counterbalance the completion of old business. Several of the independents are operating at better rates than last week or the week before, but Steel Corporation operations, which have regularly been higher than independent mill operations since the first of the year, continue to decrease.

Lettings of fabricated steel orders in April represented 21½% of the month's capacity, against 17½% in March, 12½% in February and 12% in January. A large quantity of such work has been figured upon, but it is only in the case of small jobs that there are lettings, investors in large projects apparently preferring to wait.

A careful canvass of the railroad situation has been made by steel interests, resulting in the conclusion that the railroads are not in urgent need of buying steel products during the next few months. Though some roads are bare of supplies others have more than are necessary, and by various exchanges the Railroad Administration will be able to avoid buying much steel. Action has not been taken as to the 200,000 tons of rails recently inquired for, but the prospect seems to be that purchases will not be made at this time. There is an unconfirmed rumor that the French government is about to close with the Steel Corporation for 100,000 tons of rails, arrangements having to be made for banking accommodations to carry payments over a considerable period. Generally there is an improvement in export business, which has been light for months. The fairly large exports reported monthly are chiefly on old orders; much of the material had been rolled and was awaiting shipping accommodations at the ending of hostilities.

The large steel producers are with scarcely an exception adhering rigidly to the prices of Mar. 21. There is cutting, ranging up to $2 per ton, or possibly more, in many products, chiefly by small mills, also by a Western interest, whose cutting under the Pittsburgh basis is viewed as a surrender of part of the freight advantage arising from location. Indications are that there will be no general break in the market, at least in the near future, and there has been such a change in judgment in the last few weeks that some observers now think a general buying movement can start from the present price level.

Pig Iron—No improvement in the demand for pig iron is to be recorded, purchases being only of small tonnages, for immediate shipment. Even on such business there are occasional price irregularities. The melt of foundry iron is believed to have increased of late, and stocks in consumers' hands have decreased considerably. Many merchant furnaces have gone out, and those still in blast are accumulating little iron. The probability is that more merchant pig iron is being consumed than is being made. Though the market is soft, it is quotable at Mar. 21 prices: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40. One furnace with $1.10 freight to Pittsburgh quotes these same prices at furnace, and there may be other cases of the sort, so that the Pittsburgh market is not at the full Valley equivalent.

Steel—Rumors continue of shading of billet, sheet bar and slab prices by $1 to $2 a ton, but these have not been fully confirmed, and all or nearly all the large producers are adhering strictly to regular prices. Irregularities seem to be confined to small producers of openhearth steel. We quote: Billets, $38.50; sheet bars and small billets, $42; slabs, $41, f.o.b. Pittsburgh or Youngstown. Rods are firm at $52, Pittsburgh.

Ferromanganese—The market on resale 80% ferromanganese continues quotable at about $110, delivered, though a few sales have lately been made at less, sometimes at much less, the seller apparently not knowing what could be secured. The producers' asking price continues at $150, delivered. The British c.i.f. price is £25, equal to about $116 at the Atlantic seaboard, but there is no buying even at that figure, which is interesting chiefly as an indication of the future of the market, as the cost of production is undoubtedly lower in the United States than in Britain. Spiegeleisen continues nominal at $33@35 for 18% resale, there being no transactions.

Coke—The spot furnace coke market has stiffened further, the usual quotations being $4. This could be shaded, but perhaps not by as much as 25c., whereas a few weeks ago sales were made at $3.50@3.60. May settlements on monthly adjustment contracts were generally made at $4, and this figure will probably obtain for June. Furnacemen and coke operators are beginning to sound each other out on second-half contracts. Operators are disposed to ask $4, and in some cases $4.25, for second half, but furnaces are hardly likely to start the bidding at over $3.50. Production in the Connellsville and Lower Connellsville region is now about 100,000 tons per month, or a shade more, whereas during the major part of last year production ran well over 300,000 tons, and a few years ago a rate of 425,000 tons a month was maintained for a year. Much of the decrease of consumption falls upon the Connellsville region, byproduct operations remaining at close to capacity.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	74.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.715	99.505		37.940	48.980	
June	76.971	99.500		39.065	48.875	
July	79.010	99.625		40.110	48.813	
Aug.	85.407	100.292		43.418	49.077	
Sept.	100.740	101.125		50.920	49.500	
Oct.	87.332	101.125		44.324	49.500	
Nov.	85.891	101.125		43.584	49.500	
Dec.	85.960	101.125		43.052	48.492	
Year	81.417	96.772		40.851	47.516	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce sterling silver, 925 fine.

STOCK QUOTATIONS

N. Y. EXCH.†	May 20
Alaska Gold M.	4
Alaska Juneau	2¼
Am.Sm.&Ref.,com.	78
Am.Sm.& Ref., pf.	‡109
Am.Sm.Sec., pf., A	‡93
Am. Zinc	16¼
Am. Zinc, pf.	‡48
Anaconda	67¼
Batopilas Min	‡2
Bethlehem Steel	‡75
Butte & Superior	25
Butte Cop. & Zinc	2¾
Cerro de Pasco	44½
Chile Cop	23¼
Chino	38½
Colo. Fuel & Iron	46½
Crucible Steel	74¾
Crucible Steel, pf	*95
Dome Mines	15
Federal M. & S.	15¼
Federal M. & S., pf	43
Great Nor., ore ctf.	46
Greene Cananea	41
Gulf States Steel	70
Homestake	‡81
Inspiration Con	54½
International Nickel	26½
Kennecott	34¼
Lackawanna Steel	78½
Mexican Petrol.	181½
Miami Copper	27¼
Nat'l Lead, com	‡75
National Lead, pf	‡108
Nev. Consol	17¾
Ontario Min	8½
Ray Con	21½
Republic I.&S.,com	86½
Republic I.&S., pf	103½
Sloss-Sheffield	58
Tennessee C. & C.	15
U. S. Steel, com	102¼
U. S. Steel, pf	115½
Utah Copper	78
Va. Iron C. & C.	‡63¼
Worthington Pump	68

BOSTON CURB*	May 20
Boston Ely	1¼
Boston & Mont	65
Butte & Lon'n Dev	12
Calaveras	1
Chief Con	3¼
Contact	05
Corbin	‡ 25
Cortez	5
Crown Reserve	35
Crystal Cop	16
Eagle & Blue Bell	2$\frac{3}{16}$
First Nat. Cop	1$\frac{11}{16}$
Gadsden Cop	3½
Houghton Copper	50
Intermountain	‡ 05
Iron Blossom	38
Iron Cap	10¼
Majestic	19
Mexican Metals	17
Mines of America	‡ 05
Mojave Tungsten	23
Nat. Zinc & Lead	13
Nevada-Douglas	15
New Baltic	1
Oneco	50
Pacific Mines	‡ 25
Rex Cons	14
Yukon Gold	75

SAN FRAN.*	May 13
Alta	‡ 08
Andes	29
Best & Belcher	35
Caledonia	24
Challenge Con	‡ 03
Confidence	25
Con. Virginia	2 70
Gould & Curry	12
Hale & Norcross	26
Jacket-Cr. Pt	25
Mexican	62
Occidental	40
Ophir	2 00
Overman	10
Savage	19
Sierra Nevada	19
Union Con	40
Utah Con	‡ 01
Belmont	3 50
Jim Butler	14
MacNamara	‡ 15
Midway	51
Mont.-Tonopah	25
North Star	10
Rescue Eula	21
West End Con	2 62½
Atlanta	04
Booth	13
Comb. Frac	07
Florence	45
Jumbo Extension	14
Kewanas	04
Nevada Hills	07
Nevada Packard	19
Round Mountain	30
Silver Pick	09
White Caps	23

COLO. SPRINGS*	May 13
Cresson Con	4 50
Doctor Jack Pot	03
Elkton Con	05
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	1 79
Granite	.14
Isabella	.05½
Mary McKinney	‡ 07½
Portland	.95
United Gold M	.16½
Vindicator	30

BOSTON EXCH.†	May 20
Adventure	‡.50
Ahmeek	74
Algomah	.60
Allouez	37
Ariz. Com.	12½
Arnold	‡.20
Bingham Mines	9½
Bonanza	20
Butte-Balaklava	‡ 65
Calumet & Ariz	64½
Calumet & Hecla	400
Carson Hill	13½
Centennial	13
Copper Range	44½
Daly West	3½
Davis-Daly	6¾
East Butte	9¾
Franklin	2¾
Granby	‡66
Hancock	5
Hedley	‡12
Helvetia	5¼
Indiana	‡ 50
Isle Royale	28½
Keweenaw	‡1½
Lake	4
La Salle	2½
Mason Valley	3½
Mass	5½
Mayflower	6½
Michigan	6
Mohawk	59½
New Arcadian	2½
New Cornelia	17½
New Idria	9
Nipissing	12
North Butte	11¾
North Lake	.51
Ojibway	3½
Old Dominion	34½
Osceola	51
Quincy	61
St. Mary's M. L.	48½
Santa Fe	‡ 25
Seneca	24
Shannon	3
Shattuck-Ariz	‡11
So. Lake	1¼
So. Utah	25
Superior	6¼
Superior & Bost.	2½
Trinity	3¼
Tuolumne	.99
U. S. Smelting	65½
U. S. Smelting, pf	49½
Utah Apex	3
Utah Con	10¼
Utah Metal	1⅛
Victoria	‡2½
Winona	.99
Wolverine	18½

N. Y. CURB†	May 20
Am. Tin & Tung	¼
Big Ledge	1¼
Butte & N. Y.	‡ 50
Butte Detroit	‡ 04
Caledonia	39
Calumet & Jerome	¼
Can. Cop. Corpn	1¼
Carlisle	½
Cashboy	10½
Con. Ariz. Sm	¾
Con. Coppermines	5½
Goldfield Con	16
Goldfield Merger	05
Hecla Min.	5¼
Howe Sound	5¼
Jerome Verde	1$\frac{11}{16}$
Louisiana	⅜
Magma	‡31
Marsh	08
McKinley-Dar-Sa	60
Milford	‡ 75
Mother Lode	42
Nixon Nevada	21
Ohio Cop	‡ 50
Rawley	‡2½
Ray Hercules	2
Richmond	‡ 50
Rochester Mines	23
St. Joseph Lead	‡13
Standard S. L	$\frac{5}{8}$
Stewart	32
Success	‡ 05
Tonopah	1¾
Tonopah Divide	8½
Tonopah Ex	3
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	4¼
United Verde Ext.	‡ 36½
United Zinc	25
Utica Mines	‡ 08

TORONTO*	May 20
Adanac	22
Bailey	04
Beaver Con	45
Chambers Ferland	2 00
Coniagas	04
Hargraves	‡5 75
Kerr Lake	50
La Rose	1 00
Lake Shore	2 00
Min. Corp. of Can	08
Peterson Lake	18
Beck-Hughes	40
Temiskaming	03
Wettlaufer-Lor	‡ 68
Davidson	40
Dome Exten	20
Dome Lake	7 00
Hollinger	1 75
McIntyre	12½
Newray	20
Porcu. Crown	20
Vipond	13
West Dome	

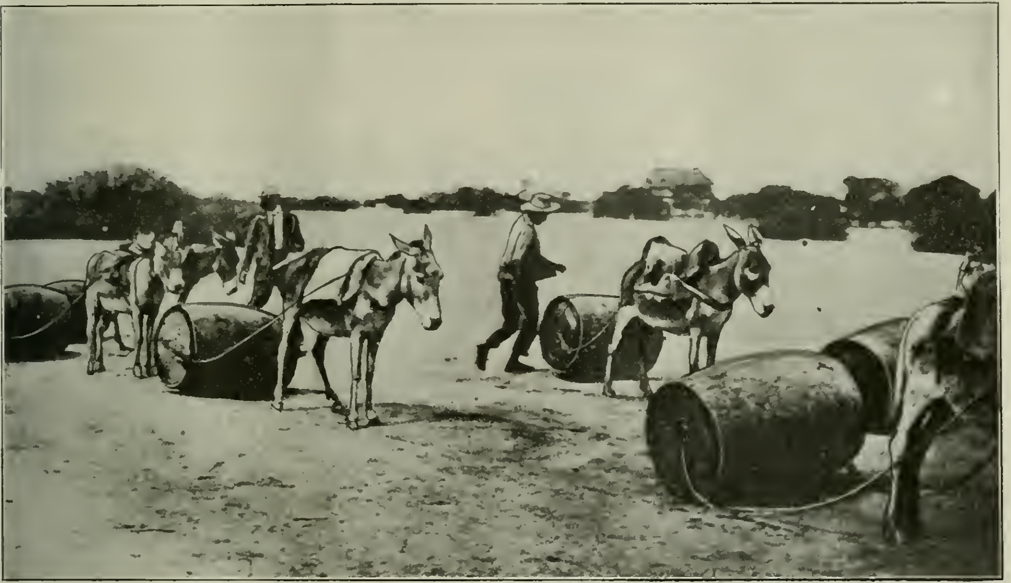
*Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

May 31, 1919

Volume 107

Number 22



ECUADORIAN METHOD OF TRANSPORTING PETROLEUM TO THE COAST FOR SHIPMENT

Petroleum in Ecuador

By WALTER M. BRODIE *

An account of the geology and occurrence of oil in Ecuador, details from a number of reports that have been submitted from time to time on the subject, and data as to the legal aspect of concessions in the republic. The author affirms that if American enterprise is to have its share in the petroleum industry of South America attention may well be directed to the coast lands of Ecuador and Peru.

ECUADOR, situated between Colombia on the north and Peru on the south, is commercially and industrially interesting, as it has a great diversity of climate, altitude, and products. Quito, the capital, has an elevation of 9500 ft. and is 290 miles from the coast, by railroad. The coast country has a hot, dry climate, which is tempered, however, by the ocean currents which come from the cold regions of the southern hemisphere and cool the westerly winds, and by the high Andes Mountains on the east, which modify the hot breezes from the opposite direction.

For many years the existence of petroleum along the southwest coast of Ecuador has been known, and it has been produced in small quantities for half a century. The Bay of Guayaquil, or Bay of Ancón, as it is sometimes called, divides the coast country of Ecuador from that of Peru. Oil fields are found both north and south of this bay. The principal city in the neighborhood is Guayaquil, with about 60,000 inhabitants. It is the principal port of the country, and a center of commercial activity.

The best-known oil fields on the coast of Ecuador lie on the peninsula of Santa Elena, about 100 miles west from the city of Guayaquil. Coast steamers connect with the small port of Ballenita, just north of the promontory, and the locality can also be reached by automobile or on horseback during the dry season. The region has been described in a geography written by the German geologist Wolf, which was published in Leipzig in 1892 under the auspices of the government of Ecuador. Wolf holds (and D. Clerc, a French engineer, who reported on the Santa Elena oil fields in 1909, confirms his contention) that the surface of the ground near the oil pits of Santa Elena belongs to post-Tertiary formation, which is estimated by Clerc to be at least 164 ft. thick; that the underlying Tertiary formation is 325 to 650 ft. thick at least, and that this lower formation comes to the surface to the east and to the north of Santa Elena. Still further north the ridge of hills which bounds the peninsula belongs to the Cretaceous period.

---

*Mining engineer, 47 Cedar St., New York.

OIL ZONE COVERS LARGE AREA

The oil zone is estimated to cover about 600 square miles. It reaches from Salinas, the most western point of the Santa Elena district, where the shore water furnishes the salt for the Republic of Ecuador, to San Vicente, where there are numerous springs and pits with highly mineralized waters, and comprises a considerable part of the lowlands along the coast. In this zone there are several harbors. One of the best is Ballenita, about 700 miles south from Panama and 90 miles northwest from Guayaquil, which latter distance can be covered in the dry season by auto in five or six hours, but which cannot be made overland in the rainy or winter season, owing to the numerous gulches, which are impassable when full of water.

THE GAS SPRING, "EL VOLCANCITO DE SAN VICENTE," IN THE CANTON SANTA ELENA, ECUADOR

The immediate neighborhood of Santa Elena is fairly level, with a slight inclination toward the west coast. Toward the northeast there are elevations about 140 ft. high; and here a number of gulches or cuts show that erosion has exposed the underlying Tertiary rocks. The country is dry for the greater part of the year, and good drinkable water, timber, and fuel are scarce. Water is now procured from pits, but an abundant supply could be obtained from the rivers of Olon and Menglar, if a few miles of pipe line were laid. In the oil zone of Puna water is obtained from pits and trenches, and also, when necessary, by condensation of steam. This latter method of procuring drinking water is often adopted when the only water obtainable is brackish or bad.

EARLY EXPERIMENTATION FAILED

In 1876, President Garcia Moreno, who tried to develop a petroleum industry, started an exploration for the government and began to drill a deep hole, but a part of the machinery broke when the hole was only 50 meters deep. Soon afterward the president died, and the work was suspended and, later, abandoned. At that time oil-bearing ground was not denounceable by private parties. The government leased the oil lands. In 1892, when the Mining Code of Ecuador was revised, the new law authorized private individuals to examine and to preëmpt oil grounds, but the region of Santa Elena had been leased for 20 years; and it was not until 1908 and 1909 that claims were filed by various persons, who, little by little, took up all the available ground.

In 1908 a report was made by Edward J. Rye on the petroleum of the Bay of Ancón. He found the oil-bearing strata to be similar to and more pronounced than those of Peru, where, notably at Negritos and at Lorritos, for several years about 1400 tons monthly had been produced. He recommended that drilling be done.

NUMEROUS REPORTS CONFIRM OIL OCCURRENCE

A report was made in 1909 by M. J. Stephen, Ph. D., who tells about the occurrence of petroleum and gas at various points and also recommends the development of specific areas by drilling. Another detailed report on the region was made in 1909, by the French engineer Clerc, who says that all signs are favorable, and points out that a number of shallow pits, which were dug and worked by hand, had yielded 300 tons of oil monthly for many years, that the country is healthful and good to work in and to live in, and that it has the necessary resources for a profitable industry, as it lies near the coast and within reach of the large city of Guayaquil. He says, also, that the formation of Santa Elena is Quaternary, in which oil has been found in horizontal strata lying in discordant stratification over Tertiary ground, which is strongly folded, and which consists of porous sandstones, alternating with impervious clayey schists. He mentions and describes a well-known point in the neighborhood, "El Volcancito," where the Tertiary formation has come to the surface and where oil can be seen oozing out of the ground.

M. Clerc, whose report is made with considerable care, insists on the necessity of careful investigation, points out the similarity of the region to the Peru oil areas across the bay to the south, and speaks hopefully of the future of the district. The reports of Rye and Stephen were in large measure responsible for the formation of the Ancón Oil Co., of Ecuador, Ltd., in London, which acquired several properties. Charles Maddock came to Ecuador to take charge; and soon after his arrival on one of the properties, San José, a hole was located and drilled. The work on the holdings of the Ancón Oil Co. was carried on principally in 1911 and 1912, but the property is now owned by Milnes and Williamson, who only a few months ago were operating in Santa Elena.

OIL FOUND NEAR COAST

In 1912 another engineer, R. A. Graham, came to examine the properties of the Ancón Oil Co. and reported that the company owned 5000 acres and many options, that the prospects are good, that the location is favorable, as the distance is only 650 miles south from Panama, whereas the California fields are 3100 miles north of Panama; that extensive properties can be secured in Ecuador more easily than in California; that the oil, being near the coast, needs no long pipe lines for transportation, and that there is a good market, especially for fuel oil, in Ecuador and in other accessible parts of South America. He also recommends drilling.

In 1914, Charles Maddock, who had previously been with the Ancón Oil Co., reported on the Santa Elena region. He stated that one well had been sunk to a depth of 2000 ft., the only deep well up to date; that at 1700 ft. a petroleum was found which gave a 30% motor oil, as analyzed in Paris; that the sandstones and shales are similar to those of Peru and belong to the Miocene period; that in Peru, notably at Negritos and Torritos, oil has been produced for years at the rate of 14,000 tons per month, and that the Negritos deposit has been worked for 30 years. He stated also that the Ecuador oil fields, if intelligently developed, will eventually be as important as those further south, and will be able to compete with other oil fields of the world which now furnish petroleum to South America.

MINING TAXES ARE LOW

In Ecuador the mineral rights are separate and distinct from the surface rights. A title to mining property grants perpetual and exclusive ownership, as long as the mining tax is paid and the mining law is observed. The mining tax thus far has been low, and the result has been that nearly all the promising ground has been taken up by private interests. Concessions have been applied for at various times, but have not been granted. In 1917 several petitions were presented by well-known oil operators for the unoccupied ground which had not been acquired privately. The Congress of Ecuador would not grant the rights requested, but simply passed a resolution, authorizing the executive government to legalize the matter, and, in accord with certain specified conditions of the resolution, to grant a concession. The press of the country immediately raised a cry, and the president of the republic, Dr. Bagueviza, who is opposed to all monopolies, objected to the resolution, which was not insisted on by Congress.

According to the constitution of the country, when Congress passes a law the executive government has the right to object and to present its reasons for doing so. If Congress accepts these views, the law does not pass. If Congress insists, the president has to promulgate the law and to see that it is enforced. Congress is renewed every two years. The majority of the country is opposed to all monopoly. The Mining Code dates from 1886 and it was revised in 1892. It has not been changed since. The reforms of that date give to individuals the right to denounce oil lands. The mining law may be changed, but no future law can abrogate the present ownership of property. The only tax on mining is the "patent" or mining tax, which must be paid whether the mining property is being worked or not. If the tax is not paid, the mine is sold by public auction. Any excess resulting from such sale over the amount due, after paying the taxes, goes to the owner. (Article 13 of the Mining Code.)

At present the mining tax amounts to 8 *sucres* per *pertenencia*, or claim of 200,000 square meters, or 20 hectares; so that a *mina*, or mining field of maximum size, of 20 *pertenencias*, or 400 hectares, pays 100 *sucres* yearly. A *sucre* is equal to about 50c., U. S. currency. Assuming that an acre contains 4000 square meters, a mining property of 400 hectares, or 1000 acres, pays about $80, U. S. currency, per year. The owner of the subsoil has rights of preference, but has to indemnify the owner of the surface. In the oil regions of Ecuador, however, the surface is not valuable, as the country there is mostly dry and barren.

Mines and their products are exempt from other taxes for a period of 20 years. Machinery and mining tools are exempt from duties, and sales of mines and mining contracts do not pay taxes, either fiscal or municipal, for the same length of time.

When in 1892 the Mining Code was revised, this exemption was granted for 25 years and, therefore, was to end in 1917. Congress did not change this law, but, in compliance with a petition presented by the miners of the country, conceded in 1914 an extension of this grant for 20 years, counting from Oct. 8, 1914.

Two enterprises in active operation are mentioned in the report of M. Clerc and are working still. They extract oil from pits dug by hand, and produce about 3000 barrels of oil monthly. It is reasonable to assume that only a few enterprises can work at a profit under such conditions, and that such work can at this time be done in the old primitive way is worthy of note.

The indications of oil can be seen over a great extent of country. On the island of Puná, at the head of the bay, for instance, there are noteworthy indications of oil in several places. Even the oysters along the coast are often strongly impregnated with oil, and the water of several marshes, among others the *pozo de la lechuza* —the pit of the outlet—shows signs of oil and mineral pitch.

HOT SPRINGS ARE COMMON

The denouncements or locations of claims made up to date cover virtually the whole coast of the republic. Unoccupied oil lands therefore lie well inland, and transportation to and from them would, under present conditions, be comparatively difficult. About 14 miles east of Santa Elena there is a mud spring, known as the little volcano of San Vicente. In Spanish-American countries, be it understood, almost any place or spot where gas, or air, or steam comes out of the ground is called a *volcan*. The cone of the *volcancito* is about 30 ft. wide and 7 ft. above the bottom of a wide and shallow valley, which is surrounded by vertical bluffs of sandstone and Tertiary schists. Mud, salty water, gas bubbles and a little petroleum are thrown up constantly. North of this there are springs of warm water with a temperature in some of over 105° Fahrenheit.

DRILL HOLE ON THE BAY OF ANCON, ECUADOR

Near the village of Santa Elena there is a group of pits measuring about 10 to 15 ft. across and, in instances, 40 ft. deep, which have been worked for years, and are known as the San Raimundo property. Every morning a light wooden tripod is put up successively over each pit, and, with a hand windlass and rope, a bucket, filled by a man below, is hoisted up by other men above, until the oil which has gathered in the pit has been taken out. The oil is poured into barrels, from which the water is drawn off and which hold about 220 kilos of oil each. The barrels are then rolled to a central point, where the oil is pumped up with a hand pump into a tank which stands 10 ft. above the ground.

Novel Method of Barrel Transportation

From this tank the oil goes through a pipe, about 2000 meters long, to the shore, where it is again put in barrels. These are placed two by two on floats, which are pulled by a rope to the sailing vessels, which take the barrels to Guayaquil in seven or eight days for 2 *sucres* per barrel. The 20 pits produce 600 to 800 barrels per month. Some pits produce at first up to 1000 liters or, say, one ton daily. The best locations for sinking pits are those where certain signs show on the surface, produced presumably by the oil rising through small cracks in the ground. Other owners transport their oil to the coast by means of donkeys.

About two kilometers toward the southeast from Santa Elena, near Corral Viejo, there are old workings similar to the ones mentioned, with pits generally from 15 to 40 ft. deep, but in one case as deep as 70 ft. These pits still yield petroleum, but it is heavier, of a black color, and further away from the shore. The pits are not being worked now. Greater depth has not been reached, on account of water, gas, and the expense of timbering.

Approximately 1½ kilometers toward west are the Santa Paula pits. These are also about 20 in number. The process here is simpler than it is at the San Raimundo pits, because the barrels, when full, are rolled directly for a distance of a mile and a quarter to the coast, from which they are shipped by sailing vessel to Guayaquil. The business has been and still is successful.

Wolf mentions that teeth and bones of *Mastodon andium* have been found in the Pleistocene of Santa Elena, which distinctly show the age of the surface ground in that region, but the occurrence of oil in this formation is accepted as an accident, it having come up from the Tertiary formation underneath.

Sample of Oil From Ecuador Gave A High-Grade Product

Charles Maddock in his report made in 1914 says that in the only deep drill hole made, and which he located, a depth of 2000 ft. was reached, and that at 1700 ft. petroleum was struck which, as analyzed in Paris, gave 30% motor oil and must be considered a high-grade oil. He mentions that while drilling the hole one oil stratum was penetrated, with a strong enough flow to make the oil seep up behind the lining while further drilling was in process.

It is probable that the occurrence of oil on the west coast of South America, in Ecuador and Peru, may in course of time become of considerable interest. The old way of gathering and shipping the oil however will soon be superseded.

A statement made by Sir Boverton Redwood, of London, in regard to the petroleum from shallow depth at Santa Elena says:

"Color: Very dark. Red brown. Specific gravity at 60° F., 0.937; point of inflammability, 156° F.; sulphur, 0.25% calorific value 10,790 calories, or 12,420 B. t. u.

"The percentage of commercial products contained is as follows: Kerosene (sp.gr. 0.843), f.p. 105° F., 19.2%; oil, intermediate and lubricating, 66.2%; carbon, coke, 8.7%; loss, 5.9%. Rectane and ostane probably were lost while the oil was rising through the porous strata from a lower deposit."

If American enterprise is to have its share in the petroleum industry of South America, the time has come to give the coast lands of Ecuador and Peru careful attention, not by finessing for government concessions, but by a thorough study of the ground and a close examination of present conditions of ownership and of the laws affecting the industry. European countries have already given this matter some attention, and probably will keep up their activities so as to secure as large a part as possible of the supply and of the market of this important product.

League Wants Licensed Assayers

British Columbia Correspondence

The Free Miners' League of Prince Rupert has presented a petition to the provincial government asking that the Minister of Mines appoint licensed assayers at central points throughout the province. It also requests that the holder of a Free Miners' certificate, when purchasing his license, shall receive five assay coupons, each of which, on presentation to a district assayer, shall entitle him to one assay at half the current charge. These coupons, it is suggested, should be made valid only for the year in which they were issued.

Correspondence From Venezuela

To stimulate the mining industry of Venezuela by providing protection for investments is the intention of the government of General Juan Vincente Gomez, which is putting forth every reasonable effort to that end, according to reports from those familiar with the situation. The government at present has no jurisdiction over the state courts, and, in common with other Pan-American states, one of the difficulties to development of the mining industry is over-legislation and the fact that mining laws are changed every year or so. A mining law prepared under expert advice and guaranteed for a period of, say, 25 years would attract capital and develop the country. It is necessary that the present laws be modified if the oil lands are to receive proper development and the national interests are to be protected.

Labor in Arizona Camps

Warren Correspondence

Arizona camps report insufficient labor generally in regard to miners and mechanics. Though the Jerome district has been practically shut down owing to the curtailment at the United Verde and United Verde Extension properties, the camps of Globe and Bisbee cannot get men enough. The reason given is that a large number have gone to the Ranger oil fields in Texas. There is an oversupply of engineering and clerical men, and also of timekeepers, but it is reported draftsmen are difficult to obtain. In no case, however, has a company refused to reinstate a man who left its employ to enlist in any branch of the service. The Inspiration Copper Co., at Miami, has put on development work every man who was qualified, as this company has found it necessary to do a large amount of development to maintain the ore supply.

The Geology and Economics of Coal

BY J. R. FINLAY*

A comprehensive and lucid monograph by an experienced writer and engineer, who discusses the geological aspect of coal formation, the occurrence and location of peat swamps, the extent of existing deposits, and the main features of the coal-forming period. Geological processes and geographical changes are considered, and the paper, which is to appear in a revised edition of the author's treatise on "Cost of Mining," is concluded with pertinent statistics on coal consumption and distribution.

MODERN civilization is propelled by the annual combustion of more than 1,200,000,000 tons of coal. This vast use of power, other than human or animal muscle, is the basic fact in the mightiest revolution in industry, in art, and in habits that the human race ever experienced. Every time one presses a button to turn on an electric light, every time he enters an elevator or a street car, he participates not only in a human revolution, but in a great geologic fact; for the mining and destruction of coal removes some of the important strata of the earth's crust.

Coal mining is the basis and dependence of other kinds of mining, just as it is of other industries, and, also, it is one of the simplest and commonest of mining operations, and serves as a standard by which the complexity and cost of other forms of mining may be appraised.

If coal were not so abundant and so widely distributed by nature, its use could not, of course, be so extensive and fundamental. The fact of its extensive distribution is the most powerful element in the conduct of the business of mining and selling coal. If it were not cheap it would not be so extensively used; it would not, therefore, be so valuable. But because it is cheap it is often wasted. It is cheap because it can be offered in the market by innumerable competitors, whose aim is not the wise use of coal, but ready-money profit from it. Hence this most valuable of mineral resources has been in considerable measure crudely and greedily exploited.

PRESENT TIME IS COAL-FORMING AGE

The subject of the origin, history, and distribution of this substance is simple enough to be understood easily by any one willing to give it attention; but at the same time it involves facts that are hard to grasp about the changes that have taken place, and are still taking place, on the earth's crust. Coal is being formed at the present day in immense quantities over extensive areas. The present age is therefore a coal-forming age; but whether conditions are favorable for burying it under accumulations of sediment, so that the coal now being formed may be preserved indefinitely in the earth's crust, and whether the formation of coal is more general in this age than in past geological ages, or less so, are questions not easily answered. Coal is nothing but buried peat; coal formations are nothing more than a series of swampy land surfaces that were finally buried in a variety of ways under sediments.

Peoples living in certain areas of the Anglo-Saxon world, for instance those of the southwestern half of the United States, of the whole of Australia, and of South Africa, may never have seen a peat bog or have any clear idea of what it is like. To them it may be a matter of surprise to learn that the natural surface of the earth, north of a line drawn across North America from Vancouver Island to New York City, and across Europe and Asia from Paris to Moscow to Vladivostok, is occupied to a considerable percentage of its area by peat bogs. How large the percentage is I do not know: to find out would involve mapping 8,000,000 or 9,000,000 square miles of land in a solid block occupying the subarctic and north temperate zones of the northern hemisphere. In all this vast space, wherever the climate is damp enough or the lowlands are partly flooded, mosses and semi-aquatic trees, like cedar, tamarack and alder, spread over the surface, holding and absorbing water like a sponge. The trees and plants live and die partly immersed in water. When they fall they are, in large part, covered with water, and this preserves them indefinitely from decay. A woody, or at least a vegetable, mass accumulates for ages, until it finally forms a "muck" of almost indefinite depth, always completely saturated with water under the spongy covering of moss. The moss, indeed, seems like a carpet spread over the surface of a lake; the traveler sinks in it to his knees, and although he sees before him the prospect of a wide plain or meadow, he finds its surface trembling under his footsteps for yards around. If he has the bad luck to step into a water hole, or break through the mossy carpet, he instantly mires in vegetable ooze, which may be 100 ft. deep. Such are the "tundras" of Siberia and Alaska, the "muskegs" of Canada, the "tamarack swamps" of Michigan, the bogs of Massachusetts and of Ireland, and the marshes of Germany and Russia. I am sure that the area of these swamps is far greater than that of all the coal fields of the world together. The vegetable ooze and the mat of preserved wood is peat. It is incipient coal. It constitutes in itself an inconceivably great potential fuel supply, at present only casually used because it cannot compete with the more convenient and desirable fuels that may be cut from the forest or dug out of the rocks.

ABUNDANCE OF PEAT NOT UNIVERSALLY RECOGNIZED

These northern marshes are not the only places where peat accumulates. The cypress swamps of Arkansas and Louisiana, the "Dismal Swamp" of Virginia, the mangrove swamps of tropical tide flats, are also receptacles for such vegetable ooze; but in general the south temperate and tropical zones are not favorable for their formation. The hot sun quickly dries up a swamp unless it is replenished by a constant supply of water. Even an occasional drought will expose the vegetable mass to rapid destruction by oxidation or rotting. In a dry climate, therefore, or in one in which the rainy seasons alternate with prolonged droughts, the process is impossible except under unusual circumstances. That is why so many people may live and die without knowing what peat is, although it is really so abundant.

The mere growth of peat on the surface does not lead to the formation of coal. To complete the process it is necessary to bury the peat under sediments. The conditions that favor such burying are not by any means so common as those which permit of the accumulation on the surface. Undoubtedly most of the peat that forms is eventually destroyed again without ever being buried. A change of climate or of drainage easily puts it in the way of destruction.

---

*Mining engineer, 43 Cedar St., New York.

The manner in which peat swamps may be effectively buried is well worth consideration. It is really a matter of common geography. Every schoolboy knows about the dikes of Holland and the levees of New Orleans, and that these dikes are to protect large areas from overflow either by the tide or by the river floods, or by both. Both tracts are in the deltas of large rivers—the Rhine and the Mississippi. When a river builds a delta into the margin of the ocean it raises a flat pile of mud higher and higher, and the river itself debouches right on top of the pile, and usually sends its waters trickling in smaller or larger streams down the sides of it in all directions.

THE BURIAL OF PEAT SWAMPS

The banks of the main river and of each branch are invariably higher than the country between the branches—at least they become so sooner or later. Eventually a stream will break through one of these banks and start a new channel in the hollow between old channels and in time fill it with silt to a point higher than the old channels, which, in their turn, become low ground. Supposing such hollows to be filled with peat swamps, these swamps would sooner or later be covered by the river muds, and the peat would in time become a coal bed.

The Rhine delta is actually in a peat-forming climate today; and, if it were not for the interference of civilization, nearly the whole of Holland and a good part of Belgium and Friesland would be a coal-forming region on no mean scale. All that would be necessary would be the continuance of the present climate and a maintenance of the present sea level; or, better still, a slow subsidence of the delta at approximately the rate at which the river can fill it up. The peat swamps might grow deeper indefinitely, always keeping their surface up to the level, or slightly above the level, of the river channels, thus helping to maintain those channels for long periods. In this manner the rivers would slowly build their beds and banks higher and higher, and build out deltas further and further. The waves and shore currents would spread the mud in bars and beaches along the shores of the delta and enable the beaches to creep further out into the sea. As they crept out the peat bogs would follow them. Thus the whole area of the delta between the river channels and the sea beaches would be filled with enormous accumulations of peat, interrupted, of course, by occasional patches where overflows would pour in mud, by other patches where the water would become too deep for the swamp plants and thus make lakes, or by sand dunes blown up from the beaches. If the subsidence of the delta should become too rapid for the river to maintain it, the sea would finally break through the beaches and begin flooding the swamps with salt water, killing the growth and immediately beginning to cover the peat with beach sands and sediments. The shallow bottoms of the bays would be occupied by marine animals and plants. If the water were not muddied by a constant supply of fresh silt, a limestone might be deposited instead of mud. Still further a portion of the peat bogs might be rapidly covered by a march of sand dunes blown from the beaches.

Thus, in the case of a large river delta in a damp, cool climate, it is clear that there might be deep and extensive deposits of peat and that these deposits would, in the course of time, under stable conditions, be covered either by river mud, marine sediments, or by wind-blown sand. It is also apparent that a whole delta might be covered by an acceleration of the subsidence but when the subsidence ceased, or slowed up, a new delta would form on top of the old one, and as it grew out would cover up the old one to the new level of the sea, or of the new delta. New peat swamps would form on the new surface, which, by the way, would also extend further up the river valley and back over the lower slopes near the shore. Thus the process would go on until some radical change in the earth's crust put an end to the formation of the delta, or changed the climate so that peat swamps would no longer grow.

If Louisiana had the climate of Michigan it would be possible to see all these operations going on in this country on a huge scale. From Cairo, Ill., to the Gulf, and for vast stretches along the Gulf of Texas, Louisiana, Mississippi, Alabama, and Florida, there would be interminable peat deposits, all in process of gradual burying in the ways I have indicated, and it is my conclusion that such deposits might easily be on a scale equal to anything known in the great coal beds of the world. For instance, the Pittsburgh coal seam is believed to have been continuous over an area of 10,000 square miles; and it is reasonable to expect that, with no change whatever in conditions other than to substitute the climate of the Great Lakes, a continuous peat swamp would form on the Mississippi delta over even a greater area. The total area of lowlands in which swamp formation would be continuous and active must be more than 100,000 square miles.

If this climate and these conditions were to continue indefinitely, and if the weighting of the delta caused a slow subsidence, the coal-forming process would eventually spread over an immense area. A subsidence of 500 feet, an extremely moderate earth movement, geologically speaking, if accomplished slowly, would cause the active delta and the peat-forming area to march progressively up the valleys beyond Kansas City, Chicago, and Pittsburgh, leaving behind in the lower basin innumerable deposits of peat at different levels, covered by a deep and ever-deepening mass of sediments. Over the site of New Orleans, limestone beds would now be forming and beneath them great coal measures, and no doubt oil and gas rocks also would be securely locked. Such a development would be the counterpart of the great coal formation of the Carboniferous period, not, of course, at the same places, but on an equivalent scale.

GEOLOGICAL PROCESSES INVOLVE PHENOMENAL TIME PERIODS

This, of course, is only a rude sketch of the major features of a coal-forming period. There are innumerable variations of details of all kinds; but, in general, one may see in any coal mine an actual record of just such happenings. I have said that any observer who gives the matter attention can readily grasp the general features of this process; but there ought, perhaps, to be added one qualification or explanation. To form a conception of what is involved in the coal-forming process it is necessary to dissociate one's imagination from the limitations of human experience. It is difficult to picture the life scale of the earth instead of the life scale of a man. A generation seems a full cycle, and it is hard to get fully away from that conception of time; but to think effectively of geological processes one must banish that limitation completely.

The span of human life, or even the whole period of recorded history, is such an insignificant fraction of time that the geological processes have made only trivial changes in geography during the whole of it. A coal-forming epoch such as I have attempted to picture must be measured in millions of years, rather than in thousands, and yet it constitutes only a modest portion of geological history. In North America, fortunately, the coal beds still remain, and they have been remarkably well preserved, too, by three such general coal-forming periods, all on a truly colossal scale, besides several others of minor importance. The publications of the U. S. Geological Survey and of many of the state surveys are full of information about this subject, a bulk of literature, indeed, too great for digestion, but for a general view one may read two volumes, *Bulletin* 38 of the U. S. Bureau of Mines, by White and Thiessen, and Professional Paper 100 A, of the U. S. Geological Survey, by Campbell, on the coal fields of the United States. Even these discussions are scarcely adequate, for they deal only with this country. A general review of the coal resources of the world was made by the International Geological Congress at the Montreal meeting in 1913. These publications are not easily obtained by the casual reader.

As other mining methods are largely an elaboration of coal mining, and a comprehension of the characteristics and location of the principal coal fields is necessary for an understanding of the economics of mining, I am attempting to give in a few succeeding paragraphs some further generalizations on this most interesting subject.

FORMATION OF COAL MEASURES IS A REGULAR GEOLOGICAL PROCESS

"Technically, at least," says David White, chief geologist of the U. S. Geological Survey, "coal is found in the Ordovician and Cambrian—and probably even in the pre-Cambrian—sedimentary series, where it is now represented by bedded graphite. . . . Well-developed coal has been found in the strata of every period since the Silurian. . . . At present coal is commercially mined (in the United States) from rocks of basal Mississippian (Lower Carboniferous), Pennsylvania (Upper Carboniferous), Triassic, Lower Cretaceous, Upper Cretaceous, and Tertiary ages. Some mining for fuel has been done in the Jurassic of Alaska." Thus the formation of coal is shown to be one of the regular geological processes, and it has gone on persistently in all times since plant life has existed on the globe. But it is only occasionally that conditions have occurred which are favorable to the preservation by burying, as well as for the formation of peat on a large scale. It is found that these conditions accompany cycles of world history, which have repeated themselves in general terms, though not in precise detail. These cycles have a singular bearing on the formation, preservation, and exposure of metal deposits also.

Although it is a little far-fetched to assert that a study of these broad geologic processes has an intimate bearing on the practical every-day pursuits of mining, it is not extravagant to say that it is important to those who wish to have a rational vision of economic resources, or to expect that it will have increasing weight in future explorations for minerals. One may be positive that, with industries organizing on a more and more comprehensive scale, and governments undertaking projects to harmonize and further such industries, these major geologic facts will have considerable weight in the locating of manufacturing enterprises and of trade routes. At any rate, the subject is interesting.

DIFFERENTIATION BETWEEN NATURAL GROUPS

A century ago, as soon as the observations upon the earth's crust had become expansive enough to afford a basis for generalized description, geologists (mainly English at that time) perceived that almost everywhere the sedimentary rocks were separated into several natural groups by abrupt differences of solidity and attitude. The older, harder, and more tilted or contorted rocks they called Primary, an intermediate group they called Secondary, and the more recent and less solidified group the Tertiary. These divisions have been found, by the more exhaustive and far-reaching researches of all later geologists, to be established with about the same definiteness all over the world. Broader and more detailed mapping has since added a fourth and older group, obscure to the earlier geologists because less generally exposed, but now established with the same distinctness as the others; and the principal sedimentary rocks throughout the world (omitting the recent unconsolidated materials called the Quaternary) are now divided into four great groups generally named as follows:

1. The Algonkian or Eozoic, containing the recognizable earliest vestiges of life.
2. The Paleozoic, or Old Life group, Primary.
3. The Mesozoic, or Middle Life group, Secondary.
4. The Cenozoic, or Later Life group, Tertiary.

It must be borne in mind that these divisions are not in the least arbitrary or conventional, but are clearly marked by nature. Is it not remarkable that the same differences should appear in all the continents and in both hemispheres? What has mud being washed down into a bay in Australia to do with mud in a lake in Montana? Why should not the entire series of rocks in Australia be laid down without any reference to what may happen in Montana?

EACH STRATIFIED-ROCK GROUP REPRESENTS CYCLE IN GEOLOGIC HISTORY

It appears that each of the great groups of stratified rocks represents a cycle of world history during which conditions were comparatively stable and uniform. This does not mean that minor and differential changes did not occur during and throughout these periods. The sea level oscillated more or less, just as it is doing at this moment; the processes of erosion brought about their progressive changes at all times; but during these periods these agencies proceeded along the same general lines, with regional or local instead of world-wide interruptions. In general, the progress was toward the wearing down of continental masses, the filling up of depressions, the formation of vast plains, and the development of equable climate by the leveling of those barriers, such as lofty mountain ridges, which cause abrupt changes.

In each of the great cycles the last stage was the one favorable to the formation of coal on a great scale. The continents were not only worn down almost flat, but the wearing of them down had filled up the contiguous shallow parts of the ocean, tending to raise the comparative level of the sea. Minor oscillations or warpings of the surface would thus flood or expose large areas of flat lands. The climate, being equable, was also stable for long periods; and an area wet enough to promote the formation of peat would remain so. Thus the conditions briefly outlined previously for the creation of extensive coal deposits reached perfection.

"Revolutions" of Earth's Crust

For reasons dimly understood, or not at all, these cycles of quiescence and equilibrium were interrupted finally in each case by world-wide convulsive movements of the earth's crust, called "revolutions." These "revolutions" were not cataclysms in the sense of being sudden and overwhelming disturbances, although they were sufficiently rapid to exterminate innumerable forms of life and to produce great changes in living conditions for both plants and animals. There were no doubt violent earthquakes, always accompanied by abundant volcanic activity; but, in general, the "revolutions" were progressive and differential. The leveling forces were overcome by the forces of upheaval. Great mountain chains and plateaus were thrown up; frequently new ones, the continents in general, were raised and took new forms, the ocean beds were deepened, and the sea level retreated. In other words, there were immense changes of geography and of climate. Thus in the southern hemisphere, at the close of the Paleozoic, the mild climate of the coal-forming Carboniferous period was succeeded by a formidable refrigeration, so that in Permian time ice fields covered portions of South America, Australia, and Africa on a scale exceeding that of the recent glacial period of the northern hemisphere. This is merely an example.

The "revolution" having worked itself out, the conditions of comparative equilibrium returned, the erosive forces proceeded again with the work of leveling the uplifted continents; in short, a new cycle parallel to but not identical with the old one was under way.

The major coal formations were therefore laid down toward the end of these cycles when the continents were maturely eroded and flattened, when climate was equable and stable, and the earth's crust free from disturbances. How far these processes were carried may be gathered from a paragraph or two on the geography of the principal coal formations of North America.

The Paleozoic Coal Fields

1. The Paleozoic coal fields extend from central Oklahoma to Massachusetts, 1500 miles in a straight line, and from Birmingham, Ala., to Cedar Rapids, Iowa, in greatest breadth 750 miles. This area contains only the remains of the original deposits, but it gives some idea of the huge, low swampy plains, so near sea level that they were repeatedly flooded by gentle oscillations of the level. It was traversed by rivers, which in all probability carried more water than the Mississippi system of today. In fact the lowlands alone, those subject to periodic or occasional overflow by the rivers or the sea, amounted to 1,000,000 square miles in a solid block.

It is not reasonable to suppose that this great tract was all of the same level, or that coal was either formed or buried simultaneously over the whole of it; rather there is evidence to point to the conclusion that through the progressive changes of sea level the whole area was affected by delta- and peat-forming conditions, which at any given time would form a broad strip immediately back of the seacoast. The actual deltas probably extended up the rivers for hundreds of miles, just as the Mississippi delta of today extends up to Cairo, more than 500 miles in a straight line from the mouth of the river, although for the greater part of that distance the delta covers only a strip on each side of the river. Whenever the sea level rose, these delta strips would retreat inland; whenever the sea level retreated, the deltas would advance. Such oscillations did take place; but, on the whole, the basin was subsiding. During the period the sediments, containing numerous separate beds of coal, accumulated to a depth of several thousand feet, the surface required for this remaining meanwhile practically at sea level, varying from 100 or 200 ft. above to 100 or 200 ft. below. To get an accurate idea of the appearance of the whole country within the area mentioned, one need do nothing more than take a look at an uncleared tract near New Orleans. The plants were actually different, but to a casual observer they would not have appeared so.

The Pennsylvania Epoch

As to the geography outside of this plain, only a general conception is possible. Toward the north there was a large area of higher land, extending unbrokenly from central Minnesota to Labrador and perhaps beyond. To the southeast, in Georgia, South Carolina, North Carolina, and Virginia, there were, no doubt, land areas, probably large islands of moderate elevation and maturely eroded surface. Toward the west a shallow sea of clear water extended from central Texas, Oklahoma, Kansas, and Nebraska. To say that this sea covered the Rocky Mountains is inaccurate. There were no Rocky Mountains to cover. There had been mountains in that region, to be sure, but they were different mountains entirely, which had been worn down to a plain and finally immersed in the sea under discussion. Just where this sea ended toward the north and northwest I do not know, but it certainly covered nearly the whole of New Mexico, the northern part of Old Mexico, the whole of Arizona, a portion, at least, of southern California and Nevada, and most of Utah, Colorado, Wyoming, Montana, and South Dakota.

Such was, dimly, the Pennsylvania epoch in North America at the close of Paleozoic time. Marius R. Campbell estimates that the remains of the coal left on those delta plains amounts to 1,088,000,000,000 tons, over a trillion, enough to maintain the total present output of the United States for 1500 years. This coal is all of good quality and high rank, varying from bituminous to anthracite, and the tract mentioned contains more coal, by far, than the whole Continent of Europe—possibly more than the whole of Asia.

Relative Importance of Various Coal Fields

The coal fields of Europe are at present the most important, economically speaking, excepting those of North America. The most valuable were formed during the same epoch and under analogous conditions. A similar delta plain extended, with possible, or probable, interruptions, from Ireland through Great Britain, Germany, Poland, and Russia to the Sea of Azov "The number of workable seams," say Chamberlain and Saulsbury, "is large in many places. Thus, in Westphalia the number of workable beds is said to be 90. The aggregate (maximum) thickness of the coal in Lancashire is 150 ft., and in Westphalia, 274 ft. Here, as elsewhere, beds of marine origin alternate with those which were deposited on land, in marshes, and other places."

Coal Development Progressed After Upper Cretaceous Period

2. In North America it is a mistake to focus attention too exclusively upon the Paleozoic coal fields. At the end of the next, or Mesozoic, world cycle in Upper Cretaceous time, there was a still greater coal development. Those interested in the subject might repeat almost the same description of continental and climatic conditions, but when one comes to geography it is necessary to migrate. An immense, flat, subsiding plain so near sea level that it was repeatedly flooded with sea water extended from the Gulf of Mexico to the Arctic Ocean, right over where now are the highest mountains and plateaus of the Rocky Mountain system. The plain terminated in higher land to the eastward on a line from east-central Texas to Duluth to Winnipeg; on the west on a line from northwestern Arizona through western Utah and southeastern Idaho, northwestern Montana, and eastern British Columbia toward the mouth of the Mackenzie River. This great plain was, therefore, 3500 miles long and up to 1000 miles wide. How much of it was generally under sea water and how much above during the coal-forming age it is impossible to estimate, but it contains every kind of sediment in great volume, including shales, limestones, and sandstones. The coal seems to have formed principally in the central portion of this tract, from which it is reasonable to assume that in this area the erosion of the chief land areas to the west was sufficient to keep the basin nearly full of mud.

Coal was formed on a scale quite equal to that of the Pennsylvanian time. It remains now in New Mexico, Colorado, Utah, Wyoming, and Montana. Mr. Campbell estimates the amount available at a depth of less than 3000 ft. at 1,400,000,000,000 tons of sub-bituminous and bituminous rank, with some anthracite. Lying at a depth of from 3000 to 6000 ft., he estimates 666,000,000,000 tons more, so that the Upper Cretaceous has left a total of over 2,000,000,000,000 tons in the United States alone. Possibly a third as much more lies in Canada. Much of this coal is of excellent quality for all purposes, including large amounts suitable for good metallurgical coke.

The Period of Vast Geologic Changes

3. At the end of this wonderful period another world "revolution" occurred, or, perhaps more accurately, began. Great geographical changes took place. Australia was permanently separated from Asia. In North America the great Cretaceous trough began to split from end to end along the line of the Front Range of the Rocky Mountains, where blocks of the hard underlying rocks were pushed up through the Cretaceous sediments like flatirons through pancakes, raising portions up bodily and crumpling other portions along their flanks. The process of slow subsidence was thus reversed, and the great trough humped up in the middle so that the whole became rather a plateau, the eastern half left undisturbed other than by a gentle tilting which made a wide slope of the Great Plains, the western edge of which are in places nearly 8000 ft. above sea level. The western half became an area of mountains and plateaus, in which the strata are generally disturbed and exposed by faulting and folding, and intruded by volcanic rocks, some of which are enormous batholiths.

Although this post-Cretaceous change was extensive enough at once to produce an abrupt unconformity between those rocks and the succeeding Tertiary formations, it was not extensive enough at first greatly to change the climate. Parts of the great trough remained lowlands and were to some extent filled by fresh water lakes, along which coal formation continued. The largest of these areas was in North Dakota, Montana, and Alberta, where the deposits were on a truly imposing scale. But these coals were never deeply covered by sediments, nor have they been affected by earth movements such as would compress and alter them. They are therefore still lignites, the first stage removed from peat, and are coals of low rank and poor quality. They would be in other countries, however, a wonderful fuel supply. Mr. Campbell estimates in this field 965,000,000,000 tons in the United States alone, much of it occurring in thick seams. Though this lignite will not make metallurgical coke, it will make gas and power. It will not stand transportation or storage well, but it can be used on the ground for electrical generation, whenever a demand shall rise for it, to good advantage.

With this exception the Tertiary coals were formed in smaller detached lake basins, or in isolated tracts along the coasts. They occur in Alabama, Mississippi, Tennessee, Arkansas, Louisiana, Texas, California, Oregon, and Washington. The aggregate amount in these fields is great, but in all the Southern States the coal lies in unconsolidated sediments and is a soft low-grade lignite. It is only in the State of Washington that one of these Tertiary fields has been so affected by earth movements as to reach bituminous and sub-bituminous rank. Owing to its position on the great harbor of Puget Sound, and to the general scarcity of coal along the Pacific, this is apparently a field of marked economic importance. Mr. Campbell estimates for it about 65,000,000,000 tons, of which probably about 80,000,000 tons have been mined.

Coal Statistics

It appears that though the production of coal per capita is still increasing in this country, it is not doing so at the former rate. The increase between 1897 and 1907 was from about 2.77 tons per capita to about 5.6 tons per capita; from 1907 to 1917 the increase was only from 5.6 to 6.5. It might appear from this that the desire of the population for fuel is nearly satisfied. It may be assumed with certainty that a time will come when the consumption of coal will increase only in proportion to the increase of population.

The same facts are shown by the total output of the country to date. It will be remembered that up to 1907 the production was doubling each decade, so that between 1897 and that year it was nearly equal to the entire production of the country previous to 1907. From 1907 to 1917 the production was only 75% of the previous production.

Still more noticeable is the fact that the number of men employed in coal mining has not increased at the former rate. In 1897 the number was 397,000; in 1907, 680,000—an increase of 283,000 for the decade; but in 1917 the number had risen only to 750,000, an increase of only 70,000 for the decade.

Statistics show a remarkable uniformity of conditions in the coal industry up to the end of 1915. In that year the value of all coal at the mines was estimated by the U. S. Geological Survey at $1.29 per ton, almost exactly the same as shown by the tables for the years 1903-1907.

Argentine Fuel Developments*

In an article on the Argentine petroleum industry, Dr. B. Sichel says that, though the existence of natural oil fields in the Argentine has been known for several decades, the petroleum industry, now so flourishing, had its beginning in 1907, when an engineer, Enrique Hermitte, while boring for water on the coast of the Chubat district, at the instance of the Office of Mines, Geology and Hydrology, found oil after penetration to a depth of 532 meters.

The development of the Comodoro Rivadavia oil output since 1907 has been astonishing, and justifies hopes of increasing prosperity. The output between 1911 and 1917 inclusive was as follows:

ARGENTINE PETROLEUM PRODUCTION 1911-1917

Year	Production Tons	Year	Production Tons
1911	1,926	1915	75,900
1912	6,860	1916	116,000
1913	19,050	1917	130,000
1914	40,530		

What this output of petroleum means for the Argentine may be realized when it is remembered that profitable deposits of coal and other mineral fuel are comparatively rare. The peat bogs are not productive enough to be of much account, and although the hard timber found in the north is suitable for fuel, it is of importance only for the northern district, owing to high freight rates. The Argentine is, therefore, compelled to obtain fuel from abroad, and it forms by far the most valuable item of the country's imports. The normal demand for foreign fuel since 1913 has been: Pit coal, 4,046,278 tons, valued at 28,323,946 pesos (gold); coke, 21,317 tons, valued at 170,539 pesos (gold).

Of the total coal import, England contributed 94.4%, the United States, 3.1%, and Germany, 1.5%. There was, too, a large import of wood for fuel and also of petroleum. The amount of the latter imported in 1913 was: Refined petroleum, 68,228,658 l., valued at 2,046,860 pesos (gold); crude petroleum, 119,318,402 kg., valued at 11,931,840 pesos (gold).

The refined petroleum came exclusively from the United States; but during the war a part of it was derived from Mexico, especially from the Anglo-Mexican Petroleum Products Co. Import of coal has been largely reduced during the war years, and that of crude oil proportionately increased. The Argentine's dependence on England and the United States constituted a serious danger for the country in time of war and also during the strike of the English miners in 1912. Accordingly, a wide field was opened for the production of the country's petroleum, and since 1914, when large quantities of oil became available, it has found a ready market.

The composition of Argentine petroleum makes it especially adapted for use as fuel, containing, as it does, 2.5% benzine, 4.8% kerosene, 8.3% gasoline, 27.5% lubricating oil, and 55.1% asphalt. It is, in fact, an asphaltic oil of which the density is stated to be 0.920. It contains few volatile substances, is free from sulphur and phosphorus, and its water content never exceeds 1%. Distillation at 220° C. gives a product whose flashpoint is reached at 102° C—an excellent oil for ships' boilers. The crude oil can be employed direct for boiler fuel and in Diesel motors, and develops 10,860 heat units, only 140 less than the maximum. Its heating capacity is 1½ times that of coal, 100,000 tons of crude oil being equal to 150,000 tons of coal. It is of less importance as an illuminating oil, as distillation gives a yield of only 10%, as against 40% and 70% of the Baku and Pennsylvania oils. It should, however, be remembered that borings at present are comparatively shallow, and that it is at greater depths that oils richer in volatile substances are found.

Argentine petroleum is used by the Italian Electricity Co., in Buenos Aires, and by the German Overseas Electricity Co., as fuel. It is also used in the frozen meat establishments, in mills, on the railways, especially the Patagonian government railways; in river shipping and in the navy, and will soon be used in other establishments, as transpport conditions are favorable, especially in the coastal districts.

In order entirely to replace foreign coal and petroleum, between 2½ and 3 million tons of Argentine petroleum would be required annually, and as the present output is about 150,000 tons, the industry is afforded a wide field of activity, which will remain extensive enough, when, as is intended, the output is increased to 300,000 tons. At present the yield is not nearly large enough to meet the country's requirements, and it is impossible to estimate the capacity of output of the zone. Some experts believe that the Comodoro Rivadavia contains between 930 and 1000 million cu.m., though others place it at 130,000 tons per hectare, which approximates 130 million tons per 1000 hectares. All such estimates are problematical, for up to the present only 130 hectares contain relatively shallow borings, none of which, however, has been fruitless. At all events, oil will be practically inexhaustible for many years.

Mine-Dust Sampling

Tests are being conducted at the Pittsburgh station of the Bureau of Mines on the sugar-tube method of collecting dust samples from the air of metal mines, a modification of that used by Edwin Higgins in sampling dust in mines of the Joplin district. Preliminary experiments have shown that the old type of sugar tube had an extremely high resistance to breathing, amounting to from 15 to 20 in. at 16 liters per minute. This large resistance renders it impossible for a man to take a sample of appreciable size. As a result of experiments made with different dimensions of tubes, a size was found in which the resistance is reduced to only 3 in. of water at 32 liters per minute, and which is decidedly more efficient in removing fine dust.

On applying the standard tobacco-smoke test, it was found that the efficiency of the old type of sugar tubes was only 50%. That of the new type will probably be about 90%. Optical methods are used for determining the efficiency, and by such methods very fine particles can be distinguished—much finer than by any other method.

---

*Translated from *Wirtschaftsdienst* and abstracted from the technical supplement to the *Review of the Foreign Press*, issued by the General Staff, War Office, London.

Prominent Metallurgists

L. D. ANDERSON
Manager, Midvale Smeltery, U. S. Smelting, Refining and Mining Co.

F. N. FLYNN
Assistant General Superintendent, Balbach Smelting and Refining Co.

T. W. CAVERS
Research Metallurgist, International Nickel Co., Coppercliff, Ontario.

F. R. CORWIN
Superintendent of Smeltery, Consolidated Arizona Smelting Co.

Standard Buildings

The *Journal* has published a number of special articles respecting standardization of underground practice, the papers having for their aim the increased efficiency obtainable through the adoption of a uniform standardized way of doing things or by using type tools and equipment.

Efficiency may be fostered not only by eliminating useless physical work, but by the conservation of the mental power of those who are in charge of operations. When it is established that a certain brand of explosive gives the best result in the quarry or mine, the manager need give the matter no further attention—he simply tells the purchasing agent to buy that quality of explosive on the most favorable terms. The same may be said of fuel and lubricants, steel and drills.

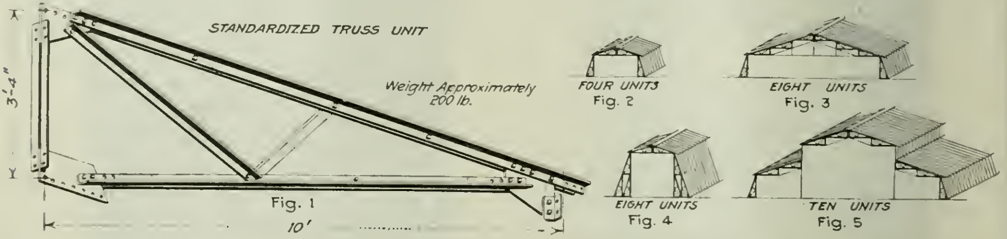


Fig. 1

FOUR UNITS Fig. 2

EIGHT UNITS Fig. 3

EIGHT UNITS Fig. 4

TEN UNITS Fig. 5

DETAILS OF STANDARDIZED TRUSS-UNIT SYSTEM

The standard building remains to be described. Mine-camp buildings are often temporary affairs; but where it is desirable to establish a community by providing for men with families, much can be accomplished by adopting a standard-type cabin. Being of uniform design, a minimum supervision in construction is necessary, and the reordering of supplies and the construction of the building are merely repetitions of earlier efforts. Of course, this method of procedure is not applicable to the permanent camp, where the miner may own his own home and build it in a manner to suit himself.

The adoption of duplicate cabins or dwellings simply means the standardization of buildings, and adds to the general economy of the mining plant. The same idea may be extended to certain of the mine or mill buildings to advantage. If the storehouse, blacksmith shop, timber mill, and stables can all be built on the same general plan, supervision expense may be reduced and the work accomplished with greater speed.

With the idea of preparing for an emergency wherein a number of simple buildings, varying little in detail, would be required at short notice, Milliken Brothers, of New York, have designed a standard truss-unit system that may be used in the construction of corrugated iron buildings of, possibly, varying form and size. Of course the machinery and the work carried on inside of such a building must be adapted to the building. The great advantage in this or any similar type of ready-to-order building is that it is always in stock, ready to ship at a moment's notice, may be put together with nuts and bolts, and every member is the duplicate of the other, so that, in the erection, expert millwrights or mechanics are not required. The Milliken unit is shown in Fig. 1. Types of construction in which it may be used are shown in Figs. 2, 3, 4, and 5.

Such construction is peculiarly adapted to foreign countries importing their equipment from the United States. It makes little difference what is lost or fails to arrive on time, the building may go on with whatever comes in, the most necessary building being the first to be erected. Moreover, the greater part of any such work may be done by any native capable of turning a spanner.

There is a field in standard mill building for some enterprising steel or iron manufacturer. In glancing over the drawings of new mill buildings erected during the last two years it will be noted that there is a great similarity in the design of at least 50% of the smaller mills, i.e. those not exceeding 200 or 300 tons' daily capacity. The same roofing and siding, the same trusses and columns might have been used in every one of these buildings without making perceptible alterations in the plans.

If it were possible to order from standard stock the covering for small mills and the support for shafting, the placing of various appliances could often be adapted to the requirements of the standard form. In many instances small mills are required in a hurry, and such standard equipment would be ordered if it was held in stock and mill builders were generally aware of its availability.

Motor Trucks to States

More than $45,000,000 worth of motor trucks are soon to be distributed by the Secretary of Agriculture through the Bureau of Public Roads to the state highway departments. These trucks have been declared surplus by the War Department, and are being distributed to the states under the provisions of Sec. 7 of the Post Office Appropriation Bill. They must be used by the states on roads constructed in whole or in part by Federal aid, for which $200,000,000, in addition to the former appropriation, was given to the states under the same bill. All that the states must do to acquire the use of these 20,000 trucks, which range in capacity from two to five tons, is to pay the loading and freight charges. Of the 20,000 motor vehicles to be acquired practically free by the states, 11,000 are new and 9000 have been used, but all are declared to be in serviceable condition. The motors will be apportioned to states only upon request of the state highway departments on the basis of the requests received from the respective states and in accordance with the apportionment provided in the Federal aid law approved in 1916. The requirements of the law are such that the Bureau of Public Roads cannot distribute any trucks to counties or individuals.

Benjamin G. Lamme Awarded Medal

Benjamin G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Co., was on May 16 awarded the Edison Medal by the American Institute of Electrical Engineers for "invention and development of electrical machinery." The Edison Medal was founded by an association composed of friends and associates of Thomas A. Edison, and is awarded annually for meritorious achievement in electrical science, electrical engineering, or the electric arts. The award of this medal is one of the highest honors that can be conferred upon an American or Canadian electrical engineer, and among those who have received it are George Westinghouse, Elihu Thompson, Frank J. Sprague, Alexander Graham Bell, and Nikola Tesla.

The honor of the award of the medal to Mr. Lamme follows closely his appointment to membership on the Naval Consulting Board. This appointment by the Secretary of the Navy emanated from the recommendation of the American Institute of Electrical Engineers, consisting of 10,000 members. Mr. Lamme was chairman of one of the important committees whose work had far-reaching results in the prosecution of the war.

Mr. Lamme was born in 1864 on a farm near Springfield, Ohio. His attendance at the country schools in the vicinity of his home was followed by a course in mechanical engineering at the Ohio State University, from which he was graduated in 1888. In 1889 he entered the employ of the Westinghouse company, and because of his remarkable ability his promotion was rapid; in 1900 he was made assistant chief engineer and in 1903, chief engineer, which position he has held ever since.

Mr. Lamme is not only an engineer but also a most fertile inventor, over 150 patents having been granted to him. These patents relate almost exclusively to dynamo-electric machinery, and cover motors, controllers, electrical coils and windings, rotary converters, generators, turbo-generators, and a variety of other apparatus. An unusually large number of his inventions have been put into practical use, and many of them have found world-wide application.

Among the achievements of Mr. Lamme may be mentioned the development of the alternating-current motor, the "harnessing of Niagara Falls," and the design of the equipment used in the electrification of the New York, New Haven & Hartford R.R., the Pennsylvania, the Norfolk & Western, and other prominent railroads.

Some of the papers which Mr. Lamme has read before scientific societies have become classics, especially noteworthy being a paper on the design of the induction motor, which was read before the National Electric Light Association at Niagara Falls in 1897. This, even today, is regarded as the last word in the design of alternating-current motors.

Mineral Production of Queensland

The total value of the Queensland mineral output in 1918, according to the official report of the Queensland Under Secretary for Mines, (published in the *Queensland Government Mining Journal*), was £3,740,925, a decrease, when compared with that of 1917, of £272,052. The greater part of this decline is accounted for by the continued falling off in gold yield, which has been accentuated by the increasing cost of production incidental to war conditions, without any change in the price of the metal. In other minerals, though market prices have been high, there have been several checks in the usual output—industrial troubles in the Cloncurry and other districts, combined with high wages, high cost of materials, and of machinery.

The total gold production in 1918 was 133,571 fine oz., valued at £567,371, compared with 179,305 fine oz. in the preceding year. Silver production was 152,499 oz. in 1918 and 241,639 oz. in 1917.

Production of minerals other than gold and silver is given in the accompanying table.

MINERAL AND METAL PRODUCTION OF QUEENSLAND
(In Long Tons)

	1917	1918
Tin	1,177	1,311
Lead	480	221
Coal	1,048,473	983,193
Copper	19,062	18,979
Wolfram	353	249
Manganese	21	1,299
Bismuth	4	21
Bismuth-wolfram ore	131	114
Molybdenite	111	110
Limestone (flux)	135,703	97,898
Ironstone (flux)	25,065	42,782
Fireclay	10,602	8,306
Scheelite	9	17
Arsenical pyrites	32	66
Fluorspar	71	...
Chrome iron	756	232

Dividends paid by the mining companies of Queensland during 1918 totaled £278,811, compared with £366,098 in 1917, a decrease of £87,287.

An important measure, the Chillagoe & Etheridge Railways Act of 1918, was passed by the Legislature during the 1918 session. Under this law the government acquires the Chillagoe Railway and Etheridge Railway (previously in the hands of the Chillagoe company), and certain other properties, including the Chillagoe Reduction Works, which have been idle for a number of years; the Einasleigh copper mine, which has also been closed down for some time, and other mines or mining leases previously held by the Chillagoe company. It is the intention of the government to restart reduction work as soon as possible, and also to make arrangements for the reopening of the mines which have come into its possession under the new act.

Arizona Attacks Freight Rates

PHOENIX CORRESPONDENCE

The State of Arizona, through its Corporation Commission, will assist in the prosecution of a case, alleging excessive freight charges, filed against the Director General of Railroads by the Phelps Dodge Corporation, Calumet & Arizona, Old Dominion, and United Verde Extension Mining companies. A hearing will be held in Chicago on June 2, with complaint specifications covering 47 separate rail and steamship lines.

The pre-war rate on copper bullion from Douglas to New York, by rail to Galveston and thence by water, was $8.55 a ton. An initial raise of 25% was made, and then a later raise that brings the rate up to $16.50, with marine insurance added. The annual gross surcharge thus put upon the copper mines of Arizona has been estimated as reaching $4,000,000 on normal annual shipments. The producers are willing to pay the 25% addition, but protest against a doubling of the freight rate in a time when copper values have become nominal. The Ray Consolidated company has made protest also, in a separate action. Chairman Jones of the Corporation Commission will represent the state in Chicago. He states his belief that "The producers cannot pay such rates at the present low price of copper and operate to capacity, if at all, with profit."

Italian Pig-Iron and Steel Output*

The pig-iron and steel productions of Italy in 1917, as compared with those of 1916, were as follows, according to *Revista del Servizio Minerario*:

ITALIAN PIG-IRON PRODUCTION
(In Metric Tons)

	1917	1916
Coke pig iron	410,224	443,464
Charcoal pig iron	4,440	6,630
Electric pig iron	56,524	17,298
Totals	471,188	467,392

ITALIAN STEEL PRODUCTION
(In Metric Tons)

	1917	1916
Bessemer steel	23,200	39,581
Openhearth steel	1,235,962	1,182,417
Crucible steel	1,290	710
Electric steel	36,948	22,376
Castings	35,441	24,402
Totals	1,331,641	1,269,486

The iron-ore output in 1917 is reported as 993,825 tons, compared with 942,244 tons in 1916. The 1917 manganese-ore production was 24,532 tons, as against 18,147 tons in 1916. The large production of electric pig iron in 1917 is noteworthy.

Oil Concessions Not Transferable

According to a consular report, the issue of *El Pueblo* for Apr. 12 states that the Mexican Department of Industry and Commerce confirmed the report that the following clause appears in all concessions for the exploitation of oil properties: "This concession will be declared null for any one of the following reasons: For the transfer of this contract or any of its concessions to any foreign government or to admit it as a partner, etc." Many petroleum companies have not wished to prove the legitimacy of their rights to the properties they are working, and these companies may at any time, and in accordance with Mexican laws, lose all rights.

Coal-Mine Fatalities in the U. S. in 1918

Complete fatality reports received from the state coal-mine inspectors for 1918, according to Albert H. Fay, of the U. S. Bureau of Mines, show a reduction of 4.5%, as compared with 1917. The total number killed was 2579 in 1918, and 2696 in 1917, a reduction of 117. There was a decrease of 233, or 64%, in fatalities from gas and dust explosions. Slight increases are shown in fatalities due to falling coal or rock, haulage, explosives, and electricity. The total number of fatalities underground due to explosives was 135, as compared with 111 for the previous year, representing an increase of 21%. The number of fatalities due to electricity was 88 in 1918, as compared with 79 in 1917. The electrical accidents underground show an increase of 11.4%, and haulage accidents show an increase of 5 per cent.

The conditions under which the mines were operated in 1918 were far from normal, by reason of the war. The demand for coal was unprecedented, and the mines were operated more nearly full time than in any previous year. Many of the experienced miners either enlisted or were drafted into the Army. Experienced foremen and safety engineers were often replaced by less experienced men. Many older men were employed in place of the younger men who entered the Army. General conditions were not, therefore, favorable for accident reduction. However, with the mines operating practically full time, this would have the tendency to prevent accumulations of gas in old workings and perhaps maintain better roof conditions than would be found in mines operated only part time.

FATALITIES AT COAL MINES FOR THE YEARS ENDED DEC. 31, 1917 AND 1918.

Cause	Number Killed 1917	Number Killed 1918	Increase or Decrease	Percentage of Increase or Decrease.
Underground:				
Falls of roof or face	1,218	1,293	+75	+5.16
Mine cars and locomotives	482	506	+24	+4.98
Gas and dust explosions	362	129	—233	—64.36
Explosives	111	135	+24	+21.62
Electricity	79	88	+9	+11.39
Miscellaneous underground	127	129	+2	+1.57
Totals underground	2,379	2,280	—99	—4.16
Shaft				
Totals shaft	52	52		
Surface:				
Haulage	114	118	+4	+3.51
Machinery	51	47	—4	—7.84
Miscellaneous	100	82	—18	—18.00
Totals surface	265	247	—18	—6.79
Grand totals	2,696	2,579	—117	—4.34

The general reduction shown is still more gratifying on account of the 6% increase in production. The amount of coal produced in 1918 is estimated at 685,-300,000 tons, as compared with 651,402,374 tons in 1917. The production per fatality in 1918 was the largest on record, being 266,000 tons, as compared with 241,600 in 1917.

The days worked in 1915 were 209; in 1916, 235; in 1917, 251; whereas in 1918 the increased production was brought about by working more days, rather than by a larger number of men employed. The estimates by inspectors show about 760,000 men were employed, compared with 757,317 in 1917.

In 1918 there were only three mine explosions, and there was one mine fire, in each of which more than five men were killed, representing a total of 54 fatalities, as compared with 7 similar disasters in 1917, resulting in 251 fatalities, thus indicating a considerable advance in the use of safety devices and appliances for the prevention of mine explosions.

Metal Imports and Exports of Japan

The following figures of the specified metals imported into Japan during 1917 and 1918 are given in a recent issue of the *Ironmonger*:

Metal	1917 Metric Tons	1918 Metric Tons
Lead (pig)	15,639	35,841
Imported from:		
China	582	351
United States	2,620	13,444
Australia	11,911	20,501
Other countries	526	1,545
Tin (pig)	2,010	2,830
Imported from:		
China	228	586
Straits Settlements	1,548	1,676
Other countries	234	568

Exports from Japan were as follows:

Metal	1917 Metric Tons	1918 Metric Tons
Zinc slabs	36,541	16,847
Copper ingots, etc	71,613	31,809
Copper plates and sheets	966	1,466
Copper wire	3,455	3,400
Brass and yellow metal plates and sheets	12,166	4,613
Brass and yellow metal bars and rods	1,325	758

In 1917, the United Kingdom received 24,784 tons of the copper exported from Japan, France took 18,121 tons, and Asiatic Russia, 10,852 tons, the remainder going to China, British India, the United States, and

---

*Extracted from *Iron Age*, May 1, 1919.

†Excerpt from "Coal Mine Fatalities in the U. S., 1918," U. S Bureau of Mines

other countries. In 1917, exports to France were 8578 tons, to the United Kingdom, 5454, and to Asiatic Russia, 140 tons.

Exports of zinc from Japan in 1918 went to the following countries, the 1917 figures being given in parentheses: United Kingdom, 4165 tons (18,952); France, 7055 (5928); British India, 3505 (2007); other countries, 2122 tons (9754).

The Banca Tin Trade

Banca tin comes exclusively from the Island of Banca. The mines have been worked since about 1710, and were first operated by the natives, says a consular report. The rajahs of Palembang originally owned the island and supplied the old East India Co. with tin. The Chinese, however, first placed the mines on a firm footing, and under their direction the production of the metal increased steadily until toward the end of the century, when adverse circumstances caused a serious decrease in the output.

According to local government statistics, the total production from 1718 to 1813 amounted to approximately 70,000 tons, and from 1813 to 1820 to 8400 tons. After 1820 the government placed the industry under European management, although it still remained a Chinese industry. Since 1852 the working of the mines has been entirely supervised by European mining engineers. During the last few years the tin has been subjected to a chemical test before being exported.

Banca has an area of about 4700 square miles, and its greatest length is 115 miles. Most of the mines are situated on the north and east coasts. The ore is worked almost exclusively in open pits, which are in the alluvial deposits of many rivers and in the alluvial strata on the slopes of the small hills.

Before the war the entire production of the Banca tin mines was turned over to the Netherlands Trading Co. on a consignment basis. This company placed the tin at auction in Amsterdam, to be sold for the account of the Netherlands India government. The war, however, necessitated a different method of sale, and the tin market was removed from Amsterdam to Batavia. Now the sale is entirely in the hands of the government. The market quotations are fixed in connection with the tin quotations of London and Singapore.

During 1918, especially during the second half of the year, the tin trade had to contend with many difficulties. The monthly quotations for the year, as given below, indicate the great variations in the prices (given in florins of 40.2c.) obtained per picul (136 pounds):

PRICE OF BANCA TIN, 1918.

Month	Price, Florins.	Month	Price, Florins.	Month	Price, Florins.
January......	178-182	May........	212-230	September...	222-224
February......	180-220	June........	202-214	October......	221-222
March.......	196-212	July.........	206-237	November...	180-219
April........	207-208	August......	230-246	December....	170

In March, 1918, the government prohibited the exportation of tin, but this prohibition existed only for a short time. The measure, however, immediately influenced business. Prices steadily increased, except for June and July fluctuations, and in August the highest price was reached, owing probably to the influence of the rise in prices as Singapore. This rise, moreover, induced the government to fix its limit at 264.50 florins ($106.33), which was not maintained. After August the prices went steadily lower, probably because the purchase of tin in America had been turned over to one purchasing agency, and also because in Singapore the maximum price was fixed at $148 Straits currency ($84 U. S. currency). There was comparatively little buying for the last three months of the year, Japan and Hongkong being the leading purchasers. The price, notwithstanding government control, continued to go lower, and at the end of 1918 the government's limit was lowered to about 150 florins ($60.30), at which price only Hongkong was in the market.

The United States has been for the last three years by far the largest buyer of Banca tin, as illustrated by the following: The total export in 1916 was 19,740 metric tons, of which the United States took 11,689 tons, or 59%; in 1917, the total export was 15,605 tons, the United States taking 13,575 tons, or 87%; and in 1918, of a total export of 11,566 tons, America purchased 7739, or 67%, of the total. The total production for 1918 was about 14,000 tons. The total exports to all countries for the years 1916, 1917, and 1918 were as follows:

EXPORTS OF BANCA TIN

Countries.	1916, Metric Tons	1917, Metric Tons	1918, Metric Tons	Countries.	1916, Metric Tons	1917, Metric Tons	1918, Metric Tons
France....	1,776		532	United States .	11,689	13,575	7,739
Great Britain..	3,159			All other countries..	534	1	1316
Japan......	820	1,164	1,624				
Straits Settlements.....	1,762	865	355	Totals.	19,740	15,605	11,566

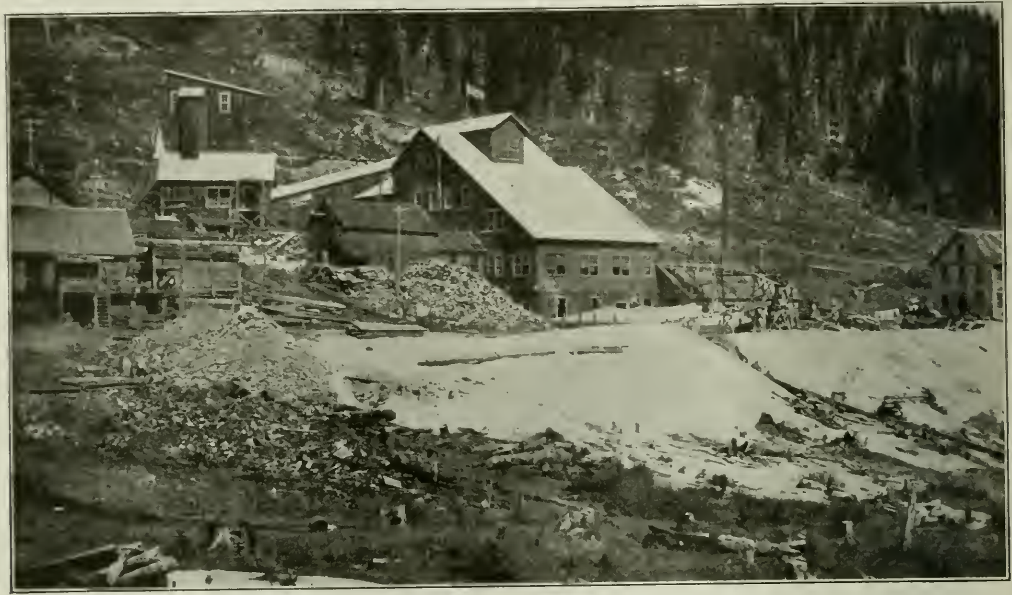
Advocates Exploration Work for Returned Soldiers

Members of the Canadian Mining Institute are being urged by H. Mortimer-Lamb, secretary-treasurer of that organization, to support representations which have been made to Sir James Lougheed, Minister of Soldiers' Civil Reëstablishment, asking for the organization of a prospecting expedition headed by returned men, to explore and investigate the mining possibilities of those parts of the dominion of which little is known.

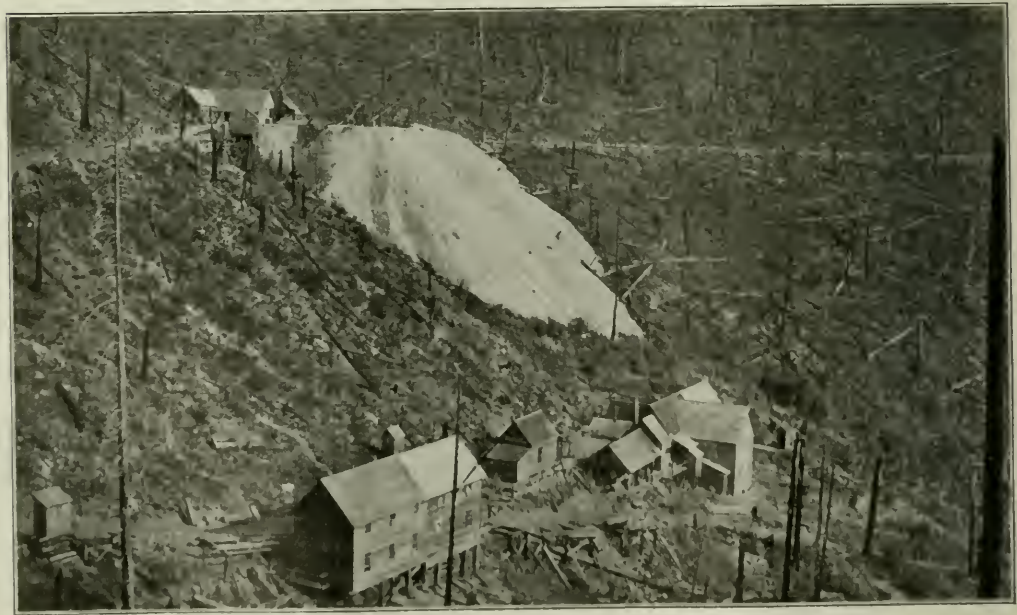
The suggestion is that the government should utilize returned soldiers in the work of searching for minerals, under the auspices and direction of the Department of Mines. It is recommended that suitable territory should be selected in different parts of Canada and that each section so chosen and defined be placed in charge of an officer of the department, whose duty is would be to act as general supervisor of the work of the exploration parties. Each of the parties would be under a mining engineer who is a returned soldier, and the personnel of each expedition would be made up of returned men who are qualified for the work of prospectors.

The Annual Report of the Judge Mining and Smelting Co., Park City, Utah, shows four dividends of 12½c. each, making a total of $240,000 paid during 1918. There was sold 19,176 tons of ore; 40,622 tons mill ore was treated, producing 6700 tons lead concentrates and 4580 tons zinc concentrates. The ratio of concentration for combined lead and zinc concentrates was 3.60 to 1. Receipts from all sources were $1,090,342; expenditures were $1,152,001, including dividends. There was a decrease of $61,659 in cash surplus. Against this, 1,602,000 lb. high-grade spelter and approximately 1000 tons zinc concentrates and 1200 tons residues were on hand or in transit to market at close of the year. The zinc plant is producing high-grade spelter, and, though a few improvements are still necessary, continual increase in production is expected. The average daily capacity of the mill is 404 tons.

Photographs From the Field



THE 250-TON CONCENTRATOR OF THE IDAHO CONTINENTAL CO. AT KLOCKMANN, IDAHO



PLANT OF MONTANA-IDAHO COPPER CO. AT ADAIR, IDAHO

THE PYNE SHAFT AT BESSEMER, ALA., THE FIRST VERTICAL SHAFT IN THE BIRMINGHAM DISTRICT

The No. 4, or Pyne, shaft of the Woodward Iron Co. is being sunk by the E. J. Longyear Co., of Minneapolis, Minn. Work was begun Aug. 11, 1918. The shaft is 13 x 21 ft. in section and is to be 1300 ft. deep. Fabricated steel sets are being put in, and it is to be lined with concrete. In addition to the shaft sinking, much development work is to be done by the contractors.

SINKING CREW AT NEW VERTICAL SHAFT OF THE WOODWARD IRON CO., BESSEMER, ALABAMA

Spelter Statistics for 1918

BY W. R. INGALLS

REVISED and complete statistics of the zinc industry of the United States in 1918 are given in this article, reports having been received from all of the ore smelters. I did not undertake to collect the statistics of production by the dross smelters either in 1917 or 1918, and the total of spelter production reported as available for consumption is short by just so much.

In a statistical investigation of this subject it is difficult to draw the line between spelter recovered *after use* and spelter reworked from waste *in the course of manufacture*. The former is a true addition to the supply available for consumption; the latter is merely an incident to consumption. About all that may safely be said statistically on this subject is that there is a rather large production of reclaimed spelter and that statistics of consumption which do not take it into account are incomplete.

As usual, the statistics for the previous year have beer revised in making the present compilation. However, this statistical investigation has been continued for so many years, and is now so well organized, that there is but little occasion for revision.

Production—The total production of spelter by ore smelters in 1918 was 525,350 tons, against 682,411 tons in 1917. In 1918 there were 14 ore smelters who produced spelter from dross to a more or less extent, a decrease of three below the previous year. The production from dross, skimmings, etc., was 13,157 tons in 1918, against 16,166 tons in 1917.

SPELTER PRODUCTION, 1913-1918, BY QUARTERS

(In Tons of 2000 Lb.)

Reports of Ore Smelters Only

	I	II	III	IV
1913				
Illinois	27,924	28,523	26,118	28,986
Kansas-Missouri	22,006	23,820	19,204	20,127
Oklahoma	21,430	21,840	18,502	21,458
Others (a)	20,722	20,153	19,238	18,211
Totals	92,082	94,336	83,062	88,782
1914				
Illinois	31,005	32,482	32,512	34,588
Kansas-Missouri	13,939	14,659	13,193	11,633
Oklahoma	22,563	22,960	22,945	23,999
Others (a)	22,717	22,715	24,106	24,296
Totals	90,224	92,816	92,756	94,516
1915				
Illinois	35,786	39,511	41,791	44,577
Kansas-Missouri	14,090	24,554	32,152	40,256
Oklahoma	24,713	26,984	28,613	31,095
Others (a)	26,255	30,575	31,360	34,830
Totals	100,844	121,624	133,916	150,758
1916				
Illinois	43,344	45,547	41,953	48,651
Arkansas	......	......	2,977	4,660
Kansas-Missouri	38,513	42,488	39,447	33,948
Oklahoma	34,994	38,786	42,604	52,680
Others (a)	37,853	39,873	41,514	48,186
Totals	156,704	166,694	168,495	188,125
1917				
Illinois	48,256	42,237	40,379	39,699
Arkansas	5,597	6,847	7,596	5,661
Kansas-Missouri	26,350	25,621	19,443	15,091
Oklahoma	53,280	57,227	48,478	45,602
Electrolytic	7,950	8,362	5,096	5,837
Others (a)	42,013	41,700	39,736	38,853
Totals	183,946	186,994	160,728	150,243
1918				
Illinois	34,848	34,829	36,445	35,686
Arkansas	6,156	5,603	7,618	7,373
Kansas-Missouri	10,284	5,016	7,198	9,336
Oklahoma	37,751	35,261	35,036	35,323
Electrolytic	8,094	9,407	11,049	10,335
Others (a)	36,881	36,265	35,481	34,075
Totals	134,014	126,381	132,827	132,128

(a) With the exception of one plant in Colorado, these are all Eastern works. In the fourth quarter of 1915 and in 1916 is included Anaconda and other electrolytic production.

Toward the end of the first quarter of 1918, the low price for spelter and the unpromising outlook caused the discontinuance of smelting in four plants, and some of these were abandoned, including among them the famous old Glendale plant of the Edgar Zinc Co., at Carondelet, St. Louis, which was one of the historic smelteries of the United States, it having been in operation for about 50 years. This cessation of production led to a considerable contraction in the figure for the second quarter, but with a temporary revival in the market during the summer, more furnaces were put in operation, and the production in the third quarter was about as large as that in the first. In the fourth quarter, in spite of the armistice and the unmistakable approach of adverse conditions, production was maintained at undiminished rate.

PRODUCTION OF SPELTER

(In Tons of 2000 Lb.)

By Ore Smelters Only

	1914	1915	1916	1917	1918
Arkansas	....	....	7,637	25,701	26,750
Colorado	8,152	8,984	8,908	7,735	3,897
Illinois	130,587	161,665	181,495	176,071	141,808
Missouri-Kansas	53,424	111,052	154,396	86,505	31,834
Oklahoma	92,467	111,405	169,064	204,587	143,371
Electrolytic	....	....	10,963	27,245	38,885
East and others (a)	85,682	114,036	147,555	154,567	138,805
Totals	370,312	507,142	680,018	682,411	525,350

(a) Includes Anaconda and other electrolytic production in 1915.

The plants that blew out in 1918 were chiefly those with coal-fired Belgian furnaces and some in the natural-gas fields that were subject to high costs. Nevertheless, in a few of these plants, operations, under lease, were resumed during the third quarter. At the end of 1918, there were four plants idle which had been producers early in the year. The plants remaining in operation were mainly those of the stronger companies, and their managements exhibited a disposition to continue operations regardless of the depressed market conditions.

Spelter Production According to Fuel.—The output of the ore smelters using coal as fuel, and the proportion of their production with respect to the whole, follow:

SPELTER PRODUCTION ACCORDING TO FUEL

Year	Production, Tons	Per Cent. of Total	Year	Production, Tons	Per Cent of Total
1911	119,989	40	1915	227,143	45
1912	134,027	38	1916	289,007	42
1913	157,653	44	1917	282,498	41
1914	173,520	48	1918	239,386	45

The remainder of the production was made by smelters using natural gas as fuel. Up to 1915 there was a general tendency toward increasing production by the smelters using coal as fuel, their proportion of the total output having risen from 40% in 1911, to 48% in 1914. In 1915 it fell to 45%, in spite of the revival of smelting at Pittsburg, Kan., which is easily explained. There were a lot of inactive natural-gas smelteries that could be put quickly into operation, which was done, and, moreover, it was quicker and easier to build new plants in the natural-gas fields than in the coal fields. The same conditions continued in 1916, and the ratio of the spelter produced by smelting with coal fell to 42%, which took us about back to the situation of 1912. In 1918, the percentage of spelter produced by the coal-fired plants rose again, this reflecting the discontinuance of smelting by the more ephemeral plants in the gas fields and the reconcentration of smelting among the more permanent plants of the coal fields.

Electrolytic Zinc—The production of electrolytic zinc in the United States in 1918 was 38,885 tons, against 27,245 tons in 1917. The Consolidated Mining and Smelting Co., of Canada, at Trail, B. C., produced 12,574 tons in 1918 and 9956 tons in 1917. The American producers in 1918 were the Anaconda, River Smelting and Refining Co., Judge Mining and Smelting Co., and the Mammoth plant of the United States Smelting, Refining and Mining Company.

One concern that was engaged in the electrolytic refining of crude spelter, whose output does not appear in these statistics, for the reason that it duplicates the report of distilled spelter, ceased operations in 1918, and its plant was abandoned.

The Electrolytic Zinc Co., of Australasia, which has built a plant at Risdon, near Hobart, Tasmania, for the treatment of Broken Hill ore, began production early in 1918, and since then produced at the rate of about 10 tons of spelter per day. This plant is considered to promise commercial success, and plans are being made for a large extension of it. Outside of the United States, Canada, Tasmania, and Japan, there was no noteworthy production of electrolytic spelter in 1918, but new plants were projected in various parts of the world.

Fine Zinc—It was reported from 11 works in 1918 that they had been engaged in the redistillation of common spelter. The aggregate production of refined spelter reported by them was 43,386 tons. This was spelter of high grade, probably assaying in the main from 99.75 to 99.90% of zinc. The production of redistilled spelter in 1917 was 41,468 tons. Among other fine spelters is the Mascot brand of the American Zinc, Lead and Smelting Co., produced directly from ore. Spelters running above 99.9% zinc are the Horsehead and Bertha brands, directly distilled; and the electrolytic metal. Altogether, the output of fine zincs in 1918 was upward of 125,000 tons. The exact figure may not be stated, for it would lead to the disclosure of individual business.

In view of the conditions that existed in the market for high-grade zinc, it is rather surprising that the production, especially of redistilled zinc, was so large as the statistics show. The explanation is manifestly that during the major part of the year, and, indeed, right up to the armistice, the governments were very large buyers of this grade of zinc, and the modification of the ordnance specifications in the early part of the year furnished a larger outlet for the redistillers. As things turned out, all of the governments over-bought their requirements, and at the end of 1918 found themselves with large stocks of high-grade zinc on hand. Previous to that time, the margin between the prices for high-grade and common zinc had so contracted that there was no longer any profit in redistilling, and the refining of spelter in that way was discontinued and is not likely to be resumed again.

General Conditions of Ore Supply—The reports as to ore receipts give interesting indications as to practice in smelting and as to market conditions. The smelters who make sulphuric acid continue, as in the past, to draw their ore mainly from Wisconsin and from the Joplin district (including Oklahoma). For the manufacture of sulphuric acid this ore is recognized to be superior, but it is noteworthy that several of the zinc acid makers are using a larger and larger proportion of Western ore. Of the total number of works—36—there were 13 in 1918 that used nothing but ore from the high-grade districts, viz., Missouri, Kansas, Oklahoma, Wisconsin, and Arkansas, the total quantity taken by them from those states being 297,652 tons. There were three works that did not use any ore from the high-grade districts, their chief supply being ore from the Rocky Mountain region and from foreign countries. Imported ores were smelted by 14 works. In 1918 Australian ore was received at one smeltery east of the Mississippi River.

In the case of every zinc-ore producing state, there was decreased production in 1918, except in Tennessee and the Joplin district. With respect to the latter, the reports by the smelters do not permit a separation according to the portions of what is commonly considered the Joplin district. However, it is well known that the output of the mines in the immediate vicinity of Joplin decreased, while there was a tremendous increase in the output of Oklahoma, especially of the Miami district of that state. The mines of that district, which possess large orebodies of relatively high grade, have become one of the controlling factors in the American zinc industry. The high grade of the ore permits it to be produced and sold at prices not very different from pre-war prices.

Ore Smelted—The smelters, as distinct and separate from the electrolytic producers, reported that in 1918 they treated 888,693 tons of blende and 256,857 tons of calamine, a total of 1,145,550 tons. In 1917 they smelted 1,149,172 tons of blende and 424,311 tons of calamine, a total of 1,573,483 tons. As I remarked last year, it should not be attempted to draw too fine distinctions from these figures respecting either the quantity or the average yield of the ore smelted, some smelters apparently having reported "ore received" as "ore smelted," and there was probably some other confusion respecting this inquiry. However, we may draw some rough deductions.

ORE SMELTED AND YIELD

	1915	1916	1917	1918
Total production of spelter, tons...	507,142	680,018	682,411	525,350
Ninety per cent. of production of zinc dust....................	1,299	2,086	4,424	5,580
Total production of zinc, tons....	508,441	682,104	686,835	530,930
Less production of electrolytic, tons	....	10,963	27,245	38,885
	508,441	671,141	659,590	492,045
Less production from dross, tons...	12,538	11,681	16,166	13,157
Net production of spelter, tons...	495,903	659,460	643,424	478,888
Amount of ore smelted, tons.......	1,188,075	1,713,912	1,573,483	1,145,550
Average spelter per ton ore, per cent.	41.74	38.49	40.88	41.80
Estimated average recovery, per cent..........................	83.3	83.3	82.0	82.0
Estimated grade of ore, per cent...	50.1	46.2	49.9	51.0

In 1914 the calamine smelted was about 26½% of the total; in 1915 it was about 28½%; in 1916 about 29¾%; in 1917, about 26.9%; and in 1918, about 22.4%. The tendency to use a larger proportion of calamine in smelting that was exhibited in 1915 and 1916 was checked in 1917, when the smelters were forced by adverse market conditions to seek high-grade blende rather than low-grade calamine, and in 1918 the relative use of calamine diminished further.

Grade of Ore Smelted—In the accompanying table an attempt has been made to estimate the average grade of the ore smelted during the last few years. The most uncertain factor is the percentage of metallurgical extraction, which has been assumed at 82% in 1918; 82% in 1917; 83.3% in 1915-16; and at 86% in 1914. These assumptions are purely arbitrary. Of course, the calculated grade of the ore is too low in just the proportion that the estimate of metallurgical recovery is too high. However, the figures afford a sort of an index as to the nature of the raw material purchased by the smelters.

Receipts of Ore—The receipts of ore by smelters in 1918 showed a decrease, the grand total having been 1,166,097 tons, compared with 1,613,272 tons in 1917. These totals include the receipts of ore by the smelters only, and do not include the ore that was taken by the manufacturers of zinc oxide or what was used by the producers of electrolytic zinc. The statistics show 1,145,550 tons smelted and 1,166,097 tons received.

RECEIPTS OF ZINC ORE

(In tons of 2000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the electrolytic producers or by the manufacturers of zinc oxide.)

State	1913	1914	1915	1916	1917	1918
Arizona	9,347	6,357	14,718	17,243	14,837	1,962
Arkansas	1,500	1,737	7,017	12,854	20,225	(*c*)
California	6,796	8,827	27,445	41,291	12,444	5,351
Colorado	220,166	164,739	148,359	194,418	184,304	82,995
Idaho	31,835	57,001	78,767	104,575	86,172	62,109
Kentucky	441	434	1,863	2,460	2,019	799
Missouri-Kansas	280,000	247,723	278,099	369,397	301,809	(*c*)
Missouri-Kansas-Oklahoma-Arkansas	(*d*)	(*d*)	(*d*)	(*d*)	(*d*)	476,954
Montana	91,257	125,663	200,528	233,645	171,904	152,905
Nevada	22,313	20,447	24,949	51,670	35,045	19,733
New Mexico	14,593	15,369	37,042	35,734	16,353	13,206
Oklahoma	23,500	26,247	25,231	42,799	153,035	(*c*)
Tennessee	8,297	18,708	38,527	43,309	38,488	45,924
Utah	27,073	20,322	21,535	43,240	21,381	14,758
Wisconsin (*a*)	89,662	74,311	90,128	91,561	137,248	123,506
Others and undistributed	57,241	57,936	122,490	111,273	192,393	98,870
Totals	884,021	845,821	1,116,698	1,395,469	1,387,657	1,099,072
Mexico	19,965	16,414	49,171	142,687	135,368	49,532
Canada	6,012	10,532	14,000	31,877	21,502	14,502
Australia			68,448	134,464	37,031	618
Other foreign	.	. . .	9,211	73,394	31,714	2,373
Grand totals (*b*)	909,998(*b*)	872,767	1,257,528	1,777,891	1,613,272	1,166,097

(*a*) Including Illinois and Iowa. (*b*) In addition to the ore reported from Canada and Mexico, zinc smelters received a few thousand tons from Europe and Eastern Siberia in 1913. (*c*) See "Missouri-Kansas-Oklahoma-Arkansas." (*d*) See under separate states

Spelter Stocks—The stock of spelter at works on Dec. 31, 1918, being the aggregate of the reports of all the smelters, was 40,325 tons, compared with 60,415 tons at the beginning of 1918. These figures include both high-grade and common spelter.

Besides the stocks of spelter in the hands of the American smelters at the end of 1918, there was a large stock in the hands of the United States Government. Estimates respecting this were uncertain, but it may be assumed in the light of later information that it was probably about 50,000 tons, a very large part of which was in the form of high-grade spelter. The stocks of spelter abroad also were large. The British Ministry of Munitions on Jan. 1 reported 30,290 long tons in its possession. On Apr. 1, its reports showed 38,050 long tons, the increase reflecting the delivery into Great Britain of stocks of the Munition Ministry, previously held elsewhere. The French government at the end of 1918 had about 45,000 tons. Italy was known to have a large stock, and there were known to be large stocks in Japan and Germany. There was no doubt whatever as to the stocks of spelter throughout the world being of great magnitude in the aggregate.

Sulphuric Acid—In 1918, there were 11 smelters who produced sulphuric acid from blende, one less than in 1917. The enumeration is, however, open to some criticism, owing to complications that are developing in the industry. It is often good business to roast the blende at a good center for the distribution for sulphuric acid, and reship the roasted ore to a good point for zinc distillation. The Western Chemical Co. has for a long time roasted ore at Denver, Colo., and sold the product to smelters. The National Zinc Co. has no roasting furnaces at its smeltery at Springfield, Ill., which gets its ore from the roasting plant of the company at Argentine, Kan. Similarly, the Grasselli Chemical Co. roasts at Canton, Cincinnati, Newcastle, Cleveland, and Grasselli the ore that is needed by its smelteries at Clarksburg, Meadowbrook, and Terre Haute. The New Jersey Zinc Co. has a roasting plant at Tiltonville, Ohio, which supplies other smelters. With the movement of the zinc-smelting industry to the eastward, the separation of blende roasting and zinc distillation is becoming more marked, as it has been for a long time in Europe. It will appear from this that the definition between zinc smelters' acid and acid derived from other sources is becoming more and more uncertain. The statistics that I offer are to be regarded, therefore, as more valuable for comparative purposes than as indicative of precise results, although in the latter respect they are probably not far out of the way.

STATISTICS OF SPELTER-SULPHURIC ACID WORKS

(In Tons of 2000 Lb.)

	1914	1915	1916	1917	1918
Ore received	434,666	614,565	752,021	779,941	485,276
Spelter produced	196,529	244,252	293,525	313,433	217,134
Sulphuric acid, basis 60 deg.	355,424	475,740	683,514	817,573	636,149

It is to be remarked that no attempt should be made to determine from the accompanying statistics any ratios between ore received and sulphuric acid produced or between spelter produced and sulphuric acid produced, for the reason that certain concerns received and smelted a good deal of calamine, which, of course, never went through the blende-roasting department at all. Moreover, in recent years zinc smelters have been boosting their sulphurous gas by burning brimstone in the flues leading to the Glover towers. In 1918, zinc smelters reported the use of 29,408 tons of brimstone for this purpose.

Imports and Exports—The imports and exports of ore, spelter, sheet zinc, and zinc dust are given in an accompanying table, the figures of which require no explanation. It will be observed that the Government figures for the exportation of spelter are different from those representing the production of spelter in bond as reported by the smelters; also that there are discrepancies with respect to the importation of ore. These differences are explained in part by the difference of the periods comprised within the respective reports, the smelters reporting the spelter when it leaves their works and the Government reporting it when it is enter for export in the custom house. In 1918 the smelters reported the production of 18,610 tons of spelter in bond, of which 15,157 tons was exported, while the Government reported the exportation of 19,855 tons of foreign origin.

In addition to the figures given in the tables which accompany this article, the following data are of interest: The zinc content of ore imported in 1918 was 24,809 short tons, whereas in 1917 it was 72,474 short tons. In 1918 the United States exported 15,816 tons of zinc dross, compared with 13,302 tons in 1917.

The table of imports and exports for 1916 has been revised to agree with the latest figures of the U. S. Department of Commerce. Changes were made in the cases of ore imports and of exports of spelter and sheet zinc.

Smelting Capacity—The capacity of the zinc-smelting works of the United States at the end of 1918 is given in the accompanying table. This statement falls short of measuring the real increase of zinc-producing capacity, for it takes no account of the electrolytic plants.

IMPORTS AND EXPORTS, BY QUARTERS

	1914		
Imports	Ore, Long Tons	Spelter, Lb.	Zinc Dust, Lb.
I	3,355	500,253	1,288,249
II	4,727	512,123	1,256,259
III	6,849	664,012	535,471
IV	13,607	83,191	1,524,128
Year	28,538	1,759,579	4,604,107
Exports	Ore, Long Tons (c)	Spelter, Lb. (a)	Dross, Lb.
I	2,883	842,465	572,477
II	4,297	872,511	....
III	1,319	48,177,681	1,239,570
IV	1,421	90,591,936	3,259,020
Year	9,920	140,484,593	5,071,067
	1915		
Imports	Ore, Long Tons	Spelter, Lb	Zinc Dust, Lb
I	14,909	480,949	502,008
II	44,449	496,601	316,073
III	33,863	461,957	355,431
IV	48,611	369,457	538,861
Year	141,832	1,808,964	1,712,373
Exports	Ore, Long Tons (c)	Spelter, Lb.	Zinc Sheet, Lb.
I	...	83,313,386 (a)	(e)
II	605	56,829,272 (a)	(e)
III	108	39,528,063 (b)	12,929,438
IV	30	58,318,807 (b)	11,836,786
Year	743	237,989,528	24,766,224
	1916		
Imports	Ore, Long Tons	Spelter, Lb.	Zinc Dust, Lb
I	110,293	435,896	779,253
II	98,497	492,823	477,425
III	74,855	243,186	273,899
IV	60,966	196,655	337,125
Year	344,611	1,368,560	1,867,702
Exports	Ore, Long Tons	Spelter, Lb. (b)	Zinc Sheet, Lb.
I	....	66,840,110	7,174,116
II	30	78,645,760	3,748,914
III	40	113,997,791	6,399,813
IV	....	128,219,039	7,701,339
Year	70	387,702,700	25,024,182
	1917		
Imports	Ore, Long Tons	Spelter, Lb.	Zinc Dust, Lb.
I	65,087	153,127	112,199
II	61,859	119,005	304,638
III	39,392	99,868	228,510
IV	22,587	141,153	155,990
Year	188,925	513,153	801,337
Exports	Ore, Long Tons	Spelter, Lb.	Zinc Sheet, Lb.
I	....	124,254,565	3,843,800
II	32	109,257,705	11,525,971
III	334	92,458,525	10,625,019
IV	814	77,948,988	7,053,201
Year	1,180	403,919,783	33,047,991
	1918		
Imports	Ore, Long Tons	Spelter, Lb.	Zinc Dust, Lb.
I	23,490	43,166	11,846
II	16,765	19,318	11,200
III	11,199	7,762	....
IV	11,851	306	....
Year	63,305	70,552	23,046
Exports	Ore, Long Tons	Spelter, Lb.	Zinc Sheet, Lb.
I	55	51,121,474	4,741,022
II	....	41,850,252	6,690,594
III	....	31,842,295	5,900,429
IV	....	47,382,576	10,483,892
(a) Year	55	(d) 172,446,400	(d) 27,750,910

(a) Includes zinc in sheets. (b) Does not include zinc in sheets, which was reported separately from July 1, 1915. (c) In addition to the exports of ore here reported, there were exported ore and calamine of foreign origin, the zinc content of which amounted to 279,000 lb. in 1914 and 1,218,500 lb. in 1915. (d) The quarterly figures do not foot up to the total given. Both are from the report of the U. S. Dept. of Commerce, and the difference is probably due to corrections made after the monthly figures were published, of which we have no knowledge. (e) Included with spelter.

At the end of 1918 the listed smelters of the United States possessed a total of about 189,000 retorts, of which operating smelters had 176,392. Of these the number in use on Dec. 15 was 124,068.

No new furnaces were reported as being in process of construction at the end of 1918.

Market Conditions—At the beginning of 1918 common spelter was quoted at 7⅝c. St. Louis. There was an overproduction and stocks were accumulating. The statistical conditions caused a decline in the market to 6.60c. That relatively low price, which was estimated to be equivalent to about 3¾c. before the war, caused a general closing of inefficient smelteries. Many of these were abandoned, and not a few were dismantled.

ZINC-SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

Name	Situation	1917	1918
American Spelter Co. (a)	Pittsburg, Kan.	896	(d) 896
American Steel & Wire Co.	Donora, Penn.	9,120	9,120
American Zinc and Chem. Co. (a)	Langeloth, Penn.	7,296	7,296
American Zinc Co. of Ill.	Hillsboro, Ill	4,864	4,864
American Zinc, Lead and Smg. Co. (a)	Dearing, Kan	4,480	(c) ....
American Zinc, Lead and Smg. Co. (a)	Caney, Kan..	6,080	(f) 6,080
American Zinc, Lead and Smg. Co. (a)	Neodesha, Kan.	3,760	(c) ....
American Zinc, Lead and Smg. Co.	E. St. Louis, Ill.	5,620	5,620
Arkansas Zinc and Smelting Corpn.	Van Buren, Ark.	3,200	3,200
Athletic Min. and Smelting Co.	Fort Smith, Ark.	1,664	2,496
Bartlesville Zinc Co.	Bartlesville, Okla.	5,184	7,488
Bartlesville Zinc Co.	Blackwell, Okla.	9,600	9,600
Bartlesville Zinc Co.	Collinsville, Okla.	13,400	(c) ....
Bartlesville Zinc Co., Lanyon-Starr.	Bartlesville, Okla.	3,456	3,456
Collinsville Zinc Co. (a)	Collinsville, Ill.	1,984	(d) 1.984
Eagle-Picher Lead Co.	Henryetta, Okla.	3,000	4,000
Edgar Zinc Co.	Carondelet, Mo.	1,982	(c) ....
Edgar Zinc Co.	Cherryvale, Kan.	5,040	5,040
Fort Smith Spelter Co.	Fort Smith, Ark.	2,560	2,560
Grasselli Chemical Co.	Clarksburg, W. Va.	5,760	5,760
Grasselli Chemical Co.	Meadowbrook, W. Va.	8,520	8,520
Grasselli Chemical Co.	Terre Haute, Ind.	3,360	4,200
Hegeler Zinc Co.	Danville, Ill.	5,400	5,400
Henryetta Spelter Co.	Henryetta, Okla.	(a) 3,000	(b) 3,000
Illinois Zinc Co.	Peru, Ill	(b) 4,640	5,440
J. B. Kirk Gas and Acid Co. (a)	Iola, Kan.	3,440	(b) 3,440
Kusa Spelter Co.	Kusa, Okla.	7,520	5,360
Lanyon Smelting Co.	Pittsburg, Kan.	(d) 448	(d) 448
Robert Lanyon Zinc and Acid Co.	Hillsboro, Ill.	3,200	3,200
Matthiessen & Hegeler Zinc Co.	La Salle, Ill.	6,168	6,168
Mineral Point Zinc Co.	Depue, Ill.	9,068	9,068
National Zinc Co.	Bartlesville, Okla	4,256	4,160
National Zinc Co.	Springfield, Ill.	4,480	4,480
New Jersey Zinc Co. of Penn.	Palmerton, Penn.	7,200	7,200
Oklahoma Spelter Co.	Kuska, Okla.	(d) 1,600	(d) 1,600
Owen Spelter Co.	Caney, Kan.	1,920	(d) 1,920
Pittsburg Zinc Co.	Pittsburg, Kan.	(d) 910	(d) 910
Prime Western Spelter Co.	Gas and Iola, Kan.	4,866	(g) 1,972
Quinton Spelter Co.	Quinton, Okla.	2,016	2,016
Sandoval Zinc Co.	Sandoval, Ill.	672	672
Tulsa Fuel and Manufacturing Co.	Collinsville, Okla.	6,232	6,232
United States Smelting Co. (a)	Altoona, Kan.	4,640	(c) ....
United States Smelting Co.	Checotah, Okla.	5,120	(i) 5,120
United States Zinc Co.	Henryetta, Okla.	2,400	3,448
United States Zinc Co.	Sand Springs, Okla.	8,000	7,560
United States Zinc Co.	Pueblo, Colo.	2,200	2,208
United Zinc Smelting Corpn.	Moundsville, W. Va.	1,728	1,728
United Zinc Smelting Corpn.	Clarksburg, W. Va.	3,648	(i) 3,648
Weir Smelting Co. (h)	Weir, Kan.	(a) 448	(d) 448
Totals		216,046	189,026

(a) Closed during latter part of 1917. (b) No report received; entered the same as previous year. (c) Dismantled. (d) Idle all year. (f) Part. (4 blocks) leased to Weir Smelting Co. (g) The plant at Gas City was wrecked by cyclone, March, 1918. (h) Weir Smelting Co. is operating 4384 retorts of the Caney plant of American Zinc, Lead and Smelting Co. (i) Idle latter part of 1918.

The curtailment of production was overdone, in view of the continued large requirement of spelter for brass making, and the market price rallied to about 8½c. at the beginning of July. After a minor setback, further improvement in the statistical position advanced the price to 9⅜c. in September, but with this advance the margin between common and high-grade spelters contracted, and eventually it ceased to be profitable to refine by redistillation. The supply of common spelter for sale being thus increased, the market started on a slow but steady decline. The advent of the armistice did not produce in zinc just the same conditions as in copper and lead, for zinc had never been under control. However, the weakness of the market became

MONTHLY AVERAGE PRICE OF SPELTER

	New York			St. Louis			London		
Month	1916	1917	1918	1916	1917	1918	1916	1917	1918
Jan.	16.915	9.619	7.836	16.745	9.449	7.661	89.810	48.329	54.000
Feb.	18.420	10.045	7.814	18.260	9.875	7.639	97.762	47.000	54.000
Mar.	16.846	10.300	7.461	16.676	10.130	7.286	95.048	47.000	54.000
Apr.	16.695	9.459	6.890	16.525	9.289	6.715	99.056	54.632	54.000
May.	14.276	9.362	7.314	14.106	9.192	7.114	94.217	54.000	54.000
June.	11.752	9.371	8.021	11.582	9.201	7.791	68.591	54.000	54.000
July.	8.925	8.643	8.688	8.755	8.473	8.338	50.750	54.000	54.000
Aug.	8.730	8.360	8.985	8.560	8.190	8.635	51.587	54.000	54.000
Sept.	8.990	8.136	9.442	8.820	7.966	9.092	52.095	54.000	54.000
Oct.	9.829	7.983	8.801	9.659	7.813	8.451	54.159	54.000	54 000
Nov.	11.592	7.847	8.491	11.422	7.672	8.141	56.023	54.000	54.100
Dec.	10.665	7 685	8.163	10.495	7.510	7.813	55.842	54.000	56.050
Year.	12.804	8.901	8.159	12.634	8.730	7.890	72.071	52.413	54.180

New York and St. Louis, cents per lb. London, pounds sterling per long ton.

a little more pronounced, and 1918 closed with the quotation of 7.45 cents.

At the beginning of 1918 high-grade spelter was quoted in the neighborhood of 12½c. During the spring the War Industries Board fixed 12c. as a maximum price. A little later, an alteration in the Army specifications increased the supply of high-grade metal. The market becoming more competitive, the price declined below 12c. Toward the close of 1918 high-grade metal was sold at 9c., and at the very end of the year it is doubtful if it were properly quotable above 8½ cents.

The prices of sheet zinc and rolled plate were fixed at 15 and 14c., respectively, and those prices were maintained until the end of 1918, the supply being steadily short, because of insufficient manufacturing capacity. Owing to the large profit that those prices permitted, the producers of special grades of ore in the Joplin district claimed a participation in it and obtained a fixed price of $75 per ton, the requirements of the sheet zinc producers being prorated among those ore producers.

AVERAGE PRICE OF ZINC SHEETS

(In Cents per Pound)

	1916	1917	1918		1916	1917	1918		1916	1917	1918
Jan.	23.40	21.00	19.00	May.	24.00	19.00	15.00	Sept.	15.00	19.00	15.00
Feb.	24.50	21.00	18.00	June.	19.50	19.00	15.00	Oct.	15.20	19.00	15.00
Mar.	25.00	21.00	15.00	July.	15.60	19.00	15.00	Nov.	18.25	19.00	15.00
April.	25.20	20.44	15.00	Aug.	15.00	19.00	15.00	Dec.	21.00	19.00	15.00

Average for the year 1916—20.14c.; 1917—19.62c.; 1918—15.58c.

Note—These are base prices for ordinary size sheets, in carload lots, f.o.b. La Salle-Peru, Ill., less 8% discount.

Bonded Spelter—In 1918 there was produced 18,610 tons of spelter in bond. In 1917 the production in this way was 82,530 tons; in 1916 it was 94,626 tons; in 1915, 15,781 tons; in 1914, 5630 tons, and in 1913, 5904 tons.

Zinc Dust—The production of commercial zinc dust in 1918 was 6201 tons, as compared with 4915 tons in 1917; 2318 in 1916; 1443 in 1915; 1042 in 1914; and 423 in 1913. In 1913 only two smelters were engaged in this manufacture, but when the outbreak of the war in 1914 cut off America's foreign supply, and the price rose from about 6c. per lb. to 15@16c., several additional smelters engaged in the manufacture of it, until there are now nine.

The importation of zinc dust was 12 short tons in 1918, compared with 401 tons in 1917; 934 tons in 1916; 856 in 1915; 2302 in 1914; and 220 in 1913. It will be observed that domestic producers now supply about all of the zinc dust that is required in this country. The price for zinc dust has declined in proportion with that for other grades of zinc. At present it is about 1.5 times the price for common spelter.

Large Producers—A particularly interesting feature of the zinc business in recent years has been the entry of several general metallurgical companies into this field. Inasmuch as several of these companies make public reports, their outputs in tons in 1918 and 1917 may be stated as follows, the figures for 1918 being given first and those for 1917 in parentheses immediately following: United States Steel Corporation, 41,715 (67,418); American Smelting and Refining Co., 20,619 (26,261); United States Smelting Co., 9386 (26,795).

The Director of the Mint reveals that the 265,000,000 silver dollars which were melted under the Pittman Act were hauled across the continent from the Philadelphia mint to San Francisco in 18 special trains. The silver was shipped in bars weighing 62 lb. each. Its dispatch, and the transfer to ships at San Francisco, were accomplished without general knowledge. All the silver was sent to India.

Manganese-Ore Mining Industry

The U. S. Tariff Commission has recently completed the assembling of information on the manganese-ore mining industry and has prepared an analysis of the competitive position of the United States in the manganese industry of the world. Among interesting facts recorded are the following:

Minor amounts of the ore are required by chemical and other industries, but 96% of the consumption is for making steel. Prior to the war, the United States produced less than 1% of its manganese requirements. The remainder was imported, mainly from India, Russia, and Brazil, in the form of ore, and from Great Britain in the form of ferromanganese. It is noted that the countries possessing the largest and richest deposits have an abundant and cheap labor supply. Under war conditions India and Russia were practically eliminated as sources of supply. The productive capacity of the world's major deposits is so much greater than the total demand for ore for steel making that if any single source is eliminated temporarily, the demand can be fully met by the remaining sources.

The industry expanded considerably in Brazil and in Cuba. The large supplies from these nearer countries, together with the increased domestic output, proved greater than even the enormously expanded needs of this country, and the United States became independent of British ferromanganese and of Indian and Russian ore. The Cuban industry was promoted by American interests and the entire production sent to the United States. The quantity imported from Cuba shows annual increases from 550 tons in the fiscal year 1915 to 67,780 tons in 1918, an amount equal to one-twelfth of America's total imports.

Domestic production of high-grade (35% or more manganese) ore, used largely for making ferromanganese, increased from 4063 tons in 1913 to about 294,000 tons in 1918. Production of low-grade (less than 35% manganese) ore, used partly for making spiegel and partly smelted direct in iron furnaces, increased from 85,588 tons in 1913 to over 1,079,000 tons in 1918. The number of shippers of high-grade ore in 1918 had increased from approximately 75 in 1917 to about 210. Manganese mining on a large scale in the United States, however, is an artificial industry. Under normal trade conditions, with a free movement of ore from foreign countries, it cannot continue except on a limited output. Domestic resources have been carefully estimated by the U. S. Geological Survey and found to be insufficient to supply domestic requirements for longer than three years at most. The domestic ore is low grade, obtainable in small lots only, and variable in character. Aside from the higher cost of domestic ore as compared with the foreign product, any large dependence on domestic supplies involves the rapid depletion of limited reserves.

The foreign resources are in some instances practically inexhaustible, high grade, and more easily mined than the domestic deposits. The average grade of imported ore is from 45 to 55% manganese, as compared with domestic "high grade" running 35 to 45%. A dominant factor in the domestic manganese industry is that most of the American mines are situated remote from the points of consumption, often at considerable distances from the railroad. Foreign manganese must eventually furnish the American supply, regardless of any temporary expedients that may lead to the continuance of domestic mining.

During the period of the war a number of mines were opened up and equipped for the purpose of providing manganese as a necessity in the war program. Many of these properties failed to return the capital invested up to the time of the signing of the armistice. As there was some justice in the claim that this investment had been undertaken for patriotic reasons, compensation rom the Government has had consideration at the hands of Congress. Such compensation is now being adjusted under the War-Minerals Relief Bill, which provides for he investigation and liquidation by the Secretary of he Interior of certain financial losses sustained during he war period in four mining industries—manganese, ungsten, pyrites, and chromite.

Conditions in Alabama Iron Industry

BIRMINGHAM CORRESPONDENCE

May 10th was a day of celebration in the Birmingham district, when practically all operations of all classes of business were suspended, that the employees might join in welcoming home the 167th Regiment of Infantry, part of the famous Rainbow Division. The blast furnaces were the only plants of the larger companies in operation that day, the mills and mines being given a full holiday in common with all other industries.

April closed with a low record of production for Alabama in the pig-iron industry, only 149,708 tons being produced, as against 182,845 for March, 185,570 for February, and 18,313 for January. The present outook, however, is bright for a larger output in May. Some small sales are reported and inquiries are more numerous.

The most encouraging development in the iron and steel industry at present in the Birmingham district is the renewed activities of the Woodward Iron Co. Practically all of this company's plants have been closed for almost two months, but with two of its mines and one furnace now operating, and rumor of another furnace soon to be blown in, production is expected to increase generally during May. The company's labor was kept for the most part near at hand during the shutdown, and, as a result, no great loss in reorganizing crews is expected. Both mines and furnace are being operated on a ten-hour day schedule, with a reduction of about 15% in wages reported.

The Tennessee Coal, Iron and Railroad Co. has only a few furnaces now in operation, but the others, owing to need of repairs, require large crews, and their shutdown is not affecting labor seriously. A large loading dock at the Bessemer Rolling Mills, Tennessee company's plant at Bessemer, Ala., is nearing completion.

With two ships building and two keels to be laid soon by the Chickasaw Shipbuilding Co., subsidiary of the Tennessee company, at Mobile, Ala., there is small possibility of operations being curtailed at the company's big Fairfield works, practically the entire product of that plant being rushed to Mobile for use in construction of ships.

No complete shutdown of the Tennessee company's big steel plant at Ensley, Ala., is expected, though curtailment of production has kept pace with the falling off of orders. The Alice furnace in the city proper has been shut down, but this loss of product is offset by the blowing in of a furnace at Bessemer, Alabama.

In general, operators are expecting more activity in May than was to be noted in the preceeding two months. This is particularly true in the iron and steel circles, even though the close of April found only 14 stacks in blast out of a total of 45 in the state.

Industrial Relations in Canada

VICTORIA CORRESPONDENCE

The Royal Industrial Commission of Canada, appointed by the dominion government to investigate and report upon the relations between employee and employer throughout the dominion, met in British Columbia recently to take evidence. Among others heard was F. M. Sylvester, managing director of the Granby Consolidated Mining and Smelting Co., who expressed the fear that any effort to establish a joint council of employees and employers for the purpose of handling labor problems would have to be confined to units if it were to meet with success. He said that such a joint council might fail "because there is so much difference of opinion and such a wide chasm between the employer and the employee in many industries." In his opinion an organization of the kind should be built from the bottom and extended over a long period.

Mr. Sylvester told the commission that he had not given the question extensive study, but he thought that the results achieved by an industrial council would be in proportion to the provision made for the education of the men. Progress could be only by evolution. Each industry would have to work out its own salvation.

Villa Raids Annoy Miners

LORDSBURG, N. M., CORRESPONDENCE

Advices received under date of May 13 are to the effect that conditions in Chihuahua and northern Durango, Mexico, are still uncertain. Practically no foreigners are living at places distant from the railroad in that section. There are no white men in Santa Eulalia. Though the mines are operating, the engineering force live in the city of Chihuahua and visit the property two or three times weekly. Even the old-time mine bosses, some of them married to native women, are taking no chances on a raid by Villa, but reside in the city and make the trip, 12 miles, to the mines as often as necessity requires.

At Cusihuiriachic there are a few American operators, but they keep saddle horses and automobiles ready for instant use and maintain a force of mounted pickets to report instantly any suspicious party of horsemen that may approach. Operating under these conditions is certainly nerve racking, but no protection can be depended upon from the Mexican government forces.

Mining in Dutch Guiana

High freight rates, tax on production, the high price of foodstuffs, and reduction in the purchasing power of gold greatly checked the gold-mining industry in 1917 in Dutch Guiana, according to a consular report. Only one company operated on a successful financial basis. The discovery of bauxite in Dutch Guiana in 1915 has resulted in the establishment of several holding companies, which have done extensive prospecting. A special ordinance for this industry was passed by the colonial parliament some time ago and sent to The Hague for ratification, which, it is expected, will be given soon.

Progress in the Manufacture of Stoping Drills

The development of stoping drills to their present status among air-driven rock-cutting machines has been the result of specialization and a consideration of conditions involved in drilling operations. In recent designs the disadvantages of the older types have been eliminated and new features and improvements have been introduced.

DRILL engineers and manufacturers have appreciated for many years the fact that one type of drill could not be efficiently applied to all conditions of drilling. The old two-man piston drill is now used under a relatively small percentage of conditions. One-man piston drills, water-hammer drills for drifting, rotating hand-feed hammer drills for sinking, and air-feed stoping drills for upper holes are some of the developments of the last 15 years. Specialization in each department of drilling has also been found necessary with increasing competition and with the adaptation of new drills to work previously done by other means with less efficiency.

The first air-feed stoping drills developed were practically all of one type, consisting of the drill cylinder proper, mounted on a reverse air-feed cylinder, in which the feed cylinder remained stationary and the air pressure carried the drill up to its work, supported on a piston rod between the drill proper and the feed cylinder. These machines were designed for hard, medium, and soft ground and for all conditions that might be met in the drilling of upper holes. The Sullivan Machinery Co. was the first to introduce in this country that type of pneumatic feed in which the feed cylinder is attached directly to the pneumatic hammer, the feed piston rod acting against an abutment. This type of pneumatic feed held supremacy for many years, and, in fact, is considered as the standard for non-rotating machines at the present time. Modifications of this pattern included hard-hitting stopers for solid-ground conditions, light-hitting stopers for soft ground, and feed cylinders of different diameters to provide a lighter or a stronger holding power against the rock.

Essentials of Successful Stoping Drills

All of the earlier types of stoping drills were rotated by hand. According to later demands from the field, the following conditions are essential to the design of a successful stoping drill: light weight and small size, to permit easy handling in high stopes; automatic rotation, to relieve the drill runner of the incessant labor of turning the drill bit by hand, particularly in hot stopes; satisfactory regulation of the strength of the feed; a water jet for laying the dust when drilling in sulphur-bearing ores, or other formations in which dust is injurious to the health of the miner; and automatic lubrication. These are the general outstanding characteristics, to which must be added, in the design of a successful stoper, the usual features of convenience as to handling, cutting speed, air-power economy, simplicity of construction, accessibility for repairs, staunchness, and ability to resist wear and hard service. The first four desiderata need not necessarily all be combined in the same machine, as they represent varying conditions called for by different fields. The last-mentioned features are essential to success in all satisfactory stoping drills.

New Features Adopted To Conform to Conditions

Drill designers have been studying conditions and developing new features with the object of producing stoping drills to meet more satisfactorily the varying factors of the field. That their efforts have met with success in the types recently introduced may be accepte as demonstrated from the encouraging reports receive as to performance and popularity with operators i many characteristic mining districts of the country.

Two new standard stopers are shown in an accompanying illustration. Fig. 1 illustrates the class DT-4 light-weight hand-rotation machine and Fig. 2 the clas DT-42 stoper, with automatic rotation and water a tachment, both made by the Sullivan Machinery Co.

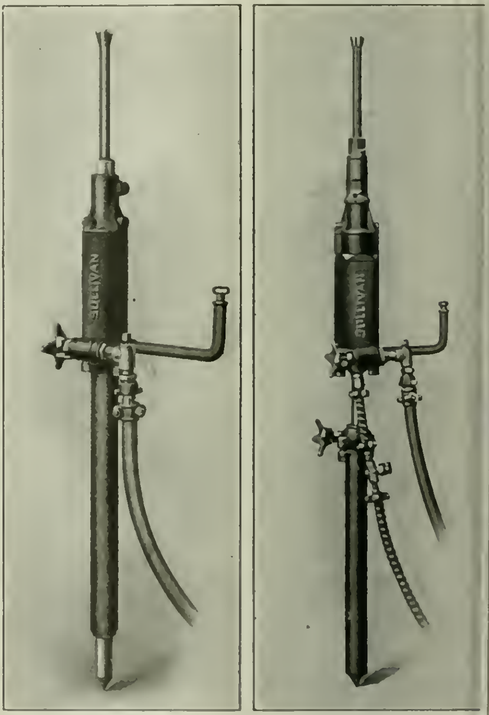


Fig. 1 Fig. 2

TYPES OF STANDARD STOPING DRILLS

Variety of Design To Meet Different Uses of Stopers

The ingenuity of the designers and the flexibility of the interchangeable part system permit the followin combinations and arrangements to meet different fie conditions: a light-weight stoper having hand rotatic and direct feed, using solid steel; a light-weight stope having hand rotation and direct feed, with water a achment, using hollow steel; a light-weight stoper having hand rotation, with reverse feed of either the dry or the water type, for use with solid or hollow steel; a rotating stoper with reverse feed, using solid steel and drilling dry; a rotating stoper with reverse feed, using hollow steel and provided with water attachment; a rotating stoper with direct feed, using solid steel and drilling dry, and a rotating stoper provided with direct feed and water attachment, and using hollow steel.

It is possible to obtain a stoper for practically all field onditions likely to be encountered. The design of the ight-weight stoper is such as to permit its use in the most confined stopes, and the light weight enables one man to carry it into narrow working places or up ladders with the least possible inconvenience and difficulty.

Control of Feed and Positive Rotation Essential in Successful Design of Self-Rotating Stoper

The self-rotating stoper is well suited for use in hot topes or in other parts of the mine where there is a emand for a labor-saving machine. Heretofore, selfotating stoping drills have not been of satisfactory deign. In this type it is desired to provide a compact, positive means of rotation and to furnish some pracical means of retarding the feed, so that in starting a ole or in fitchery ground the feed may be controlled, positively and immediately. The difficulty with preiously designed rotating stopers has been that, in these wo classes of work, the forward action of the feed, ombined with the rotation of the steel, would throw the it off the inclined surface of the rock, or into the seam r vug, causing a stuck steel or a crooked hole, with almost the certainty of loss of time and labor and freuent damage to the drill itself.

In the design of the rotating stoper an extension bar, orming an integral part of the piston proper, at the ront end of the drill, is milled with alternate straight nd spiral flutes or grooves, which engage a ratchet collar and a retaining bushing, the latter being screwed into the chuck bushing and transmitting the rotating movement to the drill steel on the return stroke of the iston. The piston delivers a free blow on the drill hank, the ratchet turning with it. It will be noted that the parts comprising the rotation are all at the ront end of the tool. There is no separate rifle bar. Experience with these new stopers has demonstrated that this form of rotation is substantial, positive, and reliable.

In their experiments with independent rotating motors mounted at the front end of the machine, the manfacturers found that the increased weight at this point aused the machine to be unwieldy, due to improper alance. The present standard arrangement, though it lengthens the machine,.permits the maintenance of good alance, which enables it to be handled with greater ase than would be possible if the extreme front end were overweighted by a bulky mass of metal. The second element in the new rotating stoper, namely, control of the feed, has been the result of much study nd experiment, and is provided in these machines by means of a hand retarder or brake.

Hand-Controlled Pressure-Reducing Valves Unsuccessful

Among earlier unsuccessful developments were pressure-reducing valves under hand control for varying the ressure of the air in the feed cylinder. These failed because of the unreliability of the valve, especially when wear had taken place, with resultant leakage; and because their control and operation are indefinite, as the operator has no means of knowing the extent to which the compressed air has been reduced in the feed cylinder. Feed cylinders of various sizes were also tested, but these, too, were unpopular, because a feed cylinder of any specified size is not sufficiently flexible to enable the operator to adapt the working pressure to varying ground conditions.

In the new machine the control is effected by means of a reverse feed cylinder and piston. A coil brake band controlled by a handle is situated at the front end of the feed cylinder, the band surrounding or gripping the feed piston in such a manner that the air pressure in the cylinder can be counteracted by a turn or two of the hand grip, which is within easy reach of the operator. In spotting a hole with the bit held against the rock by the air pressure, the feed can be so throttled as to make practically an immovable mounting. When the drill has cut a satisfactory collar for the hole, the brake is released gradually, until full feeding strength is secured. The same method is employed for cutting through a seam, loose or broken ground, or a fitcher. By tightening the brake, the rapidity of the feed is immediately reduced to the proper amount, so that the drill does not bury itself in soft ground, or drop out of line in crossing a vug or fitcher. This feature, as demonstrated in actual use in many parts of the country, gives complete adaptability for any ground conditions encountered, from soft broken material to hard, tough, solid rock.

One Throttle Controls Drill and Feed Cylinder

An important element in the success of the stoper provided with a brake is the method of throttle control. With the hose valve turned to its wide-open position, the control of the drill and feed cylinder is placed under the one throttle. Turning the throttle first admits air to the air tubes and oil pockets, and in the next position to the feed cylinder, which raises the drill to its work. Further turning of the valve causes the hammer to reciprocate slowly, and in the final full-open position the machine is operated at full speed and the feed cylinder receives full pressure.

Former Types of Water Sprayers Were Open to Criticism

The new water feature, which may be incorporated in either the light-weight stoper or the rotating stoper, solves the problem of laying the dust and cuttings in a satisfactory manner. First attempts to accomplish this object consisted of providing an outside water spray by means of which water was drawn from a bucket through a hose on the injection principle and discharged by air pressure at the side of the drill steel, against the face of the rock. This method necessitated constant refilling of the bucket and was an inconvenience to the operator in many ways. In addition, it was entirely unsatisfactory for drills rotated by hand, and was soon discarded. The next experiment consisted of a water inlet placed at the front or nose of the drill, which took water from a pressure tank or pipe line. The water was then discharged through the hollow drill steel, this action being assisted by the air pressure, which found its way into the drill steel from the front end of the cylinder.

There was considerable leakage, from the front end of the drill particularly, and the miner was likely to be thoroughly wet before the end of the shift. The object of the jet was accomplished in that it discharged the water against the back of the hole while the drill cuttings were being formed, and laid the dust at that point. The constant leakage of water, however, proved a serious objection. A machine of this type was described by an unsympathetic drill runner as resembling "a beautiful fountain playing in a park."

METHOD OF SPRAYING IN NEW TYPE OF STOPER

The form of water jet used in the DT-42 and DT-44 types consists of a water inlet to which a hose is attached from a pressure tank or supply pipe, under control of the same throttle which admits air to the drill and feed cylinder. Water is discharged through a central tube running well into the mouth of the drill steel. This water tube is surrounded by a jet of live air, taken from the back of the drill, which forms an effective seal against leakage at the chuck and also provides the additional pressure necessary to carry the water through the steel against the back of the hole where it is needed. The action of the combined water and air throttle tends to admit a small quantity of air to the tube or air-jet space first; as the throttle is turned to its next position, the water is introduced and brought to play in the drill hole, before the next turn of the throttle starts the piston moving with increasing rapidity. In stopping the machine, the process is reversed, so that, just before the air is finally shut off, a jet of live air blows through the steel, clearing out any water which may remain in it, and preventing this water from falling back into the chuck when the air is shut off.

A detail of design which adds to the drill runner's comfort consists in a deflecting flange or cap, which forms a part of the drill chuck. This shields downward-looking ports for the drill exhaust, so that dust or cuttings falling from the hole are not blown into the operator's face or against the upper part of his body. With the water stoper, these ports serve to carry off, without inconvenience to the runner, any sludge or water which may run down the steel from the hole and find its way into the chuck.

AUTOMATICALLY OPERATING OIL POCKET EFFECTS SUCCESSFUL LUBRICATION

With each stroke of the piston, a measured quantity of oil is drawn from a reservoir in the handle into the working parts of the drill. A supplementary oil pocket in the throttle valve casing is provided, which fills automatically with oil, when the machine is not in operation. On the opening of the throttle, the entrapped oil is blown into the air-inlet passages of the cylinder, after which the automatic lubrication goes into affect. In the automatic-rotation type, the rotating mechanism is lubricated by an independent oiler in the throttle valve, which blows oil into the ratchet chamber each time the drill starts to work. In addition, the chuck housing is furnished with a grease chamber, from which the rotation parts are lubricated.

The new stopers are both of the valveless pattern. The air-thrown piston is of the simplest possible design and the cylinder is of one diameter throughout. In this design, the effort has been made to overcome previous detriments to valveless drills, the high air consumption per unit of work done, and a rapid diminution of efficiency with increased wear. The Sullivan design embodies unusual simplicity in the number and shape of the working parts. The piston is equipped with ample bearing surface, to insure it against wear, and the design is such that, when wear does occur, with inevitable increase of air consumption, the drilling speed will not be materially affected, and the cushion, which is provided at both ends of the piston travel, is still retained in full effectiveness to protect the machine against undue jar and breakage.

The principal factors which determine drilling speed are force and frequency of blow. The relation of these two elements has been so balanced in this design that average ground and air-pressure conditions are met to the best advantage with regard to the shock to which the drill steel is subjected and the wear of the gage of the drill bit.

REPLACEMENT AND INTERCHANGEABILITY OF PARTS

Wearing parts of these machines have been made simple and easy to replace, should wear or breakage occur after long service. All parts are made on an interchangeable system and every part of the machine is constructed of drop-forged steels billets of special alloy metal, or from tool-steel bars, the wearing surfaces being thoroughly heat-treated by special processes which are the results of long experience in this branch of manufacture.

Classification and Compensation Of Engineers

Engineering Council has for some time been working upon the classification and compensation of engineers. It has organized a committee to investigate the matter, the membership of which is as follows: Arthur S. Tuttle, deputy chief engineer, Board of Estimate, New York City, chairman; Francis Lee Stuart, formerly chief enginer, Baltimore & Ohio R.R., and consulting engineer, U. S. Railroad Administration; John C. Hoyt, hydraulic engineer, U. S. Geological Survey; Charles Whiting Baker, consulting engineer, New York City, and M. O. Leighton, consulting engineer, Washington, D. C.

The work of the committee may be divided as follows:

1. Determination of the various classes of engineering positions.
2. Collecting data in regard to compensation now paid for each class.
3. Determining an equitable rate of compensation for each class.

Among the basic factors for determining compensation are:

1. Amount necessary to sustain the individual and his dependents properly.
2. The worth of the position occupied, as determined by the importance of the product.
3. The worth of the employee, as measured by hi qualifications and efficiency.

Tasmania's Mineral Production or 1918 has been officially reported by the Secretary for Mines as follow the items being arranged in order of descending value Blister copper, 5559 tons; tin ore, 2256: zinc, 3822; silver lead ore, 7241; osmiridium, 1607 oz.; gold, including gol contained in blister copper, 10,529 oz.; scheelite, 216 tons coal, 60,163; wolfram, 155; asbestos, 2854; iron pyrites 5106; copper and copper ore, 444; bismuth, 5; barytes, 217 ocher, 100 tons. The total value of the mineral product was £1,750,574, an increase over the preceding year o £166,284.

Exposition of Chemical Industries

The Fifth Annual National Exposition of Chemical Industries will be held this year in Chicago, at the Coliseum and First Regiment Armory, during the week of Sept. 22, and, as usual, a number of other meetings will be held at the same time. A program is in preparation which includes the general meetings of the American Electrochemical Society, of the American Institute of Mining and Metallurgical Engineers, and of the American Ceramic Society.

The Chicago Section of the American Chemical Society will have headquarters at the exposition, where it is probable that a meeting will be held. The Mining Institute is arranging to conduct a pyrometry symposium, which will consider several phases of the subject as follows: Methods of Pyrometry, Industrial Pyrometry, Pyrometry and Its Relation to Science. Special stress will also be laid upon the iron and steel industry by the Institute.

The management has made arrangements to engage the First Regiment Armory for exhibits and meetings of some of the societies. The armory faces the next parallel street, which is Michigan Boulevard and is divided from the Coliseum only by a narrow alleyway, across which visitors will step from exhibit to exhibit. The managers report that much of this space is already engaged. It is expected that there will be a larger number of exhibitors than at a similar period last year, and many new companies which have not formerly exhibited will take advantage of the exhibition to demonstrate and display their various products.

During exposition week, no other conventions will be held in Chicago except those invited by the exposition, and this fact should assure adequate hotel accommodations for the visitors who will go to the city. The office of the management of the exposition will be transferred on June 1 from New York to 417 South Dearborn St., Chicago.

Westinghouse Company To Establish Memorial Scholarships

As a suitable and appropriate war memorial to the more than 8000 employees of the Westinghouse Electric and Manufacturing Co. who entered the service of the Government in the Great War, the company has decided to establish a number of technical scholarships. Some of the details of the plan by which this will be done have been given out by E. M. Herr, the president, as follows:

Four war memorial scholarships will be established each year under the following general conditions: Candidates will be limited to sons of employees of the Westinghouse Electric and Manufacturing Co. and its subsidiaries who shall have been employees in good standing for a period of five years. Two of such annual scholarships may be open to the younger employees of the company or its subsidiaries who have been in their service for a period of at least two years and who do not exceed the age of twenty-three. The selection is to be determined by competitive examination to be conducted annually by the Educational Department under the direction of a committee.

Scholarships will entitle the successful candidate to pursue a four years' course in any technical school or college that he may select, with the approval of the committee. The scholar may pursue a course in any branch of engineering that he may select. Scholarships will be granted for one year only, but will be continued for the full four years, provided the scholar pursues a course in any branch of engineering that he may select. Each scholarship carries with it an annual payment of $500, to be made in two installments, and the number of new scholarships will be four each year.

It is the intention to continue these memorial scholarships from year to year, but the company reserves the right to recognize changing conditions and to modify the plan or to discontinue it entirely.

Manganese Mines in Ecuador

The manganese mines of Ecuador are near the town of San Antonio, Province of Pichincha, Ecuador, according to a consular report. They are owned by Dr. Alejandro Cardenas, of Quito, and are registered under the name "Belsaida." The claims cover an area of about 1⅓ square miles.

The principal deposit so far discovered consists of a blanket vein 3 to 9 ft. thick, and an extension of about 21,000 sq.ft., a portion being exposed. Samples from many other deposits in the vicinity, of undetermined extent, appear to be of similar quality. Work was begun at the principal deposit in February, 1918, with a limited force and in a primitive manner, about 5 tons being the daily output with 10 men working. The ore extracted was dried in the open air and bagged for export.

An assay made by F. Hunt, of New York, showed the following percentages: Manganese, 46.36; iron, 1.55; copper, 0.02; phosphorus, 0.14; silica, 6.44. Other samples showed 53.2% of manganese. Some have a higher percentage of silica, and still others show limestone. The small quantity of phosphorus should be noted. The mines are 7874 ft. above sea level. The climate is healthful; and the rainy season lasts from January to April, with a small rainfall. The district is wholly volcanic, partly covered with sand. The Guaillabamba River passes through a deep gorge near by.

No experienced miners are available, but the native workmen, of which the supply is sufficient, are easily managed, and learn readily under kindly direction. A 10-hour day is in effect. The foreman receives daily less than 50c.; laborers are paid 35c.; women, 30c.; and boys, 20c. The women and boys carry the ore from the mine to the drying place, and crush and sort the product.

Quito, the railway terminus, is 28 miles from the mine. The road is fairly passable to mule traffic, and could be fitted for wagons by constructing a small bridge. The supply of mules is sufficient—400 to 500 animals being available—and the present cost of transporting one mule load of 220 lb. is 68c., U. S. currency.

The railway rate from Quito to Guayaquil is about 1c. U. S. currency, a pound for ore in bags. No export duty is exacted. The lighterage and other port charges are $1.50, U. S. currency, per ton.

Zinc Production in Japan in 1917 amounted to 53,852 long tons, according to a note in *The Ironmonger*. The probable output of zinc during the first half of 1918 was about 10,983 long tons, this indicating a decrease which is probably due to the great reduction in imports of zinc ore from Australia and Tonkin during 1917, and to the decrease in the imports of old Chinese copper ("cash") which were exceptionally large in 1917 and yielded about 20% zinc when melted.

Company Reports

Anaconda Copper Mining Co.

The annual report of the Anaconda Copper Mining Co. for 1918 shows that the profit for the year, before charging depreciation of $6,104,185.43, amounted to $26,907,055.47. The profits of the last three months of the year were absorbed by the adjustment for inventory purposes to a cost basis of copper which had been reported in the September estimate as sold at 26c., the orders for which were subsequently canceled by the Government.

The mines of the company produced during the year 4,918,468.30 tons of ore and 6553.69 tons of precipitates, a total of 4,925,021.99 tons. During the year 1918, a total of 41.85 miles of development was done in the mines, in the form of drifts, crosscuts, raises, shafts, and winzes, as compared with 38.61 miles during 1917. Shafts were sunk additional depths aggregating 4991 ft. The results of development work were satisfactory.

The copper reduction works treated for all companies during the year, 4,959,580 tons of ore and other cupriferous material in Anaconda, and 57,000 tons of ore and other cupriferous material at Great Falls. Of this amount 4,350,446 tons of ore was produced by company mines, 618,256 tons of ore was either purchased from or treated for other companies, and 47,878 tons of precipitates and cleanings from the old works at Anaconda and Butte was treated. At Anaconda, 279,030,318 lb. copper, 10,001,604.81 oz. silver, and 59,403.116 oz. gold were produced. At Great Falls, 14,573,408 lb. copper, 966,300.31 oz. silver and 4914.506 oz. gold were produced.

The electrolytic copper refinery at Great Falls produced, during the year, 191,404,125 lb. of cathodes, 189,067,167 lb. of which was melted into shapes at Great Falls. The copper-leaching plant at Anaconda treated during the year 500,688 tons of tailings and 64,978 tons of copper ore, from which there was produced 6662 tons of cement copper.

The zinc plants at Anaconda and Great Falls treated during the year 393,193 tons of ore and other zinkiferous material, of which amount 255,057 tons of ore was produced by mines of the company, and 138,136 tons of ore and concentrates were purchased from other companies. At Great Falls, during the year, 72,131,238 lb, of electrolytic zinc was produced. The electrolytic-zinc plant operated continuously throughout the year, with excellent results, as every effort was made to secure as great an output as possible, in order to meet the requirements of the Government. The zinc produced, on account of its purity, was used largely in munition work.

In South America, at the property of the Andes Copper Mining Co., additional churn drilling was done, aggregating 11,800 ft., by which approximately 5,000,000 tons of ore was added to the reserves. Drifts and raises amounting to 2990 ft. were driven, exploring different sections of the mine. In connection with the water supply, 295 ft. of tunnels was driven, and 15 miles of wagon road, over which supplies for pipe lines will be transported, was completed. Living quarters of the employees will be situated at the mill site.

Shattuck Arizona Copper Co.

The Shattuck Arizona Copper Co. reports for the quarter ended Mar. 31, 1919, that it was necessary to suspend mining operations Feb. 22, 1919, because of a fire which started between the 700- and 800-ft. levels in the oldest workings of the mine, known as No. 1 stope. The ores produced from this section were massive sulphide of iron and copper from which most of the commercial copper ores had been extracted. Part of the section was filled with low-grade pyritic material and the territory had been abandoned. The only openings remaining here were air courses kept open to ventilate the filled section, which has been developing considerable heat during the past two years.

Fire gases were noticed coming from the old air courses on Feb. 14, and attempts were made, without success, to reach the burning sections and extinguish the fire by water sprays. On Feb. 22 the volume of gas and sulphur smoke pouring out of the shaft was so great that it was no longer safe to attempt mining operations, especially because the workmen on all levels of the mine above the 700 were being made sick by gases which penetrated all the upper levels. The men were returned to the surface safely, and trained helmet crews were put to work bulkheading off the fire area, and preparations made to flood the mine between the 700- and 900-ft. levels. Flooding operations started on Feb. 23, and it is estimated that 18,000,000 gal. of water will be required to fill openings, not allowing for seepage. Water amounting to 350,000 gal. per day has been pumped into the mine. On Mar. 31 the water reached a level 50 ft. above the 800 level, and it is gaining approximately 1 ft. per day. All the available water in the district is being used, and results of the flooding operations to date can be considered satisfactory. Sulphur gases are no longer noticeable, but considerable wood gas continues to be noticeable from the burning section. Mining operations will be resumed when the workings are made safe for the company's employees.

The production for the first quarter of 1919 is as follows: Copper recovered, 1,000,844 lb.; gold recovered, 160 oz.; silver recovered, 44,129 oz.; lead recovered, 678,914 lb. The loss on operations, exclusive of depletion, amounted to $163,988.30.

Nevada Consolidated Copper Co.

The quarterly report of the Nevada Consolidated Copper Co. for January to March, 1919, shows that the production of copper was 12,201,444 lb., as compared with 19,020,773 lb. for the preceding quarterly period.

During the quarter 529,692 dry tons of Nevada Consolidated ore, averaging 1.79% copper, was milled. Of the tonnage milled, 65% was supplied from the pit and 35% from the underground workings of the Ruth mine. In addition to the treatment of company ores, 8105 tons of customs ore was concentrated, and the resulting concentrates, together with 12,198 tons of customs ore and concentrates, were smelted at the Steptoe plant during the quarter. The cost of production per lb. of copper was 16.85c. Miscellaneous earnings, including the value of gold and silver recovered, amounted for the quarter to 2.34c. per lb. of copper. When it is realized how seriously Government regulation affected the cost of production, the results obtained during the first quarterly period following release from Federal restrictions may be considered encouraging in their indication that many of the conditions responsible for high costs can be further, although gradually, remedied.

The operating loss amounted to $192,613.67; miscellaneous income was $81,454.55, distributions to stockholders were $749,796.38, and net deficit was $860,955.50.

The company has on hand sufficient refined copper to meet immediate demands, and will not increase production until such time as a revival in the trade and return of normal industrial conditions justify that course.

Magma Copper Co.

The Magma Copper Co. of Superior, Ariz., reports net earnings for the year 1918, disregarding depletion, at $519,350. The net cost of producing copper, not including depletion, but including depreciation and all other charges and deducting the revenue from the gold and silver, was 16.425c. per lb. The average price received for about 60% of the production was 25.05c. per lb. The remainder of the production, about 40%, is carried at 15c. per lb. For the preceding year the cost and selling prices were 16.01c. and 26.423c. per lb., respectively. Net production for the year, after deducting all smelting and refining losses, was 10,968,556 lb. copper, 463,503 oz. silver, and 5699.4 oz. gold.

During 1918, 90,321 tons of ore was mined, of which 7.04% came from development and 92.96% from stopes. The cumulative tonnage of all classes of ores since the beginning of operations up to the end of the year is 382,680. The ore reserves are estimated as 235,000 tons (copper, 5.7%; silver, 4.2 oz.; gold, 0.02 oz. per on) reasonably assured copper-sulphide ore and 20,000 ons (zinc, 13.5%; lead, 2%: silver, 12 oz. per ton) f reasonably assured lead-zinc ore. At the mill, 74,441 ons of ore was treated (mill heads were copper, 4.496%; lver, 3.803 oz., and gold, 0.05 oz. per ton), and 29,588 ns concentrates was produced (copper, 10.78%; silver, 41 oz., and gold, 0.1379 oz. per ton); a recovery of .33% of the copper in the mill heads. The development ring the year totaled 11,122 feet.

Ray Consolidated Copper Co.

The quarterly report of the Ray Consolidated Copper shows that the gross production of copper contained concentrates for the first three months of 1919 was 01,149 lb. In addition, a total of 180,348 lb. of c per was contained in the ores sent direct to the s ltery, making the total gross production from both s ces for the quarter 12,471,729 lb. During the quart 440,200 dry tons was milled, averaging 1.793% copp The mill extraction for the quarter was 77.88% o he total copper contained in concentrating ores.

he milling cost for the quarter was $1.19 per ton, as co pared with $0.95 for the previous quarter, exclusive of ederal income and excess-profits tax. The average mi ng cost of ore milled for the quarter was $1.70 per tor of which 5.97c. was the cost of coarse crushing, lea ng the net mining cost $1.64 per ton, as compared with $1.80 for the previous quarter, both exclusive of income and excess-profits taxes.

Operating deficit amounted to $244,667.21, miscellaneous income, $92,369.16, and disbursement to stockholders, $788,589.50. The net deficit for the quarter was $940,887.55.

Total dividend distributions from the beginning of the company's operation to the end of the first quarter of 1919 have amounted to $21,469,673.17.

Tonopah Extension Mining Co.

The annual report of the Tonopah Extension Mining Co., for the year ended Mar. 31, 1919, shows that 114,921 tons of ore was mined and milled, which carried an average of 12.818 oz. silver and 0.121 oz. gold per ton. The recovery is given as 93.05%, and the total costs were reported as $8.488 per ton. The increase in the cost of milling is attributed largely to the inferior quality of iron, steel, and pebbles used, together with the increased cost of these materials.

A total of 10,322 ft. of development work was done during the year. The nature of the orebodies is said to preclude accurate measurement of ore in sight, and no definite figures are given. Dividends were distributed amounting to $192,406.83, representing 15% on each full share of stock outstanding.

Amparo Mining Co.

The Amparo Mining Co. report for the year ended Dec. 31, 1918, states that the results of the year have been better than were expected. The amount of ore mined and treated at the mill amounted to 120,046 tons. Costs show a reduction from $9.93 a ton to $8.60 a ton, as compared with 1917. The theoretical extraction of gold and silver amounted to 89.3%, but no actual recovery figures are given. In addition to gold and silver bullion, the products from the mine were concentrates, slag, and short zinc.

Development in the mine has been so satisfactory that the tonnage of milling ore in sight shows a decided increase over that of last year. The settling of slime has been a serious problem, and new vats are now being installed. A new tube mill is also being erected.

Dividends paid during the year amounted to $300,000.

Wallaroo & Moonta Mining and Smelting Co., Ltd.

The Wallaroo & Moonta Mining and Smelting Co., Ltd., according to the annual report for the year ended Dec. 31, 1918, earned a profit for the year of £69,907 2s. 1d. after providing for royalty on mineral leases (£1636 5s.) and state income tax for 1917-1918 (£9844 0s. 7d.). Dividends paid amounted to £80,000.

The total ore produced from the Wallaroo mines was 54,501 tons, containing 8.91% copper. The Moonta mines produced 8782 tons, containing 14.73% copper. The cementation plant at the Moonta mines produced 790 tons of precipitate, containing 555 tons of copper. The Wallaroo smelting works treated during the past year 68,199 tons of ore, precipitate, and blister. The following metals were produced: 9390 tons of refined copper, 1454 tons of electrolytic copper, 2992 oz. fine gold, and 1608 oz. silver, 996 fine. The production of sulphuric acid was 6745 tons.

Mason Valley Mines Co.

During 1918, the refined-copper production of the Mason Valley Mines Co. was 15,475,851 lb., including metal obtained from outside sources, 88% of which was produced by the Bluestone Mining and Smelting Co. and the Nevada-Douglas Consolidated Copper Co. Two furnaces were in blast until Apr. 27, 1918, at which time one was shut down, and on Feb. 28, 1919, the other was closed. During 1918 a total of 336,943 tons, of which 118,251 tons was mined from company properties and those held under option, was smelted.

Development work at claims was as follows: At the Mason Valley group, 3296 ft. of raises, drifts, and crosscuts; Majuba Hill, 750 ft. of drifts, crosscuts, raises, and winzes, and an advance of 1900 ft. in No. 3 tunnel; and a total of 2793 ft. of drifts, raises, winzes, and crosscuts at the Gray Eagle group. Net profit for the year, after deducting interest, taxes, exploration charges, and depreciation, was $174,261.93.

Old Dominion Co.

The Old Dominion Co. in 1918 produced 72,588 tons of smelting ore, 153,166 tons of concentrating ore, and 4697 tons of converting ore, having an average content of 4.52% copper. Total metal production for the year, including that obtained from custom ores, was: Copper, 33,378.158 lb.; silver, 184,982 oz.; and gold, 5071 oz. Total development work done was 22,163 ft., distributed as follows: Sinking, 256 ft.; drifting, 10,477 ft.; raising, 5589 ft., and intermediate work, 5841 ft.

In the concentrating department, 226,998 tons, which includes custom ore handled, of an average grade of 3.90% copper, was milled, compared with 199,575 tons, of 3.78% copper, in 1917. There was smelted 165,028 tons in 1918, compared with 198,548 tons in 1917. Income from sales of metal was $5,731,082.29, and total expense, including mining, treatment, refinement, plant depreciation, administrative expenses, and taxes, was $5,125,125.19. Deducting a provision of $304,195.32 for depletion of mines, the net income for 1918 was $301,761.78. Four dividends of $297,071 each were paid.

Mining Corporation of Canada, Ltd.

For the year ended Dec. 31, 1918, the Mining Corporation of Canada, Ltd., according to the company's annual report, produced 1,708,252.41 oz. of silver. In the preceding annual report, the ore reserves at the end of 1917 were stated to contain 1,545,370 oz. The production during 1918 was therefore considerably more than the estimated reserves. The tailing-treatment plant is now in successful operation, and the quantity of silver remaining in the tailing beds must be taken into consideration.

The price realized during 1918 for silver averaged 110.11c. per oz., as against an average of 88.09c. for 1917. The net profits for the year, after writing off the proper amounts for depreciation and special expenditure, were $925,760.38; and after payment of the four quarterly dividends there is to the credit of profit and loss account $3,025,347.45.

The total amount of exploration and development work carried out in 1918 amounted to 6540 ft., as compared with 8491 ft. for 1917. The total tonnage treated was 60,114, the total ounces recovered being 1,708,252.41, of which 245,895.34 oz. was from high-grade ore.

New Idria Quicksilver Mining Co.

The annual report of the New Idria Quicksilver Mining Co. for the year 1918 shows that the production of quicksilver amounted to 10,700 flasks, as compared with 11,000 flasks for the previous year. Operations were conducted under difficult and abnormal conditions, on account of the war, scarcity of labor, and scarcity and high cost of supplies. A large amount of construction work was, however, done. Five rotary-kiln furnaces have been installed, one of which, begun in 1917, was fired in April, 1918, and was operated continuously for the rest of the year. Two of the others were nearly completed and ready for operation at the end of the year, and the remaining two have been recently completed. These furnaces will have a total roasting capacity of from 400 to 500 tons per day.

About 40% of the company's total production was supplied to the Government on direct contract, and additional quantities were furnished for the uses of the Government and its allies on specific orders during the year. By agreement with the War Industries Board, the price on Government requisitions was made $105 per flask. The average price in the open market for the year was about $125 per flask.

During the year the company was notified by the War Industries Board that Government requirements of the year 1919 would be largely in excess of 1918, and construction work was therefore carried on with all possible dispatch in order to be in position to fulfill these requirements. The ending of the war, however, caused a radical change in the situation, and in October the Government advised that requirements for 1919 would be smaller than for the last year. The construction work then under way was so far advanced, however, that it was deemed expedient to complete it. Net proceeds from the sales of quicksilver during the year amounted to $1,311,393.81; operating expense, depreciation, and depletion totaled $1,101,204.96; and the operating profit, subject to reserve for Federal taxes, was $167,540.46.

Arizona Commercial Mining Co.

The operations of the Arizona Commercial Mining Co., at Globe, Ariz., for the year 1918 consisted in additional development measuring 6729 ft., as compared to 3545 ft. in 1917. The tonnages and grade of ore extracted during the year are given in the table:

	1918		1917	
	Dry Tons	Per Cent. Cu	Dry Tons	Per Cent Cu
Smelting ore	11,712	10.268	12,686	9.640
Concentrating ore	51,052	4.863	27,015	4.521
Secondary smeltery products	18	17.760	.....	.
Lease ore	13	5.620	.....	
Totals	62 796	5.874	39,702	6.153

The production from the 62,796.9 tons of ore was 6,076,303 lb. copper, 15,980.7 oz. silver, and 830.62 oz. gold. The income before providing for depletion is given as $270,158, and, after deducting the depletion, $156,912, the net income is $113,246.

Quarterly Report Chief Consolidated.—The report for the first quarter of 1919 of the Chief Consolidated Mining Co. of Arizona, operating the Chief Consolidated mine and the Plutus Mining Co., at Eureka, Utah, gives a total new development footage of 5070 ft., and shipment of 15,170 tons, which yielded over smelting, transportation, and sampling charges, $413,261. The net profit for the quarter, after payment of all charges, was $125,304.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Claims Exceed Available Funds

With the statutory limitation of the time for filing claims approaching, the War-Minerals Relief Commission is being almost swamped by the inrush of late claims. The aggregate of the amount asked by the claimants may exceed $10,000,000, or $1,500,000 in excess of the entire amount allowed by Congress to settle the claims and pay the expenses of the commission. At the close of business on June 2, after which no further claims will be received, it is believed that there will be no less than 1200 claims on the docket of the commission.

The larger claims received during the week ended May 21 were filed by the following: F. H. Nett, San Bernardino, Calif.; Eagle Mine, Denver; Markstein-Dorn, Atlanta; M. A. Delano, Palo Alto, Calif.; Robert Brown, San Francisco; Tres Amigos Co., Los Angeles; G. C. Grimmett, Kerby, Ore.; Joseph Migliore, New York; Henry Lockhart, New York; S. J. Gish, Central City, Ky.; Bill-Jim Mineral Co., Holdenville, Okla.; S. H. Dolbear, San Francisco; Down Town Mines Co., Leadville, Colo.; U. S. Manganese Mining Co., Hollywood, Calif.; J. G. Murphy, Guadalajara, Mexico; R. B. Miller, Bluefields, W. Va.; H. W. Smith, Santa Fé, N. M.; A. L. Wakeham, Oroville, California.

Mineral Resources of Western Talkeetna Mountains, in Alaska

Increased interest is being shown in the mineral resources of the western Talkeetna Mountains, in Alaska, which may now become available through the building of the Government railway in that region. Discussing the general geology of the district, Stephen R. Capps, of the U. S. Geological Survey, says:

"The striking feature that at once becomes apparent on inspection of the geologic map of the western Talkeetna Mountains is the great predominance of igneous materials over sedimentary rocks. Great areas of deep-seated granite intrusives, older deformed lava flows, and little-disturbed Tertiary lavas occupy almost all the region, in which the hard rocks are exposed, and the granitic rocks and older lavas doubtless extend westward beneath the mantle of unconsolidated materials. Except for a narrow and interrupted belt of sediments that crosses the basins of Sheep River and Iron Creek, and a few isolated outliers of this group of sediments, with some materials of sedimentary origin intimately intruded by granite rocks in the area between lower Sheep River and Iron Creek, the entire western Talkeetna Mountains are composed of igneous materials.

"Most of the orebodies are due to the replacement, along zones of faulting and shearing, of andesite-greenstone by metallic minerals, but one or two have some of the aspects of contact-metamorphic deposits, though they lie at some distance from the contact of the diorite and greenstone. So far as is known, the free-gold content of the ores is not sufficient to justify the installation of crushing and amalgamating machinery. The base character of the ore will necessitate smelting for the recovery of the copper and gold. The ores contain large amounts of metallic minerals, in addition to those which carry the copper and gold, so that concentration, to reduce the weight and bulk of the ores shipped, is likely to offer difficulties. The imperative need is cheap transportation, and that can be obtained for this camp only by the construction of a branch line of the Government railroad."

U. S. Mineral Resources

A preliminary report on the mineral resources of the United States for the calendar year 1918 will be issued by the Geological Survey about July 1. The report will include general tables for all mineral products, showing production, imports, and exports of the year 1917 and 1918, and will contain, for each of the principal mineral commodities, separate tables showing production, imports, and exports from 1913 to 1918. This report will not supplant any of the regular reports of the Survey.

Most of the statistics of mineral production compiled by the Geological Survey have been made public in the form of press bulletins or of separate reports dealing with individual commodities. These are issued long in advance of the appearance of the final two-volume work on mineral resources of the United States. It is believed that the assembling, in addition, of statistics for all mineral commodities in a single small pamphlet, to be issued within six months after the close of the year to which the statistics relate, will be of considerable utility and convenience to the mineral industry.

Decrease in Mine Accidents

The notable decrease in the number of fatalities in mines in the United States thus far this year leads to the hope that a new record will be established in the prevention of accidents in mining operations. It is realized by the statisticians in charge of the work that a much smaller amount of material is now being produced by the mines, but, even taking this factor into consideration, accidents are not occurring as frequently as in previous years. Some are of the opinion that the greatly decreased number of non-English speaking workmen now engaged in American mines is one of the potent causes of decreased accidents. Indirect causes of accidents, as a rule, are not taken into account in the average compilation of accident figures, but many contend that the ignorance of new workmen, especially when they are foreigners without mining experience and with no knoweldge of English, is a more potent factor in causing accidents than is generally supposed.

For the last four years, immigration has been cut off. As a result, even the ignorant foreign miners of four years ago now have a working knowledge of English and have become fairly accustomed to their duties. Under normal conditions, a considerable portion of mine labor is recruited from Croatians, Montenegrins, Italians, Russians, Poles, and Slovenians. Figures show that only a small percentage of those applying for work in mines ever have had experience in that class of work. Most of them were farmers in their native lands.

Bureau of Mines Oil-Conservation Investigation

A study by the Bureau of Mines of means to prevent waste of oil and gas in the Wyoming field has been made possible by voluntary contributions from the Midwestern Refining Co. and the Ohio Oil Co. The former company contributed $20,000 for the work, and the Ohio company $10,000. The investigations will be entirely under the direction of the Bureau of Mines. In making the appropriation, the donors referred to it as "industrial appreciation for the valuable work already done by the Bureau of Mines."

National Museum's War Work

During the Great War the National Museum's department of geology was called upon frequently for materials for experimental work in connection with the activities by the Bureau of Standards, the Naval Experiment Station, the Department of Agriculture, the Geological Survey, the Carnegie Institution, and various arsenals. One call from the Bureau of Standards was for 27 varieties of minerals, many of which were rare. The head curator of geology at the request of the National Research Council took over the entire work of securing optical quartz for the needs of the United States and Great Britain. The division of mineral technology, in addition to furnishing a large amount of special data to the Army and Navy and a number of Government boards, published several pamphlets on the fertilizer. fuel, sulphur, and power situations, of particular value to the Government bureaus handling these products.

Germany's Chemical Trade in The United States

America's dependence upon Germany's chemical industries before the war is pointed out in great detail in a census of chemical imports issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, with the coöperation of the American Chemical Society. The purpose of the bulletin is to show to American manufacturers the extent of the domestic markets for the various chemical lines that are now being manufactured in this country, but which had not previously been produced here.

It is shown that nearly $45,000,000 worth of manufactured chemicals were imported into this country in 1914, not counting dyes, which the Bureau has covered in a previous bulletin. Of this total more than 40% came from Germany, which was the chief source of supply. These German chemical products included a great many that could not be obtained from other countries, because they were patented or because the secret of their successful manufacture was not known in other countries. Some of them, especially the medicinal preparations, were of prime importance, although expressed in monetary terms the imports do not seem impressive.

A great obstacle in the way of getting the manufacture of these formerly imported articles started in this country has been the fact that no one knew to what extent there was a market for them, and it was to supply this detailed information that the Bureau of Foreign and Domestic Commerce and the American Chemical Society undertook the compilation of a report on this subject. Firms which are obtaining German patents from the Chemical Foundation, recently organized under the direction of the Alien Property Custodian, expect to find in the statistics the facts they need to plan their operations intelligently.

In addition to being the chief source of imports of dyes and other coal-tar products, acids, fertilizers, and a long list of other chemicals, Germany normally supplied this country with large quantities of allied products, such as paints, pigments, and varnishes, all of which are shown in detail in the report. Imports by quantity and value of 2500 products are included, and there is a list of 3000 other products imported in amounts less than $100 each. For most of these products, the import statistics are now printed for the first time.

The title of the bulletin is "Chemical and Allied Products Used in the United States," Miscellaneous Series No. 82. Copies can be purchased at 25c. each from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the district and coöperative offices of the Bureau of Foreign and Domestic Commerce.

Only 8% of the officers discharged from the Army up to May 3 have requested assistance in the obtaining of employment. The total number asking aid was 8309, of which 835 were technical engineers, 143 were chemists and metallurgists, and 15 were miners.

A law of Jan. 14, 1919, provides that the new use of natural products in Uruguay, or the first form of their industrial utilization, shall confer upon the discoverer the right of exclusive exploitation for the time and under the conditions fixed by the law of Nov. 13, 1885, regulating patent privileges, says a consular report.

The foreign-trade situation with regard to several mineral commodities is to be considered by the interdepartmental committee which has been created at the instance of the State Department. The committee already has gone exhaustively into the coal and the petroleum situations and has considered potash at one meeting. Nitrates, tungsten, chromite, manganese, magnesite, and zirconium will be taken up in the near future, it is expected.

Lectures on geological subjects have been delivered recently before the West Point post-graduate classes now at Camp Humphreys by George Otis Smith, P. S. Smith, W. C. Alden, and O. B. Meinzer, all of the Geological Survey. The West Point men, who were graduated after having completed three years of the course, as a result of the war, now are rounding out their work at Camp Humphreys. A series of lectures on mining engineering is to be given in the near future by members of the staff of the Bureau of Mines.

General Goethals Honored by Engineers

In recognition of his distinction in the engineering profession and as the builder of the Panama Canal, Maj. Gen. George W. Goethals has been awarded the John Fritz Medal. Presentation of the gold medal, with an engraved certificate stating the origin of the medal and the specific distinction, was made by Ambrose Swasey, past president of the American Society of Mechanical Engineers, in the presence of a large and appreciative assemblage of engineers and guests in the auditorium of the Engineering Societies Building, 29 West 39th St., New York City, on Thursday evening, May 22.

Addresses were made also by Henry L. Stimson, former Secretary of War, and W. L. Saunders, past president American Institute of Mining and Metallurgical Engineers, testifying to the perseverance, skill, singleness of purpose, and devotion to duty by which General Goethals has brought to a successful completion one of the greatest works of the ages and placed him on the list of men whose engineering achievements are known the world over.

Mr. Swasey in his address said General Goethals had gone to war with the elements when his country was at peace, and had truly represented himself in the ten years' fight on the canal job as a soldier, an engineer, and a man.

In responding, the General said several other men came to his mind in accepting the medallion, chief among them being the late Colonel Roosevelt, whose courage and steadfastness as the chief executive of the nation made the canal possible. General Goethals recalled how the medical men of the army conquered the yellow-fever scourge only after several of the best among them died and others were left permanent cripples for their sacrifices, which he compared to any that had occurred in the world war. In concluding he paid a tribute to the 50,000 American workmen who did their part, imbued solely with the idea that their efforts meant the future glorification of the country's greatness.

The John Fritz Medal was established in 1902 in honor of John Fritz, of Bethlehem, Penn. The medal is of gold, is awarded not oftener than once a year, and is accompanied with the engraved certificate. This certificate states the origin of the medal, the specific achievement for which the award is made, and bears the names of the members of the board by which the medal was awarded and the signatures of the president and secretary of the board. The board of awards is formed of sixteen men, four representatives from each of the four national societies of civil, mining, mechanical and electrical engineers. The first award of the medal was made to John Fritz at a dinner given to him on his 80th birthday, Aug. 21, 1902. Among those who have received the medal in past years are George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter and Prof. John E. Sweet.

Michigan Copper Sales and Production

HOUGHTON CORRESPONDENCE

Michigan copper mines now are selling metal at 50% of normal. Sales made recently by the producing interests of the Lake Superior copper district are at the rate of 10,000,000 lb. of copper for the month of May. This is the first time in six months that the metal sales of the Michigan mines have come up to the total of production. Production is lower than ever before, but June output will be lower than that of May.

A decidedly more cheerful attitude is observed among the larger producing interests of the district relative to the future. Though there has been no diminution in the total amount of copper on hand in the district, and though the total is larger than ever before in the history of the industry, the fact that the shipments on bona-fide sales are large enough to take the present output is a favorable feature.

Two important factors are believed to indicate a gradual betterment in the copper-metal situation, from the point of view of Michigan producers. One is the fact that the general market now is absorbing half the normal output of the mines, and that this business is entirely domestic, indicating a general improvement in construction work that calls for copper in the United States. Though it is well known that the mines cannot expect to go back to full-time production until the foreign demand makes itself felt in the market, the knowledge that much of the domestic buying is for copper wire is considered a good sign.

None of the Calumet & Hecla group of mines will show any increase in output. As a matter of fact, 50% figures will be achieved in May and production may go below that in June. One important source of copper production was cut off by the Calumet & Hecla in the week of May 22 when the dredge that furnished the sand from the sand pile in Torch Lake went into drydock. This shuts off 850,000 lb. a month. The dredge is in dock for repairs. It has operated continuously for five years. The plan to make extensive repairs was made more than a year ago, when the drydock was built at Point Mills, five miles from the scene of the dredge operations in Torch Lake. The big dredge was towed through Torch Lake and the canal into Big Portage to the specially constructed drydock.

The exodus of workmen from the district practically has ended. No more men are being laid off by the Calumet & Hecla, nor by that company's subsidiaries. The Quincy, Mohawk, Wolverine, and all three Copper Range mines, Baltic, Trimountain, and Champion, are working full time and with full crews. Their copper output is not normal, but it has not been normal for more than a year. Quincy will show an increase in May over April, and there is no effort to decrease production at Mohawk, which is now making the best record of the mine's career. A comparatively limited number of the miners who were let out by the Calumet & Hecla and subsidiaries went to work at other mines in the district.

Manganese and Silver in the Philipsburg, Montana, District

BUTTE CORRESPONDENCE

During the war the Philipsburg district came into considerable prominence through its production of manganese for use in steel manufacture, though it is now principally a silver producer. Thirty years or more ago the Philipsburg district was rich in silver, but when the price of the metal declined the district lost heavily in population and finally became a mere village. It remained in that position until this country entered the war and the Government called for the production of manganese. Then many mining men opened up abandoned properties, and after building modern plants the manganese was shipped East in large quantities. As soon as the production of manganese became unnecessary, a number of the mining men started to explore for silver, and some have been successful. When the boom in silver started, what is known as the Scratch Awl shaft was reopened. In a short crosscut a rich body of silver ore was found, and in a short time this body of ore was extended along the drift for a distance of 150 ft. The first carload was brought to the Washoe smeltery and showed high silver content. The Scratch Awl ground is a narrow strip about 1000 ft. long and is entirely surrounded by claims of the Granite Bi-Metallic Co. The new orebody is said to be exactly in the middle of the Scratch Awl ground, with well-defined walls and a fine line, so that the chances of litigation appear remote. The ore in large part is native silver. Several other properties are being opened up, and the Bi-Metallic is engaged in sinking two shafts to a depth of 1000 ft. each.

March Exports of Mining Machinery

The exports of mining machinery from the United States during March, 1919, according to the Department of Commerce, were as follows:

Countries	Oil-Well Machinery	All Other Mining Machinery
France	....	$70,770
Norway	....	19,503
Spain	....	13,687
Sweden	$556	....
England	....	57,627
Scotland	....	40
Canada	7,300	110,109
Costa Rica	....	135
Honduras	....	2,661
Nicaragua	....	3,768
Panama	32,835	....
Salvador	....	1,574
Mexico	36,811	94,035
Newfoundland and Labrador	....	198
Cuba	17,730	14,421
Argentina	19,828	500
Bolivia	....	59,935
Brazil	478	8,434
Chile		63,536
Colombia	270	7,634
British Guiana	1,083	....
French Guiana		1,306
Peru	1,092	29,289
Venezuela	3,453	6,547
Aden	45	....
Chosen		17,087
British India	26,878	13,928
Straits Settlements	....	346
Dutch East Indies	181,896	78,731
French East Indies		4,233
Hongkong		540
Japan	32,320	44,833
Russia in Asia		4,355
Australia	1,040	14,839
Philippine Islands	48,615	3,811
Belgian Kongo		117,101
British West Africa		3,556
British South Africa		78,829
Madagascar	2,359	
Totals	$414,589	$947,898

During February, 1919, the value of oil-well machinery exported totaled $398,041 and that of all other mining machinery was $1,070,717. March, 1918, exports were valued at $123,572 and $1,286,616, respectively.

U. S. Patent Office Society

Employees of the U. S. Patent Office have organized, under the name of the Patent Office Society, for the purpose of advocating certain reforms in the administrative branches of the department, which, it is claimed, will bring about a higher efficiency in the system. Committees on legislation and publicity have been appointed with a view to educating the public to the necessity for an immediate improvement of the present Patent Office system and to further Congressional enactment to broaden the scope of the department. The plan includes the separation of the Patent Office from the Department of the Interior and provides for an executive officer who shall be an industrial and efficiency expert.

Labor Conditions in Utah Mines

SALT LAKE CITY CORRESPONDENCE

The possibility of a strike in the Tintic district appears to be at an end. At a meeting held in Eureka, at which 1200 persons, miners and citizens of Eureka, were present, it was decided to put off indefinitely the taking of a "strike vote." Conditions are normal at this camp. At Park City the strike is still on, although a few men, chiefly Ontario Silver employees, have returned to work. The pumps at this property have been working throughout the period of strike, manned by old employees. It is expected that more men will follow the example of the Ontario Silver employees and return to their work.

Utah mine operators last March undertook an investigation into the cost of mine supplies and necessaries of life in this section, which are as high as they were last July, and in some cases higher. The continuance of high prices, with copper and lead at the present low level, makes an extremely precarious situation. In the effort to investigate causes and reduce the cost of supplies to themselves and the cost of living to their employees, a number of operators have circularized Salt Lake business men and dealers in the mining camps, inviting coöperation in finding a solution of the problem and forecasting a closing of the mines unless conditions improve. A blank is enclosed in the letter giving a list of commodities—flour, rice, sugar, butter, peas, string beans, tomatoes, eggs, ham, bacon, pork and beans, and other foodstuffs, asking for information regarding prices paid in 1915, 1918, and 1919. The letter reads in part:

"We have been unable to ascertain that those who furnish supplies and the necessaries of life to our employees are making efforts to reduce the cost of these commodities. Unless action along this line is taken at once, and substantial reductions are made, many more mining properties will close down in the near future. This would cause great distress to our men and their families and injury to the commercial and manufacturing industries of the state, as well as to the mining industry. We have determined to act in the matter ourselves rather than to remain acquiescent and see our own business crippled, with consequent bad effect on the state as a whole. Our preliminary inquiries disclose that the costs of supplies in Salt Lake and the mining camps are as high as they were last July. We purpose extending our inquiries as far as possible and taking such action as will serve our welfare and that of our employees. Your coöperation is invited to solve a situation, which if not corrected in the immediate future, will seriously injure our business as well as yours."

Those signing the letter are: Imer Pett, general manager Bingham Mines Co. and Eagle & Blue Bell Mining Co., chairman; C. E. Allen, manager of mines, U. S. Smelting Co.; C. F. Jennings, assistant purchasing agent, Utah Copper Co.; F. J. Wescott, secretary Silver King Coalition Mines Co., and J. B. Whitehill, purchasing agent, International Smelting Company.

Editorials

The Odds That Favor

THERE'S an old chairman of the board of an important bank in New York who is said to have graduated more bank presidents from among his clerks than any other man in America. One of his requirements (or preferences that are so strong as to amount almost to requirements) is that he does not want city boys. He wants young men who have been raised in the country, preferably on a farm, and he insists upon taking them when they are reasonably young. He is not particularly interested as to whether they have been through college or not. His point is that if they have grown up in the country they have developed mental resources to meet conditions as they arise—they do not need the flare of lights and the blare of bands for their leisure. In short, he wants young men who can sit down and think during their hours of ease, with a view to doing better for the bank, and thus better for themselves. He may be prejudiced about the evils of city life, but usually he cuts off the argument with the statement that "city boys know too much." Like all good bankers, he objects to clerks with bad habits, but he also objects to those who address themselves to building up a social reputation by dancing all night in addition to working by day.

Rich young men who have had all the so-called advantages are likely to be under a serious handicap in industry. They are not noted, as a class, for their contributions of hard work. Men engaged in research do not want them, fearing that they may be inclined to take a vacation as soon as they have become useful. Fathers often think that if their sons put on overalls they achieve wisdom thereby, and in their mother's eyes this amounts to nothing less than heroism; but unrelated persons usually want them only for their potentialities to "swing" capital.

It is the young man who must work, who must make a career for himself or meet the tragedy of failure, that is usually given preference when a job is to be filled. Men with the proper mental equipment and preparation, who have ambition within them and nothing on the side in the way of property, are towers of strength in research. They are full of invention and are unafraid of everything except failure. And they hardly believe in failure. We have seen splendid young fellows exploited in the most outrageous manner, to the breaking point and beyond, just because they were ambitious and had ginger to spare, and were resolved by the might of their youth to make a good career.

In nearly every large industrial establishment there are such men, with youth and enthusiasm and a vast capacity to do things, to think and to plan. They are of the kind who, if they were clerks at the old Fifth Avenue bank, would become bank presidents. But they dig and shovel coal and load and unload along with others who are feeble minded, and with older men whose thinking apparatus, such as they have, is already atrophied—men who can work only with their hands—and strike.

If these young men with Type-A minds could be picked out, and the vision of a successful career spread before them, they might achieve wonders. Each has his own way to make, and he has nothing to fall back on in case of failure—but he has very little light ahead.

All sorts of ways to pick out those marked for success are proposed, from judging them by the shape of their faces to sizing them up by the color of their hair and skin, but most of these methods smack of quackery. On the other hand, within the domain of applied psychology, there are tests that have proved remarkably successful in the Army. This is no field for the tyro, any more than it is for the phrenologist or the astrologer, or the fortune teller of any sort. It is a subject that is new—one that demands scholarship, real scholarship, with long academic study and earnest laboratory experiment back of it. We believe, however, that the time is approaching when it will be possible, by means of a few carefully prepared tests by the right examiners, to select the really gifted and capable young men.

Let us grant for the sake of argument that such tests are possible and practicable. Then suppose that in a body of 1500 workmen there should be fifteen, or even seven, young men of high mentality. Suppose these were set apart as cadets and offered special courses of study to equip them for positions of responsibility in the establishment. Their achievements might well be no less than astounding.

For graduate chemists and engineers, employers now have to take what they can find. Few are available, because of the cost of an education, and these are not all first-class material. But this fraction of 1% of exceptional and gifted men—the young fellows whom the dice of circumstance have shut out from opportunity—are working all unknown and with a mighty longing in their hearts. Under the plan mentioned, they would find the doors opened to them, and it seems reasonable to believe that, out of their pent-up desire to function in affairs, they would contribute ideas and inventions and better order, and help in a measure that cannot be purchased. It seems possible that the way of progress may lie along this line. It would be taking the long chance, but opportunity and the men are still too far apart.

Fake Oil-Stock Promotion

THE sale of stock as a means of raising funds for the legitimate development of mineral discoveries is in danger of receiving a serious setback. There are times when mass psychology seems to affect individuals, ordinarily well balanced, to buy anything which is called stock, even although, when subjected to a merely cursory examination, its dubious character is obvious.

At present there is what amounts almost to a stampede to purchase so-called oil stocks. Hundreds of companies have been floated, and though many of these may have merit, there are also many which, making glittering promises and holding forth the inducement of close proximity to some producing company as an enticing bait to be taken by the "sucker," can present only the prospect of a complete loss of the money paid for their stocks.

Between the substantial stock and the out-and-out "wild-cat" there is a twilight zone which requires more than ordinary skill and expert knowledge on the part of the investor in selecting the stock that has a gambler's chance of success. To distinguish between the legitimate enterprise and the "wild-cat" it is necessary to make a searching investigation of the affairs of the company offering its shares for sale. A concern that has a definite place of business, that can present a balance sheet on demand, and which is backed by men who are known for their respectability and technical knowledge of the business in which they are engaged, and possessing connections with a bank of known standing, is at least entitled to more consideration than a company which is obviously engaged only in stock selling. Many of the latter companies, it is true, make a pretense of respectability as well as a pretense of drilling a well, but how many can stand a thorough examination by a recognized and trustworthy authority? How many take the precaution of having a competent geologist pass on the oil possibilities of their land? How many give out any real information in their prospectuses?

To say that a thorough investigation should be made by the intending purchaser is easy enough, but not many casual stock buyers are able to make such an investigation. They are admonished to "Sign here! Pay here! Hurry! Hurry! The stock is advancing." By a play upon the credulity and the greed of the individual the transaction is consummated and the money lost before the victim awakes to the fact that the purchase of stock can be made like the purchase of any worth-while thing.

Caveat emptor! is a simple thing to say, but we cannot dismiss the subject so easily. It is a matter of concern to every one who has the interests of the mining industry at heart. Every individual who is swindled in the present instance means some one who will for a long time look upon the whole field of legitimate investment in mining in much the same light as he looks upon his own unfortunate investment. It is true that, for the most part, the victims are men of small means, but in the aggregate their investable funds are worth conserving to a better purpose.

If for no other reason than for the honor of their industry, mining engineers and mining men should coöperate to seek every reasonable avenue to clean the "wild-catters" and "fly-by-nights" out of the stock-selling business. It is the duty of the New York District Attorney's Office to initiate active steps to keep these gentry from continuing. At present that office appears to be in a state of apathy. The proddings of the New York *Sun* and the *Tribune* will, we hope, have some effect. Both of these journals are to be commended for their efforts. The situation is, however, not entirely local. It is spread over much of the United States, and has reached into the small cities and villages. It is a condition that plainly demands the attention of the Federal authorities.

There was a time when the U. S. Postal service went hot foot after the sly gentry who use the mails to defraud. We hear little of that now. We do not know how many postal inspectors are engaged upon the business of hunting out mining frauds, nor do we know how many investigators the Federal Department of Justice has in the field, but concerted effort on the part of these departments, together with the coöperation of both the Bureau of Mines and the Geological Survey, is urgently needed.

Attempts will be made to bring a Federal "blue-sky law" before the present Congress, but, by the time the law is passed, and its machinery started, the hard- and the easy-earned savings of many good people, as well as an indeterminate but large sum in Liberty Bonds, will have disappeared into the pockets of an all too numerous class that preys upon the community. Only prompt and vigorous action under the laws, both state and Federal, that are now operative will prove effective in meeting the present situation.

Engineering a Flight

ADMIRAL PEARY methodically planned his attack upon the North Pole. Experimentally he tried out his conclusions. He carefully selected his companions, and inured both them and himself to the hardships of arctic travel. The food and transportation problems were fully worked out. In the light of the careful and thorough preparatory work the result was a foregone conclusion. Shackleton and Amundsen also won by similar methods.

The flying men of the Navy set their goal upon the other side of the Atlantic. They also took up their task in much the same way as the naval constructor undertakes the design of a battleship. The flight problem had many ramifications, but the two most important were the men and the machine. Both were developed, the one by preliminary training upon the smaller hydroplanes and the other out of the experience gained in the progressive design and building of larger and larger planes. The plane which was finally developed, the NC class, represents the combined efforts of many engineers and the experience of many flyers. A few of the characteristics of the plane are worth comment.

The weight of the plane without load is 15,100 lb.; and, with its maximum load, 28,200 lb.; the weight of gasoline, oil, men, and provisions being 13,100 lb. The weight of the plane is 53.5% of the combined weight of plane and load. To appreciate this better, the weight of a steel ore car of 50 tons' carrying capacity is about 24% of the combined weight of load and car. The plane carries 0.86 of its unloaded weight, the ore car 3 times its own weight. In other words the plane requires 3.5 times as much material in its construction for an equivalent carrying weight.

A steel ore car does not receive gentle treatment over the roadbeds and at the speeds that are reached in modern traffic, but the strains which it must meet are proportionally less than for the plane traveling at a speed of 80 knots. Nevertheless the plane is not subjected to the shocks, except at landing, that the ore car must meet. The large surplus of material as compared with the ore car on the basis of weight-carrying capacity is undoubtedly required on account of the peculiar conditions under which the plane must operate. The comparison becomes less striking when we consider that the plane must carry its own motive power, whereas the car is only a containing vessel.

The total area of the wings, banking planes, stabilizers and rudders is 2981.6 sq.ft. The weight when fully loaded is 9.45 lb. per sq.ft. of surface; and when gasoline and oil are exhausted the weight is 5.46 lb. per sq.ft. The aggregate power of the four motors is given as 1600 hp. or an equivalent of 0.536 hp. per sq.ft. of surface. The fully loaded weight is equivalent to 17.62 lb. per hp., and the weight, less gasoline and oil, is 10.2 lb. per hp. Thus the plane at the end of its flight has much less weight to sustain and greater power per unit of weight. It is perhaps not difficult to see why planes of this size have considerable difficulty in rising at the beginning of a long flight.

At the beginning of the flight, of the total weight the machine itself made up 53.5, the gasoline 39, the oil 3.2, and the men and supplies 4.2%. At the end of the flight, when the gasoline and oil are exhausted, the machine constitutes 92.6 and the men and supplies 7.4% of the total weight. Thus the plane is somewhat similar to the man who packs his grub upon his back on a long trip. Each day makes the load lighter. The plane, however, lightens its load at the rate of over 700 lb. per hour of flight. The man on foot lightens his pack at the rate of 4 lb. per day. His limit of travel is confined to about 10 days; the flight limit of the plane is somewhat less than a day, unless fuel and oil are replenished.

The arrangements of the flight and its execution require no repetition here. It is sufficient to say that the whole project was carried out in a way that sustains the excellent reputation of our Navy men.

Goethals Awarded John Fritz Medal

PRAISE and high honors have been accorded General George W. Goethals since the completion of the Panama Canal, and he has enjoyed in exceptional degree the esteem and confidence of the American public, and is secure in his reputation in foreign countries, but the recent award of the John Fritz Medal records professional recognition of a great professional achievement. In honoring the General, engineers conferred honor on themselves and on their profession.

General Goethals possesses in an unusual degree that which all engineers recognize as being necessary to the achievement of success—character. Another distinguishing attribute of Goethals is his steadfastness of purpose. This was strikingly illustrated when the landslide occurred at Culebra in 1915, necessitating the closing of the waterway. General Goethals immediately changed his plans for leaving his post, assumed the full responsibility of repairing the damage, remained in Panama, and completed the big job.

The Panama Canal is a monument to the confidence, courage, and patience of a man whose merit equals his reputation.

Roadbuilding in Mining Districts

TRANSPORTATION is one of the most important problems with which the mining industry has to contend. The advent of the motor truck brought the far-off district nearer the main traffic lines, but it also brought into prominence the vital necessity of good road construction as a necessary condition for the operation of motor trucks. Mining interests in the different states should combine to bring the needs of the individual mining districts in the matter of new roads and the improvement of old roads to the attention of the road departments of the various states. It is estimated that the expenditures for highway work during the current year will amount to $500,000,000. A considerable proportion of this sum ought to be expended in increasing the accessibility of our mining districts, particularly those which have been neglected by the railroads. Only by concerted action can the miners hope to secure a fair apportionment of this sum and a recognition of the fact that the industry they represent deserves consideration in the matter of improved transportation facilities.

BY THE WAY

"Come 'ere, m'son," said Cap'n Dick, "I wants to show thee sumthin'. W'ot's think on this 'ere stope? Neat, isn't un? An, dam-me, thee'll fin' un that way mos' o' tha time. An', min' you, these chaps 'oo's workin' 'ere on this contrac' is doin' 'andsome. 'Ere's tha tool box, locked h'up as nice as you please; see they bloody 'eadpoles in tha back; timber wedged h'up—h'evrything as tidy as can be an' as 'andy as a pocket in a shirt. Two o' they chaps 'oo works 'ere is 'eaded for shif' boss jobs, an' t'other figgers as 'ow 'e's gawin' to 'one o' these colleges come next fall. Dam-me, do my 'eart good to see they young chaps gettin' on, for I tell'e, m'son, with h'all this 'ere h'improved machinery an' such, man mus' 'ump 'imself to keep gawin'. Back long we, w'en I started, we 'ad nothin' but single- an' double-jackin' an' a bloody lot o' mules to drag h'out cars to tha shaf'. An' naow if thee doesn't 'ave h'air drills an' these 'ere h'electric motors, thee's got no mine, jus' a ole' in tha groun,' m'son." D. E. A. C.

Every mining region where fortunes have been made or are in the making constitutes a favorable zone for what might be called "secondary enrichment of romantic literature"; yet even if some of the stories lack positive confirmation they offer a means of spurring the imagination of youthful adventurers who will be the important mining men of future years. Africa teems with little yarns that seldom get into print; though some have been published in spite of the proverbial taciturnity of Britons. In the *South African Mining Journal* of Mar. 18, 1911, it is related that a character lovingly spoken of as "Old Hartley" once had the good fortune to shoot a large bull elephant. As the giant pachyderm writhed about in dying agony, the tusks turned up considerable ground. Hartley became interested in the appearance of the soil and panned some of it. He found that it was worth while, and that discovery marked the beginning of a goldfield. Youth should remember the advice of a fabled colored preacher in connection with a dissimilar incident in one of his sermons, which may be paraphrased as "De good Lord ain't gwine to furnish an elephant fo' ebery prospector." But listen! The natives of Africa tell of a fearsome monster, half elephant and half dragon, that is said to inhabit the vast swamps of Northern Rhodesia. From the descriptions, it seems to fit palæontologists' idea of the brontosaurus. A traveler named Menges is credited with fixing the habitat of the beast as being near the headwaters of the Lunga and Kafue rivers. Carl Hagenbeck, the famed animal collector, not only believed the tales but sent an expedition to secure a specimen, dead or alive. The hunt failed, owing to fevers and attacks by hostile natives. Hagenbeck, in his book "Beasts and Men," stated that he hoped yet to prove that the animal exists. If it does, there is still a chance for the fellow who likes sport but is too lazy to dig.

Personals

C. A. Heberlein, of Nacozari, Mexico, expects to be in New York until June 1.

D. W. Shanks is now manager of the Rio Plata Mining Co. property near Guazapares, Chihuahua, Mexico.

Marion L. Thomas is in Cherry Creek, Nev., and is not expected in New York until the latter part of June.

H. C. Carlisle of The Pas, Manitoba, expects to be in New York City at the Buckingham Hotel until about June 10.

D. H. Forbes, manager of the Teck Hughes Mine, Kirkland Lake, is in the Wellsey Hospital, Toronto, recovering from an attack of pneumonia.

T. J. Harwood, formerly of the LaRose mine, Cobalt, was in Toronto to attend the trial of the O'Brien mines vs. the LaRose mines.

John H. Banks & Son, formerly at 61 Broadway and 10 Old Slip, have removed their office and laboratories to 16 John Street.

Donald F. Irvin, mining and metallurgical engineer, writes from Antofagasta, Chile, on May 1 that at the present time he will be on a trip into Bolivia and Peru.

C. E. Addams, former manager of the Ray Hercules, now is in west Texas, representing a group of Arizona men in oil investments.

H. H. Stout has resumed his former position as superintendent of the Copper Queen smeltery at Douglas, Ariz., after serving with the engineers in France, with the rank of lieutenant colonel.

W. H. Miller, president of the Rio Plata Mining Co., and **A. Nesbett** have returned to New York after a visit to the company's property at Guazapares, Chihuahua, Mexico.

H. W. Kitson is making a geological survey for the Iron Cap Copper Co. at Globe, Ariz., in connection with the Apex litigation between this company and the Arizona Commercial Mining Co., which also involves water rights.

E. O. Dane expected to sail on May 28 for Brazil, accompanied by **John Boyd** and **Charles S. Margon**. He plans to go up the Amazon into Bolivia and will be gone about four months.

Lieut. Bernard H. Lasky has returned from service abroad with the 316th Engineers, A. E. F., and has resumed his former association with Mowry Bates, petroleum and mining geologist, Tulsa, Okla.

D. C. Williams, of the Western Exploration Co., is in Kingman, Arizona, making preliminary arrangements to unwater the Flores mine, in the Cerbat Range, Mohave County, Arizona.

Capt. G. R. De Beque, on the staff of the Chief Engineer 2nd Army, A. E. F., formerly of Guanajuato, Mexico, has returned to the United States after 20 months' service in France. He will reëstablish himself in mining engineering.

F. Julius Fohs, oil geologist, of New York and Tulsa, expected to sail on May 29 for London. He will be gone for three months, having been designated by the Zionist Organization of America, together with assistants, to make scientific investigations in Palestine. The work will be non-commercial in character.

John D. Ryan, **Cornelius F. Kelley**, and **Benjamin B. Thayer** were re-elected directors of the Anaconda Copper Mining Co. at the annual meeting of stockholders in Butte, Mont., on May 21. Mr. Ryan and Mr. Thayer made an inspection of the Anaconda properties during the week.

Professors Lambert and Carlson, of the Minnesota School of Mines, are heading the sophomore class of the school during their annual six weeks of practical work. They are at present at the Scranton mine in Hibbing, studying the underground layout.

C. O. Ellingwood, of the Western Exploration Co., is in the Middle West financing the Los Prietos Quicksilver Mines Co., recently incorporated under the laws of the State of California. This quicksilver property is in the Montecito mining district, Santa Barbara County, California.

Clement K. Quinn and associates, of Duluth, have purchased from the Jones & Laughlin interests the Rolling Mill mine, at Negaunee, Mich. The Rolling Mill shipped 250,000 tons during 1916 and has a capacity of 300,000 tons. It was idle during 1917 and 1918.

F. M. Townsend, **H. N. Waller**, **D. C. Williams**, **C. O. Ellingwood**, and **H. W. Moore**, all of Los Angeles, Calif., have formed an association under the firm name of the Western Exploration Co., with offices at 910 Higgins Bldg., Los Angeles. C. O. Ellingwood is secretary and financial agent of the company, and H. W. Moore is the engineer.

S. B. Eaton of Dover, N. J., registered at the New York office of the American Institute of Mining and Metallurgical Engineers during the month. Other registrants were: **E. O. Dane**, Philadelphia; **Jay P. Wood**, New York; **Sherman Eaton**, Smithport, N. C.; **H. Foster Bain**, Washington, D. C.; **S. B. Patterson**, Allentown, Penn.; **A. B. Hardie**, Philadelphia; **E. Fleming L'Engle**, Joplin, Mo.; **Rudolph Gahl**, Denver; **C. Vey Holman**, Maine, and **Henry A. Tobelmann**, Ajo, Arizona.

Judge E. H. Gary, chairman of the U. S. Steel Corporation, and other officials of the corporation, accompanied by **G. G. Crawford**, president of the Tennessee Coal, Iron & R.R. Co., visited Mobile, Ala., on May 15. The day was spent in inspecting the plant of the Chickasaw Shipbuilding Co., subsidiary of the Tennessee company, where four 9600-ton ships are under construction. Judge Gary and party spent the 16th in Birmingham, visiting some of the various plants of the Tennessee company.

Obituary

Leighton Stewart died of pneumonia on May 21 in San Francisco. Mr. Stewart was a mining engineer with offices at 42 Broadway, New York, and during the war served with the Canadian engineers.

Societies

Duluth Engineers' Club held the regular meeting May 19 and enjoyed a lecture and a moving picture detailing the electrification of the Chicago, Milwaukee & St. Paul R.R. W. H. Hoyt, delegate of the club to engineers' conference recently held in Chicago, reported on the proceedings of the conference.

The Mining and Metallurgical Society of America, New York Section, will hold a meeting at the Columbia University Club, 4 West 43rd St., on June 5. The subject of discussion will be "Economic Aspects of the Labor Situation." Clinton H. Crane, president of the St. Joseph Lead Co., and Walter R. Ingalls will speak, and continuation of the spirited discussion of the last meeting is desired. Dinner will be served promptly at 7 p.m.

Engineers' Club of Northern Minnesota held the final meeting before the summer adjournment at Eveleth on May 24. H. H. Hindshaw, who is in charge of the experiments being conducted by the state with regard to huge peat reserves of Minnesota, read an interesting paper on that subject. Details were completed for the entertainment of the national convention of the American Society of Engineers which will adjourn from Minneapolis to the Mesabi range on June 20.

Engineers' Society of Western Pennsylvania held a joint meeting with the Pittsburgh Section, Heat Treaters' Research Society, on May 20. The subject of the paper presented was "Notes on Heat Treatment of Steel," by T. D. Lynch, research engineer of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn. The paper was illustrated by lantern slides. On June 7 an inspection trip through the plants of the Republic Iron and Steel Co., at Youngstown, will be made.

American Institute of Electrical Engineers elected Calvert Townley president at the annual business meeting held on May 16, in New York City. Mr. Townley is assistant to the president of the Westinghouse Electric and Manufacturing Co. He was born Oct. 18, 1864, in Cincinnati, Ohio, and was graduated from the Sheffield Scientific School in 1886, afterward taking a mechanical engineer's degree in 1888. He has been connected with the New York, New Haven & Hartford R.R. as vice-president in charge of electrification out of New York, subsequently becoming first vice-president of the Consolidated Railway Co. (afterward the Connecticut Co.), president of the Lackawanna & Wyoming Valley R.R. Co., and vice-president of the Niagara, Lockport & Ontario Power Co.

Industrial News

Standard Electric and Elevator Co., of Baltimore, has secured the services as sales manager of M. H. Jones, who has been connected with the Westinghouse Electric and Manufacturing Co. for the last 15 years as assistant to the manager of Philadelphia district.

The Metal & Thermit Corporation, New York, has issued a folder entitled "How Thermit Healed My Broken Jaw," which illustrates the operations involved in making a thermit weld on the 13½-ton broken upper jaw of an alligator shear used by Joseph Joseph & Bros. Co., Modena, Penn. The break welded was 80 in. in length and varied from 4½ to 23 in. in thickness.

American Spiral Pipe Works, Chicago, has recently issued a "Production Book" containing many photographic reproductions of various lines of manufacture. The announcement states that this book is particularly interesting from an engineering and industrial standpoint and clearly illustrates the advancement in the manufacture of corrugated steel furnaces, large-diameter lap-welded steel pipe, spiral riveted pipe, forged-steel flanges and forged-steel boiler nozzles. Copy of this book will be mailed upon request.

The Allied Machinery Company of America has increased its capital stock to $5,000,000. This was made necessary by the decision of the American International Corporation to group all of its machinery export selling subsidiaries under one head. This move has in view the complete absorption of the Allied Construction Machinery Corporation by the Allied Machinery Company of America. The Allied Machinery Company de France and the Allied Machinery Company d'Italia will retain their corporate entities, but their parent corporation will be the Allied Machinery Company of America, rather than the American International Corporation, as before. This is also true of the Horne Company, Ltd., of Japan, which was purchased early in the year by the American International Corporation. All shares of the Allied Machinery Company of America will, as before, be owned by the American International Corporation.

The Allied Machinery Company of America was formed in 1911 by interests associated with the National City Bank of New York, to sell machine tools in Europe. In 1916 it was taken over by the American International Corporation, which immediately set about to expand and organize the business on a large scale. The business has increased rapidly, and today the company is operating in 14 countries. J. W. Hook will continue as president of the Allied Machinery Company of America, in general charge of the business. F. A. Monroe, S. T. Henry, and T. G. Nee have been elected vice-presidents. Mr. Monroe is in charge of the administrative affairs of the company, Mr. Henry in charge of sales and advertising, and Mr. Nee is at present in Japan devoting his attention to the affairs of the Horne Company, Ltd. R. P. Redier is general sales manager, with headquarters at Paris.

Trade Catalogs

Mineral Collection. G. S. Scott, 20 Nassau St., New York City, has issued pamphlet descriptive of a low-cost mineral collection, comprising 115 specimens, all the important ores being represented. This collection is designed to meet the need of the mining engineer or of anyone desiring a cabinet mineral collection.

Fans, Blowers, and Exhausters., Buffalo Forge Co., Buffalo, N. Y. Section 400, 5 x 8, 31 pp., illustrated. Describes the design and structural details of "Buffalo" fans, blowers, and exhausters. Included among the types are experimental blowers, pressure blowers, volume blowers and exhausters, gas and acid fume exhausters, standard mill exhausters, and double standard reversible mill exhausters. A description of miniature conoidal, electric disk, and pulley propeller fans, slide pattern blast gates, and dust and refuse collectors is also included.

Concentrating Machinery and Equipment. Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Catlog 107; 8 x 10½; 112 pp.; illustrated. The bulletin is intended to describe as far as possible the latest types and designs of machinery to meet the demands of modern practice. Most attention is given to those machines which are recognized as standard and which have shown the greatest progress. The catalog is well illustrated and is of interest to mining and metallurgical men, as it contains flow sheets, plans, and photos of recent installations of well-known mining companies. The treatment of a large variety of ores is described and a number of valuable tables of technical data are included.

"C-H Electric Soldering Irons and Hand Tools," Cutler-Hammer Mfg. Co. Milwaukee, Wis. Folder. 8 pp.; 3½ x 6. Illustrates and describes standard sizes of electric hand-soldering irons and calls attention to an automatic soldering iron rack and a new C-H soldering fixture. The automatic rack is a small, complete switchboard, which may be mounted on the wall or a machine within convenient reach of the workman, and provides a definite place for the iron when not in use. It automatically prevents overheating of a soldering iron, prolongs its life, and increases the working value of the iron. The new soldering fixture, which was illustrated and described in a previous issue of the "Journal," facilitates certain soldering operations where the manufacturing processes permit bringing the object to be soldered to the iron. The pamphlet also makes mention of the C-H current regulator, and the C-H Seventy Fifty Switch, which may be installed on the cord of any soldering iron and permits easy current control. Prices, dimensions, and other data are included.

Remco Redwood Pipe. Redwood Manufacturers' Co., Hobart Bldg., San Francisco; 6 x 9; 116 pp.; illustrated. Catalog IX, replete with information both in general and tabulated data for accurate calculations on the use of wood pipe as a closed conduit for conveying water. The introduction is an interesting history of the development of this product, from the primitive efforts of burning a hole in a straight log to the present modern steel-banded wood stave pipe as used by 49 cities for water supply and by the U. S. Government, which received since 1917 2,311,797 lineal feet of Remco pipe, 4 in. to 48 in. diameter, for use in 73 Army camps and of which 169,000 ft. was shipped to France.

The three types of pipe, continuous stave, machine banded, and bored, and the quality of timber used, with a description of pipe fittings, are described in the first pages. The principal uses of wood pipe, including main supply lines, power plants, irrigation systems, mine drainage, hydraulicking and sluicing, and sewage disposal, are discussed, giving, in many cases, the location of installations.

The last half of the catalog contains an unusual number of tables, the principal ones dealing with friction loss in small pipe, shipping weights in lb. per lineal foot, approximate freight-car capacity, maximum allowable curvature, pressure allowance in design, water-wheel tables, power and speed for direct-driven centrifugal pumps, and pressure conversion. Definitions of hydraulic engineering terms and methods of calculation of flow are also presented. The table of contents is arranged alphabetically, which makes the catalog a valuable source of reference of technical data.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Air Lift—Apparatus for Elevating Fluids by Compressed Air. Herbert T. Abrams, Orange, N. J., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,302,268; Apr. 29, 1919.)

Alloy Steel, Process of Making. Alan Kissock, Tucson, Ariz. (U. S. No. 1,300,279; Apr. 15, 1919.)

Alum—Process of Preparing Iron-free Alum. Frederick Laist, Frederick F. Frick and Robert S. Oliver, Anaconda, Mont., assignors to Anaconda Copper Mining Co., Anaconda, Mont. (U. S. No. 1,300,418; Apr. 15, 1919.)

Alumina—Process of Preparing Alumina. Frederick Laist, Frederick F. Frick and Robert S. Oliver, Anaconda, Mont., assignors to Anaconda Copper Mining Co., Anaconda, Mont. (U. S. No. 1,300,417; Apr. 15, 1919.)

Alunite—Process of Treating Alunite. Roy Cross, Kansas City, Mo., assignor to F. H. Thwing, Kansas City, Mo. (U. S. No. 1,301,394; Apr. 22, 1919.)

Bessemer Converter. Albert Rommelaere, South Vancouver, B. C. (U. S. No. 1,299,034; Apr. 1, 1919.)

Silver-Ore Treatment—Process for Extracting Silver from Ore Containing Manganese Dioxide. Martinus H. Caron, Weltevreden, Java, D. E. I., assignor to Research Corporation, New York, N. Y. (U. S. No. 1,298,454; Mar. 25, 1919.)

Sintering Ignition Process. Charles W. Adams, Jr., Murray, Utah, assignor to American Smelting and Refining Co. (U. S. No. 1,299,892; Apr. 8, 1919.)

Steel—Process of Heat Treatment of Steel. Federico Giolitti, Turin, Italy, assignor to Societa Anonima Italiana Gio. Ansaldo & C., Genoa, Italy. (U. S. No. 1,296,649; Mar. 11, 1919.)

Thickening and Separating Solids from Liquids, Apparatus for. John A. Traylor, Salt Lake City, Utah. (U. S. No. 1,299,872; Apr. 8, 1919.)

Tungsten—Metal and Its Manufacture. Aladar Pacz, Cleveland, Ohio, assignor to General Electric Company. (U. S. No. 1,299,017; Apr. 1, 1919.)

White Lead—Process of Manufacturing Certain Lead Products. William P. Thompson, Liverpool, England. (U. S. No. 1,297,934; Mar. 18, 1919.)

Zinc—Electrolytic Refining of Metallic Zinc-Bearing Materials. Charles H. Aldrich and John K. Bryan, Baltimore, Md., assignors to Electrolytic Zinc Co., Inc., New York, N. Y. (U. S. No. 1,299,414; Apr. 8, 1919.)

Zinc—Method of Producing Blue Powder. Frederick F. Farnham, Fairooks, Penn., assignor to National Metal Molding Co., Pittsburgh, Penn. (U. S. No. 1,299,445; Apr. 8, 1919.)

Zinc—Method of Refining Volatile Metals. Sven Huldt, Stockholm, Sweden. (U. S. No. 1,298,722; Apr. 1, 1919.)

Zinc Kettle. John G. Granberg, Beckemeyer, Ill. (U. S. No. 1,298,692; Apr. 1, 1919.)

Editorial Correspondence

SAN FRANCISCO—May 21

The Rate of Assessment levied to support the work of supervision of drilling operations in California oil fields so as to prevent damage to the fields by water or other causes is based upon the amounts of oil and gas produced in the proved oil land. The rate for the coming year amounts to \$.001076 per bbl. of oil, or 10,000 cu.ft. of gas produced, and \$0.137 per acre of proved oil land. The amount to be collected is \$123,000, about \$6000 less than the total assessment for last year.

Mammoth Smeltery of the United States Smelting, Refining and Mining Co. at Kennett, Shasta County, Calif., shut down for an indefinite period on May 15, 1919, after what was evidently a serious attempt on the part of the officials of the company to continue operations, even though doing so at a loss. The direct cause of the shutdown was the refusal of a small percentage of the employees to work under the reduction of 50c. a day, made by the company in February of this year. No attempt was made to get strike breakers and employ guards to continue operations, although ordinary employment agencies were used in trying to fill the places made vacant by the men who quit. These men were mechanics employed at the smeltery and included the machinists, boilermakers, and train crews, in all 36 workmen.

Comstock Northend Production for the first half of May and including last three days in April totaled approximately \$40,000, or an average of \$13,300 per week. The total for the complete month of April, as shown by bullion shipments from the Mexican mill, was \$62,000, an average of \$15,500 a week. The ore comes from Consolidated Virginia and Ophir, and in May the average per-ton value as shown by the mill returns varied from \$23 to \$26 in Consolidated Virginia and \$19 to \$30 in Ophir. A feature of the first weekly report in May was the record of mine-car samples of Consolidated Virginia ore running \$60.88 to \$2788.20; other cars sampled \$1000 a ton. These figures, of course, are exceptional, but the ore holds up to high milling return.

The New Richfield Oil Field in Orange County has already given encouraging results through the operation of the Union Oil Co. on the Chapman lease and the Standard Oil Co. on the Kraemer lease. A revised map showing development in the Richfield field to Apr. 15, 1919, is now ready for distribution. This area is included in State Mining Bureau Map 4, of the Whittier Fullerton fields, which also includes Olinda, Brae Canyon, Puenta Hills, and East Coyote fields. State Mining Bureau Map 5, of Whittier Fullerton fields, including Whittier, West Coyote, and Montebello fields, is also revised to Apr. 15, 1919, and on sale. It should be noted that the area of development in Orange County adjoining the town of Richfield has been officially designated as the Richfield field. There has been some confusion over the use of the name "Kraemer," because of certain "wild-cat" operations under a similar name in San Bernardino County.

U. S. Bureau of Mines Has Withdrawn from the conjunction work with the mines division of the California State Industrial Accident Commission. Mine inspection will now be conducted solely by the state. During the joint conduct of the mines division by the Bureau of Mines and the Industrial Accident Commission the work has been so well organized and the division is so firmly established that the aid of the Bureau of Mines is not really essential. But the entire work of mine safety and inspection should have been placed in the State Mining Bureau in the beginning. The data collected by the mine inspectors are largely duplicated by field assistants of the State Mining Bureau. Not only is the cost of gathering these data thus unnecessarily increased, but the placing of records in two distinctly separate bureaus is an inconvenience and annoyance to mining men. In fact, the mining public has but small knowledge of how much or how little of such records are available for public inspection. Both these departments are of great value to the mining industry, and their value could be largely enhanced if they were placed together under a competent director with the aid of trained assistants.

BUTTE, MONT.—May 24

No Mooney Protest Strike will be called by the engineers' union, the chief labor organization in the Butte district. The question was decided by a three to one vote on a proposal to join in a country-wide demonstration on July 4, to last for four days. The action of the engineers decided the issue as far as Butte is concerned. The machinists' union voted to have nothing to do with the movement. Electricians voted to strike four days, but unless the engineers supported them their action is without effect.

Anaconda Copper Mining Co. is apparently indisposed to increased production, particularly of copper ore, until the metal surplus shows marked reduction. However, this corporation is increasing somewhat its development program and placing its properties in position to take full advantage of any improvement in metal conditions. During the lull in operation the company is fireproofing shafts and stations and doing improvement work which was impossible to accomplish during the war, when the government was calling for a maximum copper output.

The large orebody on the 500 level of the Orphan Girl continues, with a heavy tonnage of silver-zinc-lead milling ore indicated. Shoot shows width of 35 ft. where intersected by crosscut, and this width appears to be maintained. Anaconda has purchased a half interest in the Kit Carson claim, to the west of the Orphan Girl, carrying the extension of the fissure.

It is probable the company will do further prospecting for Star West silver shoot. Operations at Bonanza have been abandoned after unsuccessful effort to discover this deposit on 500 level. The silver ore development at Alice property is progressing favorably.

Annual meeting of stockholders of the Anaconda Copper Mining Co. was held at the company's office at Anaconda, Mont., and the following directors were reëlected: John D. Ryan, Cornelius F. Kelley, and Benjamin B. Thayer. The report of Mr. Ryan as chairman of the board of directors, for the year ending Dec. 31, was adopted, and contributiens of $50,000 to the Red Cross and the United War Funds Corporation, made by the officers of the company, were approved Mr. Ryan and Mr. Thayer arrived here during the week for an inspection of the Anaconda's properties. Sentiment is pronounced that improvements in the copper metal situation are impending.

WALLACE, IDAHO—May 22

Vocational Training of Miners as adopted in the two mines of the Coeur d'Alene district has been strongly approved and commended by Ben W. Johnson, of San Francisco, Federal agent for industrial education representing the Federal Board of Vocational Training. In company with Francis A. Thomson, dean of the Idaho School of Mines, Mr. Johnson made a thorough inspection of the work of the classes in the Morning and Hecla mines, after which he expressed satisfaction with the results achieved and predicted that the system would eventually be extended to all other metal-mining districts of the West.

Control of the Ray Jefferson Mining Co. was taken over a few years ago by Eugene R. Day, representing the Day Brothers. A mill of 400-ton capacity was built and a tramway constructed to the upper workings, and with a showing of tonnage available the O.-W. R. & N. company was induced to build a 10-mile branch up Beaver Creek to the Ray-Jefferson mill. It was soon demonstrated, however, that there was not sufficient ore in the upper levels to keep the mill running profitably, whereupon a deep crosscut was started to cut the vein about 1000 ft. below the upper workings. After cutting one vein, which proved barren, work was suspended, many months ago, on account of war conditions, with about 500 ft. remaining to be run to reach the main Ray-Jefferson vein. At the annual meeting of stockholders of the company on May 19 a board of directors was elected, and one of the acts of the board was to levy an assessment of 12c. per share, payable quarterly in installments of 3c. per share. The company has 2,000,000 shares, all issued, and if all the assessments are paid the treasury will be enriched to the extent of $240,000. The assessment is a severe jolt to many stockholders, who have confidently looked forward not only to the reimbursement of the Days through ore shipments, but to receiving dividends on their holdings.

The Labor Situation continues to be a serious problem for the operators of the Coeur d'Alene district. On Mar. 16, owing to the continued high cost of mining and the unsatisfactory condition of the metal market, which made it practically impossible to sell their product, the operators reduced wages of underground men from the war rate of $5.25 per day to $4.25. This action was reluctantly taken by the companies, for it was realized that the cost of living had not come down and that reduced wages would work a hardship upon their employees. And so it did, and also upon the mining companies themselves. Many single men drew their time and left the district, and better wages on the farms and in the lumber woods made it impossible to fill their places with new men. At the same time employees with families found the pay check unequal to the cost of actual necessities, to say nothing of a little surplus. To meet this situation, the operators met on May 19 and unanimously agreed to advance wages 50c per day, making the rate $4.75, effective on May 20. Explaining this action, a statement was issued to the effect that the cost of living had not dropped, as the operators had anticipated when the reduction was made, which placed a heavy burden upon married employees in particular; that though there was no material change for the better in the lead market, there had been a sharp advance in the price of silver, and that it had been decided to give the employees the benefit of the rise, although it was stated that the additional profit of some of the companies was not equal to the wage increase. It is expected that the higher wages will result in relieving the labor shortage to a considerable extent.

ISHPEMING, MICH.—May 22

The Iron-Ore Movement From Marquette Range Mines, which started slowly following the opening of navigation, is gaining ground every day, according to railroad men. Several additional crews have been put to work in the yards the last few days, and some additional steam shovels have been put in operation. Shipments are not as heavy from either the Marquette or the Menominee range as they were a year ago. A considerable part of the ore going from here is being shipped from pockets, although inroads are being made in several of the stockpiles. Local mining men look for a busy season.

DULUTH, MINN.—May 24

The Oliver Iron Mining Co. is planning an extensive stripping campaign throughout the 1919 season, involving the removal of at least 10,000,000 cu.yd. of overburden. Among the properties to be worked are: Spruce-Leonidas, Eveleth, 4,000,000 yd.; Missabe Mountain, Virginia, 2,000,000 yd.; Canisteo, Coleraine, 2,000,000 yd; Hull-Rust, Hibbing, 2,000,000 yd.

Independent Operators are a feature of this year's shipping season. Among the new shippers from the western district are the Pickands-Mather Co., the John A. Savage Co., and the Wisconsin Steel Co., shipping from the Danube, the Draper and the Sargent respectively. The two former are equipped with washing plants; the latter is making direct shipments so far. The Cleveland-Cliffs Iron Co. is engaged in an elaborate exploration campaign on lands recently leased from the Great Northern Ore Lands corporation.

AJO, ARIZ.—May 24

About Twelve Days' Production will have to be subtracted from the New Cornelia's output for May, owing to a fire in the main pump pit, because of a short-circuit of the pump motor. Helmet men brought from Bisbee helped extinguish the blaze and to repair damage caused by the destruction of 146 ft. of shaft timbering. In the meantime water for the camp had to be brought in by tank cars from Gila Bend, 42 miles distant, and leaching operations were necessarily suspended.

Most of the machinery for the new flotation mill is on the ground. Careful experiments will be continued over a term of months before absolute determination is made of the type of mill of 5000 tons' daily capacity, that will be installed for the reduction of the sulphides now under development beneath the carbonates and on the acquired Ajo Consolidated ground. Shovels are cutting out a new gloryhole south of the old one, and preparations are being made for another giant blast of a carbonate hillside.

Estimate has been made that the 3,000,000 tons of leached tailings here contain about 1,000,000 lb. of copper. Plans are being made to secure at least a part of this by infiltration with an acid solution and deposition below on iron scrap.

JEROME, ARIZ.—May 24

United Verde has warmed up a couple of stacks at the Clarkdale smeltery and has resumed copper production on a limited scale, for the first time since Feb. 13, when closing at mine and works was forced by I. W. W. agitation. Work will be continued on measures for doubling smeltery capacity and for installation of a coal-crushing plant for the new fuel system. At the mine much is to be done on the new shaft and in perfection of plans for steam shovel stripping of the old orebodies, in which fire has been known to exist for years. The working force now is about half the strength before the strike. All men employed hereafter will be given strict physical examination and only loyal citizens will pass inspection. Married men, former employees of good record, and soldiers will have preference, and "hiring and firing" no longer will be left to the caprice of foremen and shift bosses.

United Verde Extension is expected to start its blast furnace within 30 days, on a large reserve ore supply. Much remains to be done on the long-service tunnel and transportation system that will cut ore haulage costs in half. Mine operators of the camp are united in their consideration of labor problems.

United Verde Extension has been awarded a rebate of $200,000, to be paid within 30 days, by the Santa Fé, Arizona Eastern, Southern Pacific and El Paso & Southwestern railways, adjudged by the Arizona Corporation Commission to have been overcharged on ore shipments made by the plaintiff company from Clarkdale to Douglas. The railroads have assented to the judgment.

Of the 1,000,000 shares of outstanding Gadsden stock, 70% have been optioned to the Calumet & Arizona Mining Co. of Bisbee, in consideration of that company's agreement to develop the property.

PHOENIX, ARIZ.—May 21

New Rules Governing Stock Sales in Arizona have been issued by the Arizona State Corporation Commission to the effect that all stock salesmen must exhibit to the prospective purchaser of stock a copy of the state corporation commissioners' permit authorizing the sale of the stock offered. The new regulations also state in part: "Hereafter, stock held in pool subject to our orders will be released upon application and a showing that such release will not work an injury to the public or to any party or parties in interest.

"Stock of investment companies required to be escrowed by the Arizona corporation must be escrowed in some bank or trust company in Arizona, approved by the commission, and in a form that will give the commission absolute and exclusive control over the release of such stock."

The new order also cancels the requirement providing for the announcement above all investment advertising matter that the corporation does not recommend the particular stock offered.

BIRMINGHAM, ALA.—May 23

Little Change in Operations in the iron and steel industry has taken place in the third week in May, though the prospect of greater production and more sales is brighter than for the corresponding week in April. A shipment of 1000 tons of steel billets by the Gulf States Steel Co. during the third week of May is noted in the increase of sales. This steel was for export, going to Liverpool, England, and is to be followed soon by another shipment. A large overseas trade is being sought, and, as a reduction in ocean freight rates is being applied for by manufacturers in the district, with some hope of success, it is believed the Birmingham district will soon be shipping iron at a normal rate.

SEATTLE, WASH.—May 24

The Standard Oil Co. of New Jersey has had its geologists quietly working through western Washington for the last several years, in search of possible new oil fields and has now decided to put down a test well at Moclips, Wash. Preliminary work is practically complete, machinery is now being assembled and the company expects to be drilling within a few weeks. Also, it is rumored that a second well will be drilled in the Upper Hoh River district, Jefferson County. This is the district picked by Charles E. Weaver, of the Washington State Geological Survey, as the most promising place for finding oil in this state. The Standard Oil's announcement has created considerable excitement, and a number of other enterprises are now being projected. Three years ago there was a considerable oil boom through the western part of the state, but it was unproductive. At present there are no producing wells in the state. It is reported that the Wylomont Gas and Oil Co., of Kentucky, will drill near Montesano, Washington.

VICTORIA, B. C.—May 24

The Dolly Varden Mine, one of the most promising silver properties of the Alice Arm district, northern British Columbia, will, it is expected, be taken over by the Taylor Engineering Co. This concern constructed a railway from the coast to the mine, which incidentally taps a number of other good prospects. The Dolly Varden company failed to pay the engineering company all that was claimed for this work, and, by virtue of legislation passed at the last session of the Provincial Legislature, the first-mentioned company and the Temiskaming Mining Co. were given until May 1 to arrange for the liquidation of claims amounting to $462,500. This they have not done, apparently, and the Taylor Engineering Co. therefore has the power to take possession, its first responsibility on doing so being the discharge of wages due workmen, amounting to about $150,000. This done, the same concern has authority to proceed with the operation of the mine

The Mining News

ALASKA

ALASKA ENDICOTT MINING COMPANY (William Henry Bay)—Charles Mason passed through Juneau and stated company would go ahead soon with operations. Few repair parts for old equipment were taken in.

ALASKA TREADWELL (Treadwell)—Now working on 2800 level. This company has promising silver-lead property on Seward Peninsula, which is in charge of Jim Gwyn as superintendent. Equipment now being bought to operate property.

AT McGRATH, Thomas P. Aitken, a well-known placer miner, of Atlin, B. C., has taken over a gold-quartz claim and expects to take equipment in during June.

ALASKA GASTINEAU MINING (Thane)—According to reports of Mr. Hayden, of Hayden Stone & Co., the best company can expect this year is to break even. Has No. 11 stope in fair condition and caving should be less frequent.

ALASKA PEERLESS MINING (Windham Bay)—Sam Newswander in charge. Expects to operate, as men will be available from now on.

ARIZONA

Cochise County

COPPER QUEEN (Bisbee)—Stripping overburden of porphyry deposits of Sacramento Hill section by steam shovels. Tonnage estimated at 15,000,000, averaging 1½% copper. West section, being richer, to be milled first. Established special welfare department for Mexican workmen. Smeltery at Douglas in April handled 107 carloads, 4289 tons, of Nacozari concentrates.

MOORE-LETSON (Douglas) — Lead claims in Swisshelm mountains, north of Douglas, to be developed by Chicago Exploration and Development Company.

Gila Coonty

GIBSON (Bellevue)—Mill of 500 tons' capacity about 65% complete. Dumps said to contain several hundred thousand tons of 4% sulphide copper ore.

Greenlee County

STARGO (Morenci)—Taken over by Arizona company, headed by M. J. Hannon, formerly of Bisbee. Shipments to be made to El Paso, but plans being made for cyanide mill.

Santa Cruz County

ALTO (Patagonia)—Bonded from Hazeltine-Stone-Beatty firm by L. M. Tobin. Property is cut by Baca Float boundary line.

CONSOLIDATED ARIZONA (Patagonia)—Shaft on Olive group at 75 ft. has cut argentite. Talc on either side also carries valuable content. El Paso group has new shaft equipment. Lately visited by president, J. A. Ritzler, of Kansas City, accompanied by Alfred May and J. H. Snyder, of Gary, Indiana.

FLUX (Patagonia)—Raise from 130 level has cut orebody carrying silver, lead, and copper. Above 130 level has about 100,000 tons of carbonates unavailable for treatment under present conditions. F. B. Kollberg, manager, is sinking to develop sulphides. Mill erected.

FOUR METALS (Patagonia) — Near Mowry. To resume production.

RUBY (Patagonia) — Will sink new working shaft on basis of record of churn drilling.

THREE R (Patagonia)—R. E. Fishburn named as receiver in Tucson court, to protect claims of Tucson firm on leasing company, which has started erection of mill. Debts said to exceed $20,000. R. R. Richardson served notice of forfeiture of lease.

Yavapai County

O'DONNELL (Clarkdale)—Working of claims 16 miles northwest indicate discovery of new gold districts; ore from shallow shaft development carries some copper. Santa Fe tracks cross group.

NELSON (Crown King)—G. P. Harrington, manager, driving main tunnel, now 300 ft., at rate of 5 ft. a day, to tap 950-ft. shaft. Tunnel parallels War Eagle and other developed veins, to be crosscut later. Three veins crosscut on Nelson ground. Already tunnel is furnishing water sufficient for operation of 20-stamp mill.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—Last month's bullion shipments East were 770,000 lb. copper. Company's Blue Bell and De Soto mines produced 12,600 tons ore.

McGILLIGAN (Jerome) — Option on eight claims in southeastern corner of county taken by Houghton syndicate, represented by Luther E. Warde. Ore mostly copper, with some gold.

CALIFORNIA

Amador County

ARGONANT (Jackson)—Fire now confined to 4350-ft. level. Circulation in lowest levels will be provided through raises being driven. Most of burned territory includes only old stopes and caved ground. Little valuable ground has been affected.

Calaveras County

SHEEPRANCH (Murphys) — Development under management of Eastern company reported to show encouraging results.

Nevada County

GOLDEN CENTER (Grass Valley)—Work confined to 500 level, as pumping facilities insufficient to keep lower workings unwatered.

CHAMPION (Nevada City)—Good ore being developed below 1500 level.

ARTIC QUARTZ (Washington)—Plan to resume under management of J. P. Flint, Los Angeles.

GASTON (Washington)—Being reopened under management of W. L. Williamson. Ore medium grade; for several years the mine was steady producer.

OMEGA HYDRAULIC (Washington) — High water washed out barrier, which was of basket type. Ground sluicing of bed rock will proceed until dam is reconstructed. Controled by South Yuba Mining and Development Company.

Sierra County

EL DORADO (Alleghany)—Machinery being installed by new company to sink shaft further.

LOST CAMP MINE (Dutch Flat)—Application made to California Debris Commission by John S. Day, B. J. Jeffry, and Murray Innes for permission to store debris in Woods Ravine, tributary of Blue Canyon Creek.

KATE HARDY (Forest)—Reported group of mines will be reopened on completion of examination by H. L. Valkenberg.

Trinity County

BONANZA KING (Trinity Center) — Increased working force planned this summer.

ESTABROOK DREDGE (Trinity Center)—Within few weeks dredging should start, as last shipment of heavy machinery received.

Tuolumne County

RAWHIDE (Jamestown)—News that Rawhide mine is to be worked was started when Central Land Co. filed notice of non-liability with County Recorder. Is one of the mines from which late Capt. W. A. Nevills made his fortune.

SPUR (Mount Lily)—Free gold ore reported by A. E. Caldwell. Half interest secured by Hampton, Miller, and Badger of Patterson, Caifornia.

LITTLE BONANZA (Sonora)—Optioned by Holbrook & Maguire, well-known chrome miners, who plan to open property at depth.

IDAHO

Shoshone County

MARSH (Burke) — Management announces exploratory work will begin about June 1, the company having funds to continue work during year. Engineer will make report to directors before that date. Sold hoist, from which it appears that work in shaft has been abandoned for present. Meeting of stockholders in Spokane elected Edward Pohlman, of Spokane, president; M. M. Lee, of Duluth, vice-president; Joseph McCarthy, of Spokane, secretary; J. V. Pohlman, of Spokane, treasurer, and these, with Fred L. Bergen, of Burke, Idaho, mine superintendent, constitute board of directors.

INTERSTATE-CALLAHAN (Wallace)—Announced work will resume on Nipsic group, opened by crosscut from No. 6 level of Interstate-Callahan, 2500 ft. Vein shows 12 in. good lead-silver ore. Tunnel, 1000 ft. above, has lead-silver orebody 120 ft. long and from 18 in. to 2 ft. wide. At New York meeting of directors, John A. Percival reëlected president, and H. T. McMeekin secretary-treasurer, both of New York. Decided against removal of main office from New York to Wallace.

REX (Wallace)—Ground above No. 1 level leased to Paul Meacham and others, of Wallace. Considerable body lead carbonate ore available, and lessees expect to open body of sulphide.

MICHIGAN

Copper District

SENECA (Mohawk) — Shaft sinking again and concreting work being done, as all of shaft must be concreted. No drifting yet done on Kearsarge lode, where cut by crosscut as this opening will be approached by raise. Still considering selection of mill site. Rumors of absorption of Ojibway without foundation.

MICHIGAN (Rockland) — Stamped in April, 5289 tons rock, from which return of 27.5 lb. copper per ton was secured.

Gogebic Range

McKINNEY STEEL CO. (Bessemer)—Building new houses for employees in Ironton location.

NEWPORT (Ironwood)—In last month forces reduced by about 200 men. To date shipments from stockpiles have been small.

OLIVER IRON (Ironwood)—Investigating various shoveling machines for underground use, and may place order. Drifts about 7 x 8 ft. in the clear, and large machines are consequently impracticable.

Menominee Range

ESCANABA DOCKS (Escanaba)—Total shipments iron ore from range in April as follows: C. & N. W. dock, 36,701 tons; C., M. & St. P. dock, 34,716 tons.

MINNESOTA

Cuyuna Range

CUYUNA-DULUTH (Ironton)—Sold iron ore stockpile, which remained unsold all of last season. Loading expected to start soon.

CUYUNA-MILLE LACS (Ironton) — Sinking shaft to deeper level, but no other work under way, and no intimation when this important manganiferous producer will start operations. Has 50,000 tons in stock.

FEIGH (Ironton)—Now at producing stage, all permanent equipment being installed. Has steel headframe, electric hoist, and compressor, and electric stockpile and underground haulage. Grading of spur track and stockpile grounds well under way.

MAHNOMEN (Ironton)—Clement K. Quinn open pit expects to make shipments of at least 150,000 tons this season. Has sold some tonnage of manganiferous material.

THOMPSON (Ironton)—Preparing to resume.

ADBAR (Trommald)—One diamond drill continuing exploration.

Mesabi Range

AJAX (Biwabik)—Will reënter shipping list after shutdown lasting since 1906. Discovery of a deposit running high in manganese a feature of the new development. Federal Consolidated, Minneapolis, operators.

WOODBRIDGE (Buhl)—Officials of Fort Henry Mining Co., operators, seeking to cave a certain low-grade portion of mine to make better portions more accessible. Is a state lease, and state authorities reluctant to grant the request. Conference between mine and state officials held in St. Paul, May 22.

BILLINGS (Chisholm)—New property of Tod-Stambaugh Co. Completed 12 x 12 ft. main shaft to 260 ft. level; now drifting to orebody. Surface equipment completed; among most modern plants on range.

Vermilion Range

NORTH CHANDLER (Ely)—Working one shaft only and hoisting one shift; 40,000 tons in stockpile.

PIONEER (Ely)—Producing 1700 tons daily; probably largest daily production of all mines in state. Oliver Iron Mining Co., operator.

MONTANA

Silver Bow County

BUTTE COPPER AND ZINC (Butte)—Ore showing reported good last week on 1000 level east of Emma mine. James Brennan, superintendent.

BUTTE & PLUTUS (Butte) — Plutus shaft will be sunk from 160 to 400 ft. depth and Plutus and Norwich-Mapleton veins cut at depth of about 350 ft. Some ore being shipped.

DAVIS-DALY (Butte)—High-grade copper ore cut in raise from the 2300 of Colorado mine continuing. Approximately 10 ft. ore shown, with whole width averaging good copper contents and nearly three feet of high grade. Drifts continue in ore on lower levels, deposit being opened now more than 1100 ft. in length of practically continuous ore. Moving 30,000 yd. of old dump at Colorado mine to provide room for new ore bins, change houses and surface improvements. Contractors bid $1.50 per yd. for removal of dump, but company doing its own work, handling rock at 65c. per yd. Quarterly report for period ended Mar. 31 shows net profits of about $4000, being had from ore obtained in course of development work only. Mining of ore suspended pending metal-market improvement.

NORTH BUTTE (Butte)—Edith May vein on levels below 3000 ft. continue in ore. Showing 3200 reported good, and fair on 3400. Crosscutting continues on 900 of Sarsfield. Lester Frinck, superintendent.

TUOLUMNE (Butte)—Sinbad shaft of Main Range now down to 175 ft. below 800 and expected to be cutting station on 1000 by June 15; also crosscutting for Spread Delight fissure by July and expect to be in vein by Sept. 1. Estimated that 700 ft. croscutting on 1000 necessary to reach fissure. Mose Little, superintendent.

NEVADA

Nye County

TONOPAH SHIPMENTS for the week ending May 10 amounted to 7185 tons, of estimated gross milling value of $122,145. Shippers were: Tonopah Belmont, 1860 tons; Tonopah Mining, 1100; Tonopah Extension, 2100; West End, 1108; Jim Butler, 164; Montana, 223; Midway, 59; Tonopah Divide, 420; MacNamara, 210 tons.

NEW JERSEY

Morris County

WHARTON STEEL CO. (Wharton)—Reported sold five tracts iron-ore properties in Rockaway township to Thomas Iron Co., operating in same district. Comprises Allen mine, Teabo mine, and unnamed locations. Total is close to 400 acres.

NEW MEXICO

Grant County

J. E. DEVINE leased Coyle silver-lead property, expects to have car ore ready for shipment to El Paso smelter in 30 days.

EL ORO (Steins Pass)—Leased to L. E. Foster, of Silver City, N. M., formerly in charge steam-shovel work for Chino Copper Co. Will start development at once.

OCTO (Lordsburg)—Again started shaft sinking. E. K. Davis, superintendent.

VOLCANO (Steins Pass)—Leased from E. Smith by Sam Diggs, of Tucson. Is old silver property. Will sink main shaft from 100 level at once.

Luna County

VICTORIA MINES (Gage)—Will sink 400-ft. shaft. Spent $90,000 in development work. Will install additional machinery. Norman Welch, manager; J. T. Duryae, Brooklyn, N. Y., owner.

GAGE MINING (Gage)—Have unwatered 480 ft. shaft; two 4-ton trucks hauling ore; shipping to El Paso smeltery. Captain Soloman, manager.

Sandoval County

HAGAN coal fields reported purchased by United Sulphur Development Co., of New Orleans. J. J. DelPreslin, president.

Sierra County

VIRGINIA (Kingston)—Developing rich vein silver ore recently struck. John H. Moffett, owner.

NORTH CAROLINA

Guilford County

THE GARDNER HILL MINE, near Jamestown, sold to H. K. English, of Knoxville. Concentrator will be built to work dumps, containing copper and precious metals. Former producer. Few years ago unwatered and sampled. Several shipments made of ore picked from old dumps.

Moore County

THE OLIVER QUARTZ CO. (Hemp)—At work for some time developing Gerhart Brothers' talc mine. Prior to signing of armistice engaged in mining near Waderville, producing lump quartz for lining acid towers. Was one of largest producers in country. Also produced ground quartz in mill at Charlotte, N. C., which will now grind talc. Deposits may be related to those developed near Glendon. Mineral not true talc, but pyrophyllite, which is marketed for similar purposes.

TEXAS

Brazoria County

GULF PRODUCTION (West Columbia)—Well No. 3 Eyers, on Block 27 of Park subdivision, came in May 15 at depth of 2960 ft., with initial flow of 2000 bbl.

HUMBLE OIL AND REFINING CO. (West Columbia)—Reported this company abandoned its Diggs Well No. 1 at 3965 ft. This well most easterly drilled in district.

THE TEXAS CO. (West Columbia)—Hog Well No. 15, on Block 24 of Park subdivision, came in May 16, flowing 3000 bbl from depth of 2915 feet.

Fort Bend County

DEVELOPMENT OF BLUE RIDGE FIELD greatly stimulated by opinions of several Houston lawyers that leases granted by Bassett Blakely on his Blue Ridge farm subsequent to his giving 10-year option to purchase to State Prison Commission are legal. Held that rights of these lessees are guaranteed by the state through contract issued by commission to Bassett Blakely and approved by Governor. The Texas Co. has started rigging for test hole on Robbins 160 acres. Blue Ridge Oil Co. has been recently organized to drill at Blue Ridge.

Hardin County

LAKE GRAHAM OIL (Sour Lake)—No. 2 Bashara pumping 200 bbl. fluid mixture a day, 80% of which is oil, from depth of 2996 feet.

THE TEXAS CO. (Sour Lake)—No. 113 Fee, recently worked over, pumping 110 bbl. per day.

Harris County

COMPLETIONS IN GOOSE CREEK FIELD made recently as follows: The Texas Co., No. 12A Isenhour, pumping 50 bbl.; Crown Oil and Refining Co., Hog Island No. 1, salt water at 3400 ft.; Humble Oil and Refining Co., No. 39 Gaillard, bailing; Atlantic Oil and Refining Co., Goose Lake No. 1, bailing at 2750 ft.; Ruejer and associates, No. 1 Hankins, bailing at 1550 ft.

COMPLETIONS IN HUMBLE FIELD: The Texas Co., No. 26 Koehler, flowing in heads at rate of 200 bbl. daily; No. 235 Landslide of same company, pumping 35 bbl.; George Smith's No. 3 Bready, arranging to pump at 660 ft.; Webb Oil Co., No. 16 Cherry, arranging to pump at 610 ft.; several other wells abandoned or ran into salt water.

GULF PRODUCTION (Goose Creek)—No. 12 state-land well brought in recently with initial production of 150 bbl.

Liberty County

EMPIRE GAS AND FUEL CO. (Dayton)—No. 3 Jackson pump recently installed, and now producing from 30 to 50 bbl. daily. This is not full capacity, as storage capacity insufficient to receive more.

THE TEXAS CO. (Hull)—No. 1 Palmer well, completed at depth of 2400 ft., came in May 12 at rate of 5008 bbl. flow.

UTAH

Beaver County

MILFORD-MAGNOLIA (Milford) — Reported fissure cut on 200 level 40 ft. out from shaft shows 4 ft. lead-silver ore, followed 15 feet.

Juab County

TINTIC SHIPMENTS week ended May 16, 144 cars; 18 shippers.

CHIEF CONSOLIDATED (Eureka) — New transformers and other equipment being installed to bring capacity to 5000 h.p. At present 1000 h.p. being used.

IRON KING (Eureka) — Preparing foundations for new hoisting plant for shaft sinking. Shaft to be sunk by contract.

Salt Lake County

SOUTH HECLA (Alta)—Shipped 400 to 500 tons from accumulated ore. Some trouble from inflow of surface water.

CARDIFF (Salt Lake)—Road from mine down Big Cottonwood impeded by snowslides, but expected clear for shipping June 1. New body ore varying from 5 to 10 ft. in width followed about 200 ft. Expected to begin work with small force, to be increased as shipping improves. Stated in condition to ship 75 to 150 tons daily.

MAXFIELD (Salt Lake)—Old property being worked by lessee.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Drifting being done to south on 700 level following three veins, one 2½ ft. wide, carrying silver-lead ore, shipping grade. O. F. Brinton, general manager.

Utah County

PROPERTIES BEING WORKED: Bellerephon, Globe, Bog Iron (by Earle Eagle, which has lease), American Mining, one-half mile above Pacific, and Pacific.

WISCONSIN

Gogebic Range

OGLEBY NORTON CO. (Montreal) — Has completed $70,000 clubhouse.

ASHLAND DOCKS (Ashland) — Total shipments from Gogebic Range, in Michigan and Wisconsin in April as follows: C. & N. W. dock, 139,100 tons; M., St. P. & S. Ste. M. dock, 8168 tons.

CANADA

Ontario

APRIL SHIPMENTS of ore over the Temiskaming & Northern Ontario Ry. were: Buffalo, 181 tons; Coniagas, 113; Dominion Reduction, 70; Hudson Bay, 32; La Rose, 147; McKinley-Darragh, 167; O'Brien, 64; Penn Canadian 30; Casey Cobalt, 30; Miller Lake-O'Brien, 32, or a total of 868 tons. The above shipments were made to following: Deloro Smelting & Refining Co., Marmora Deloro, 421 tons; Coniagas Reduction Co., Thorald, 47; A. S. & R., Denver, 120; A. S. & R., Pueblo, 248; Pennsylvania Smelting Co., Carnegie, 30. The price of silver remained stationary during the month of April at 101 125c.

NIPISSING (Cobalt)—Development on 109 vein proved 170 ft. in length; high-grade ore. Management acquired interest in 1000 acres oil land south Petrolia oil and gas field 20 miles southeast Burkburnett oil pool in Texas. Will start drilling within 30 days.

CANADIAN KIRKLAND (Kirkland Lake)—Shareholders' meeting called for May 28, to ratify the agreement to option the property to Sir John Carson, representing the Crown Reserve.

HOHENAUR (Kirkland Lake)—To be developed. Mining plant being installed.

TECK HUGHES (Kirkland Lake)—In April milled 2602 tons of ore and recovered $27,217, or an average of $10.46 a ton.

PITTSBURG LORRAIN (Lorrain)—Will reopen and treat old tailings from Wettlauffer mine.

Quebec

INDIAN PENINSULA (Hurricanaw)—Completed mill for treatment of molybdenum ores. Present situation with regard to this mineral unfavorable, but officials look for improvement.

COLOMBIA

TAX ON PLATINUM amounting to 5% will be imposed on exports after June 15. Exports of gold will be prohibited as long as the existing restrictions on such exports are in force in Europe and the United States. When gold has been imported from Europe and United States, permits will be granted for exportation of equal amount in substitute therefor. No change in the export duty on gold.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver New York, Cents	Silver London, Pence	May	Sterling Exchange	Silver New York, Cents	Silver London, Pence
22	4.6225	105⅛	51¼	26	4.6400	106⅛	51⅝
23	4.6375	106⅛	51¾	27	4.6375	107¾	52¼
24	4.6400	105¾	51⅜	28	4.6375	108¼	52½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
22	16.35	†72½	5.20 @5.30	5.00 @5.05	6.20 @6.25
23	16.35	†72½	5.20 @5.30	5.00 @5.05	6.20 @6.25
24	16.35	†72½	5.20 @5.30	5.00 @5.05	6.20 @6.25
26	16.35	†72½	5.15 @5.25	4.90 @5.00	6.17½ @6.22½
27	16.35	†72½	5.15 @5.25	4.90 @5.00	6.15 @6.20
28	16.35	†72½	5.15 @5.25	4.85 @4.90	6.12½ @6.15

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

May	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
22	79¾	79¾	82½	236	232¼	23½	23¾	36¼
23	78½	78.85	82½	233¼	229	23½	23¾	36¼
24		....	...		..	...	...	..
26	78¾	79	82	236	230¾	23¼	23½	36¼
27	79¼	79⅜	82	237	231	23	23¼	35¾
28	79¼	79½	82	235	230	22¾	23	36

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK, May 28, 1919

The metal markets became quiet all around this week and exhibited rather a drooping tendency. This was the case not only with lead and spelter, but also with copper. The great buying movement of April and May in copper seems to have exhausted itself for the time being.

Transatlantic freight rates remain unchanged at 1c. per lb. to British ports, while probably 1½c. to French ports and to Antwerp would have to be paid. The freight rate from San Francisco to Hong Kong and Kobe has come down to $14 per ton.

In the "Journal" of May 24, the silver prices at New York for May 17 and 19 did not show clearly, owing to defective printing. The prices on those days were $1.10½ and $1.09½, respectively.

Copper, Tin, Lead and Zinc

Copper—The great buying movement of April and May seems to have exhausted itself about May 20, since when sales have been relatively light. During the last week the total was very much less than that of the previous week, and, even so, there was no generally distributed business, a large part of what was reported being represented by a few transactions of more or less special character. Producers made sales of 16½c., regular terms, corresponding with 16.35c., cash, New York, up to May 26, inclusive. Included in these sales was one round lot for June-August delivery, which was taken at the price commonly quoted for June alone. Since May 26 producers made none but trifling sales and there were offerings on the market through brokers at concessions in prices, say, at 16¼c., New York, and perhaps lower. There is known to be considerable copper in speculative hands, whence such offers to sell may emanate. So far, however, these offerings have been of too small quantities for us to regard them as quotational, and for the last two days of the week we report the market nominally unchanged at 16.35c. Nevertheless, these offerings, whatever their character, attract attention.

With the end of the big buying movement of April and May we are able to appraise its character better than heretofore. Sales for April, large as they were, fell far short of the production in that month. The sales for May were larger and came pretty close to the present rate of production. Nevertheless, there was a further accumulation of stocks during May, for deliveries were not so large as the sales, the latter covering anticipated requirements for some time ahead. There were some sales for export, but by far the major part of the business was done with domestic manufacturers, and especially with wire-drawers. However, a considerable part of the copper taken by them was destined for export ultimately, inasmuch as some considerable sales to Europe of rods and wire were made. This means that Europe bought copper in semimanufactured forms, instead of wire-bars, through the Export Association.

It is wholly a matter of conjecture as to what extent manufacturers bought copper against orders already in their hands, and to what extent they bought simply to lay in copper for anticipated orders, on the theory that at recent prices the metal was cheap. We judge that the major part of the business was against actual orders, but a considerable part was anticipatory. As things stand now, manufacturers probably have covered about all of their requirements for June and a considerable part of what they will need or expect to need in July, while contracts have been entered into for a relatively small quantity of August copper.

The agents of the Export Association quoted £83 in England on May 22, advanced to £83½ on May 23, and later went up to £85, the advances corresponding more or less with the decline in sterling exchange. With exchange at 4.64, the equivalent of £85 would be about 17½c., c.i.f., or about 16.35c., f.a.s. here. However, American copper cannot be sold in England at those prices, while the copper over there is quoted at £82 for spot, and £83 for futures.

The Comité Central Industrial de Belgique, the unofficial organization which was charged by the Belgian Government with the collection of information regarding the destruction of property in Belgium, estimates that during the first three months of resumption of industry the requirement of copper for reconstruction will be about 15,000 metric tons.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 18½@18¾c.

Tin—On May 24, George Armsby, chief in charge of tin, War Industries Board, issued the following letter to the trade:

"On May 1, 1919, according to reports made to the American Iron and Steel Institute, the supply of tin, (including tin content of tin ores and concentrates) on hand in the United States, in the hands of consumers, jobbers, dealers, and smelters, and the unsold portion of the Inter-Allied tin, was approximately 22,000 tons. Up to May 1, 1919, 6863 tons of the 10,169 tons of Inter-Allied tin allocated to the United States had been disposed of. Since May 1, a further 1107 tons has been sold, leaving a balance unsold on May 23 of 2199 tons. During January, February, March and April, 1919, the average monthly consumption of tin in the United States, as reported to the American Iron and Steel Institute, was 3713 tons."

It has been desired for a long time that the Government should make a statement of the statistical position, and the letter of May 24 was doubtless issued in deference to that proper desire. It would be even more desirable if Mr. Armsby should be more explicit, especially with respect to the relative quantities of tin in ore and in metal, and, as to the latter, how much is in the hands of consumers and how much in other hands. However, the published figures showing a total of approximately 22,000 tons in all forms were viewed quite bearishly in the trade.

Lead—A fair business continued during the first three days of this week, but beginning with Monday there was a decided falling off, and immediately there began to be cutting of prices, some of which probably reflects certain interesting conditions. The declining tendency of the price for lead in England attracted attention. In this market there was evinced a rather strong desire to dispose of future lead even at sharp concessions, and at the close lead for July delivery was offered at 5⅛c.

The lead situation in this country has without any doubt improved statistically. The chief question at the moment is whether it has improved enough and whether foreign conditions, which lately have afforded an outlet for Mexican lead, will continue to abate that threat against our market. The production of lead in the United States probably declined to a moderate figure in May, and probably stocks in the hands of producers diminished. Certainly some important producers report themselves in quite a comfortable position statistically.

Lead manufacturers report a noteworthy increase in business in plumbing fittings, reflecting the building of numerous small houses, but the pipe business as a whole is subnormal. The sheet-lead business is also subnormal.

Zinc—With the rise in the price last week, the market met the selling of producers, who, having previously overstayed their market, welcomed the opportunity to relieve themselves. Although a moderately fair demand continued, there were more sellers than buyers, and the price declined rather easily. There were some small sales for export to England, which will probably go out via Galveston, and on May 27 galvanizers bought moderate tonnages. This morning business was done at 6.15c. and in the afternoon at 6⅛c. There was some further export business in high-grade zinc, which was quoted at 6⅞c.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal in good demand at 33c. per pound.

Antimony—There was a further advance in this metal, which in the early part of the week was sold at 8¼c., and later at 8⅜@8½c., which we quote at the close. Most of the import houses made no offers of antimony for future delivery, but in some quarters June shipments were quoted at 8⅜c., New York.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The shortage of supplies in the New York market became acute, and the price advanced to $92. San Francisco telegraphs $87, strong.

Silver and Platinum

Silver—After two weeks of excitement and wide fluctuations in price consequent upon the unexpected removal of Federal restrictions on export and price of silver, the market steadied itself at 51½d. in London and has shown an advancing tendency since, closing at 52¾d. in London on May 28. The supply of silver offering is limited and the demand is good. The outlook from India and China warrants a bullish feeling.

Mexican dollars at New York, May 22, 79½; May 23, 80½; May 24, 80; May 26, 81; May 27, 83; May 28, 83½.

Platinum—Refined ingot was in good demand at $105.

Palladium—Sales were made at $120.

Zinc and Lead Ore Markets

Joplin, Mo., May 24—Blende, high, $44.20; basis 60% zinc, premium, $41; Prime Western, $40; sludge, $37.50; flotation, $35; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $36.28; calamine, $22.20; all zinc ores, $36.10.

Lead, high, $64.30; basis 80% lead, $60@57.50; average settling price, all grades of lead, $56 per ton.

Shipments the week: Blende, 5669; calamine, 173; lead, 1430 tons. Value, all ores the week, $543.590.

Smelteries closed down by striking workmen some time ago have not been restarted, reducing the production of spelter in Oklahoma. Mines that were to close down this month will continue in operation for a few weeks, keeping the mines drained awaiting proof of the permanency of the higher prices being now offered for ores. Buyers are finding it almost impossible to fill orders, on account of the restricted output.

Platteville, Wis., May 24—Blende, basis 60%, $41 base, both for premium grade and high-lead grade. Lead ore, basis 80% lead, $54 to $56 per ton.

Shipments reported for the week were 2012 tons blende, 40 tons galena, and 336 tons sulphur ore. For the year to date the totals are 39.783 tons blende, 1897 tons galena, and 4964 tons sulphur ore.

During the week 3351 tons blende was shipped to separating plants.

Other Ores

Molybdenum Ore—No business reported.

Tungsten Ore—Chinese ore was still purchasable at $7. Business in high-grade Bolivian ore was done at $9@10.25. In general there was a distinctly better tone in this market.

Other Minerals

Pyrites—Spanish pyrites is quoted at 20c. per unit for furnace ore and 18c. for unbroken ore, c.i.f., New York or other Atlantic port.

Iron Trade Review

PITTSBURGH—May 27

A further and marked increase in the volume of steel orders being placed is to be recorded. The first improvement was noted in this report last week, the turn occurring between ten days and a fortnight ago. The change is purely in the volume of purchases, there being no difference in the character of buying or in delivery periods, except that there has been a little contracting for bars for third quarter. Testimony is uniform that the buyers are the same as formerly, purchases being for jobbing distribution and ordinary manufacturing consumption. Orders for steel for construction purposes are not in evidence.

The improved demand for steel evidently reflects increased general business activity and does not indicate the inception of new building projects, except, of course, dwelling-house construction, which is on the increase.

The increase in buying may be approximately sufficient to arrest the decline in mill operations that has proceeded steadily since early in the year, and to cause an increase. Steel production averaged 77% of capacity in March and 65% in April, the rate at the present being probably 55% or a trifle less. In the case of a number of producers the current bookings, including both new orders and specifications against contracts, are running at more than 60% of capacity. As practically all the buying is for immediate deliveries, there is no reason to suppose that it will not continue, except that there may be a slackening in July and August, which normally are dull months.

Two things are noteworthy. First, that it was a common prediction, toward the close of the war, that about six months would be required for readjustment, before there would be really active business, and such a period has expired, the present improvement dating almost precisely from a time six months after the armistice was signed; and, second, that there is no activity worth mentioning in the direction of new construction involving the use of steel, which is always necessary in order to afford full operation for the steel industry. As noted in previous reports, a great deal of construction work has been figured upon, but there is no disposition as yet to let contracts.

An exception to the general character of the steel buying, that it is only for immediate deliveries, is the fact that some steel-bar contracts have been made in the past few days for third quarter. No price guarantee is given, but if an accident should happen to the market the buyers could withhold specifications.

There are diverse influences as to prices. On the one hand, the improvement in the general tone of the market has encouraged the leading interests that were committed to the idea that prices should be maintained, and they are even stronger than formerly in that position. On the other hand, the appearance of greater demand has given encouragement to mills that were disposed to cut prices, and considerable price cutting is occurring in nearly all finished-steel products. Thus far at least the general stability of the market is not threatened. The probability is that Mar. 21 prices will be maintained, nominally at least, for several months. If construction work, including railroad rehabilitation and expansion, does not begin at these prices, and it is made clear that a start could be produced by lowering prices, the steel market will probably be thrown open, but the real test as to this cannot come before next autumn and perhaps not until next year.

Pig Iron—The pig-iron market continues stagnant, with transactions confined to small lots, which go at regular prices or at slight concessions. Merchant production is now light, and it is possible consumption exceeds production. Few furnaces are accumulating iron. Though soft, the market is quotable at former prices: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh. One furnace interest with $1.10 freight to Pittsburgh also quotes these prices at furnace.

Ferromanganese—The market continues quiet, with resale 80% at about $110, delivered, though this price has been shaded in some instances. Makers quote $150, which is nominal. Stocks, however, are steadily being exhausted and a regular market will have to be developed soon. This can hardly be at the present $150 asking price of producers, as even imported material is available at much less, perhaps at about $116 at seaboard. Spiegeleisen remains about $33@35 for resale 18%, with no transactions reported.

Coke—Connellsville coke production has dwindled to almost insignificant proportions, about 80,000 tons a week, or one-fourth the rate during nearly all of last year. Byproduct production has decreased little. Spot Connellsville furnace coke is quoted usually at $4, but this price could probably be shaded 10 to 20c. Second-half contracts should be under negotiation soon, but furnaces are showing little interest. Foundry coke is stronger, at $4.50@5, depending on brand.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75.630	88.702	101.125	36.682	44.356	48.419
Feb	77.585	85.716	101.125	37.742	42.792	48.027
Mar	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505		37.940	48.980	
June	76.971	99.500		39.065	48.875	
July	79.010	99.625		40.110	48.813	
Aug	85.407	100.292		43.418	49.077	
Sept	100.740	101.125		50.920	49.500	
Oct	87.332	101.125		44.324	49.500	
Nov	85.891	101.125		43.584	48.969	
Dec	85.960	101.125		43.052	48.492	
Year	81.417	96.772		40.851	47.516	

New York quotations cents per ounce troy, 999 fine. London pence per ounce, sterling silver, 925 fine.

STOCK QUOTATIONS

N. Y. EXCH.†	May 27
Alaska Gold M.	3½
Alaska Juneau	[illegible]
Am.Sm.&Ref.,com	8[illegible]
Am.Sm.&Ref.,pf	107½
Am.Sm.Sec.,pf.,A	‡93
Am. Zinc	17
Am. Zinc, pf	59½
Anaconda	70½
Batopilas Min.	2
Bethlehem Steel	79½
Butte & Superior	25
Butte Cop. & Zinc	13½
Cerro de Pasco	45
Chile Cop.	25½
Chino	40
Colo. Fuel & Iron	47½
Crucible Steel	80¾
Crucible Steel, pf	100
Dome Mines	14¾
Federal M. & S.	16
Federal M. & S., pf	44¾
Great Nor., ore ctf.	4[illegible]
Greene Cananea	44¼
Gulf States Steel	73¾
Homestake	85
Inspiration Con.	59
International Nickel	28½
Kennecott	36¾
Lackawanna Steel	84
Mexican Petrol.	182¾
Miami Copper	28
Nat'l Lead, com.	77½
National Lead, pf	109
Nev. Consol.	17½
Ontario Min.	8¾
Ray Con.	23
Republic I.&S.,com.	87½
Republic I.&S., pf.	104
St. Joseph Lead	14
Sloss-Sheffield	63
Tennessee C. & C.	14¾
U. S. Steel, com.	107⅝
U. S. Steel, pf.	115¾
Utah Copper	80½
Va. Iron C. & C.	67
Worthington Pump	69½

BOSTON CURB*	May 27
Boston Ely	2½
Boston & Mont.	70
Butte & Lon'n Dev.	15
Calaveras	1½
Chief Con.	3½
Contact	.05
Cortez	15
Crown Reserve	.35
Crystal Cop.	.12
Eagle & Blue Bell	2½
First Nat. Cop.	1⅛
Gadsden Cop.	3½
Houghton Copper	75
Intermountain	‡ 05
Iron Blossom	28
Iron Cap	10
Majestic	19
Mexican Metals	19
Mines of America	‡ 05
Mojave Tungsten	20
Nat. Zinc & Lead	12
Nevada-Douglas	.12
New Baltic	1
Oneco	.50
Pacific Mines	‡ 25
Rex Cons.	14
Yukon Gold	75

SAN FRAN.*	May 27
Alta	‡ 08
Andes	30
Best & Belcher	20
Caledonia	24
Challenge Con.	‡ 03
Confidence	25
Con. Virginia	1 95
Gould & Curry	10
Hale & Norcross	25
Jacket-Cr. Pt.	20
Mexican	52
Occidental	40
Ophir	1 55
Overman	10
Savage	20
Sierra Nevada	15
Union Con.	35
Utah Con.	‡ 01
Belmont	‡3 50
Jim Butler	37
MacNamara	98
Midway	48
Mont.-Tonopah	20
North Star	09
Rescue Eula	22
West End Con.	2 05
Atlanta	04
Booth	09
Comb. Frac.	04
Florence	40
Jumbo Extension	13
Kewanas	04
Nevada Hills	06
Nevada Packard	20
Round Mountain	.30
Silver Pick	.07
White Caps	18

COLO. SPRINGS*	May 27
Cresson Con.	4 50
Doctor Jack Pot	‡ 03
Elkton Con.	05
El Paso	17
Gold Sovereign	‡ 02
Golden Cycle	1 74
Granite	14
Isabella	05
Mary McKinney	07½
Portland	1 00
United Gold M.	15
Vindicator	30

BOSTON EXCH.†	May 27
Adventure	1¼
Ahmeek	76
Algomah	‡ 61
Allouez	39¾
Ariz. Com.	13¾
Arnold	‡ 20
Bingham Mines	9½
Bonanza	‡ 20
Butte-Balaklava	60
Calumet & Ariz.	65½
Calumet & Hecla	410
Carson Hill	‡13¾
Centennial	‡13
Copper Range	47¾
Daly West	‡3½
Davis-Daly	6½
East Butte	11¾
Franklin	3
Granby	‡66¾
Hancock	5½
Hedley	‡12
Helvetia	6½
Indiana	‡ 50
Isle Royale	32
Keweenaw	1½
Lake	4½
La Salle	3¾
Mason Valley	3¾
Mass	5¾
Mayflower	9
Michigan	7
Mohawk	65
New Arcadian	2½
New Cornelia	19¾
New Idria	10¾
Nipissing	12¾
North Butte	12½
North Lake	90
Ojibway	2½
Old Dominion	38
Osceola	55
Quincy	68½
St. Mary's M. L.	‡58½
Santa Fe	‡ 25
Seneca	25
Shannon	3½
Shattuck-Ariz.	‡11
So. Lake	1¾
So. Utah	27
Superior	7½
Superior & Bost.	3
Trinity	3½
Tuolumne	1¾
U. S. Smelting	69
U. S. Smelting, pf.	49½
Utah Apex	3½
Utah Con.	10½
Utah Metal	2¾
Victoria	2½
Winona	1½
Wolverine	19½

N. Y. CURB†	May 27
Am. Tin & Tung.	[illegible]
Big Ledge	[illegible]
Butte & N. Y.	[illegible]
Butte Detroit	.03
Caledonia	.38
Calumet & Jerome	[illegible]
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.10
Con. Ariz. Sm.	1¼
Con. Coppermines	5¾
El Salvador	4½
Goldfield Con.	18
Goldfield Merger	‡ 05
Hecla Min.	5½
Howe Sound	4¾
Jerome Verde	‡ [illegible]
Louisiana	
Magma	‡31
Marsh	08
McKinley-Dar-Sa.	62
Milford	‡ 75
Mother Lode	44
Nixon Nevada	21
Ohio Cop.	‡ 50
Rawley	‡2½
Ray Hercules	‡2
Richmond	‡ 50
Rochester Mines	22
Standard S. L.	[illegible]
Stewart	25
Success	‡.05
Tonopah	3½
Tonopah Divide	9
Tonopah Ex.	2½
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	4⅛
United Verde Ext.	39
United Zinc	‡ 25
[illegible] Mines	‡ 08

TORONTO*	May 27
Adanac	20
Bailey	03
Beaver Con.	45
Chambers Ferland	‡ 10
Coniagas	2 10
Hargraves	04
Kerr Lake	5 75
La Rose	35
Lake Shore	1 00
Min. Corp. of Can.	2 00
Peterson Lake	07
Teck-Hughes	15
Temiskaming	40
Wettlaufer-Lor.	03
Davidson	‡ 68
Dome Exten.	30
Dome Lake	20
Hollinger	6 75
McIntyre	1 75
Newray	12
Porcu. Crown	30
Vipond	20
West Dome	[illegible]

*Bid prices. † Closing prices. ‡ Last quotations.

Engineering and Mining Journal

June 7, 1919

Volume 107 *Number* 23

THE BEGINNINGS OF GOLDFIELD, NEVADA

State Industrial Insurance in Nevada

BY JAY A. CARPENTER*

Industrial insurance was started in Nevada in 1913. It was made voluntary on the part of the mining companies as to whether they would take advantage of the act. The rates established varied from 0.5 to 3% of the payroll for different kinds of workers in the mining industry. The total compensation for death ranges from $125 in the case of a single man without dependents to a maximum of $80 per month where a family is left. In the two-year period, July 1, 1916, to June 30, 1918, a total of $328,943 was collected in insurance premiums upon a total payroll of $14,891,436, covering mining operations in copper, silver, gold, and other mines in the state. The act has been economically administered and has received whole-hearted coöperation from the mining industry of Nevada. In 1918, 6295 men were employed in the mines of the state. Record shows milling to be almost as dangerous as mining.

THE first Nevada industrial insurance act was passed in 1913. It covered a wide range of industries, including mining. The legislation was not compulsory, but employers were required to give notice of rejecting the act, or they were presumed to have accepted it. The law gave a tabulated list of accidental injuries, with the compensation for each, extending from an injury that caused partial disability for over two weeks up to accidental death. The administration of the statute was assigned to a commission that was given authority to levy such rates upon the payrolls of the separate industries as were deemed necessary to carry out the provisions of the act.

The commission established the following rates upon the mining industry: All workmen underground, 2.5% of the payroll for that class of employees; shaft sink-ers, 3.0%; surface workers, 2.0%; reduction workers, 1.25%, and clerical employees, 0.5%. The maximum payment to any one individual was limited to $120 for one month, and anyone whose duty caused him to visit underground workings was classed as an underground workman.

---

*Mining engineer, Tonopah, Nevada.

In 1917, the industrial act was amended to a considerable extent. One amendment provides that only such employers come under the act as specifically accept it by notifying the commission. Another requires employers to estimate the premium on the future month's payroll and pay in advance. The two amendments were the results of successful suits against the commission by workmen injured at small mines operated by companies which had not given notice of rejection, but had not paid the industrial insurance.

Compensation for Injuries

The compensations for injuries were made higher and are as follows: For temporary total disability extending over one week after injury, the compensation is 50% of the wages, but not to exceed $70 per month or extend over 12 months, and for permanent total disability it is 50% of the wages, but not over $50 per month, to extend for life. In case of death, the compensation varies from only $125 for burial expenses in the case of a single man without dependents, to $36 per month to a widow until death or remarriage, with $12 per month for each child under 18, provided the total compensation does not exceed $80 per month.

The foregoing figures are stated in the act as a percentage of the workman's pay, but are given here for a workman who earns the maximum rate figured of $120 per month, which is practically true of every employee of a mining company in Nevada today. In the case of partial dependents, their allotment is a percentage of the amount for total dependents to correspond with the percentage of the total monthly wages that the deceased had been sending or giving them. In case the dependents are aliens not living in this country, compensation is 60% of the regular amount. For partial permanent disability there is a wide range of compensation to suit the nature of the disability.

These compensation figures were higher than those of the original act, and as the commission did not feel that enough reserve funds had been accumulated under the old rates, it changed the rates. As the amounts that the commission had paid out for compensation in the mining industry had been higher than expected, the rates for mining and milling were increased, and, at the same time, the rates were reduced in nearly all other industries. The mining rate was increased to 3.5% and the milling rate to 2.0%, both to be figured on the gross payroll. The mining rate included all mine workers, whether surface, shaft, or underground. The Nevada Mine Operators' Association objected to this increase, as its members considered it unnecessarily large, and that, as the compensation was based upon a maximum pay of $120 per month, the assessed rate should not be applied to any sum over $120 paid to any individual. In the case of high-salaried employees, ranging from $5000 to $10,000 per year, whose underground risks are very light, the companies were forced to pay from $175 to $350 accident insurance per year for each employee.

The result of this increase in rates, and a great deal of valuable data on industrial insurance, are given in the biennial report of the Nevada Industrial Commission, recently issued. It covers the period from July 1, 1916, to June 30, 1918. In this period $328,943 in insurance premiums was collected upon a total payroll of $14,891,436, covering mining operations in copper, silver, gold and other mines. In this time, 1921 accidents were reported, of which 449 were minor injuries of less than a week's duration. There were 47 accidents resulting in death or permanent total disability and 164 of permanent partial disability.

In the case of fatalities, the average compensation paid out, or estimated to be paid out in monthly instalments, was $3211 per fatality. In one-fourth of the fatalities there were no dependents and the compensation was only that of burial expenses, and in one-tenth there was left a widow with three or four children, in which cases the compensation is estimated at over $8000 per case.

Total Compensation Liability

The total liability for compensation on the 1921 cases is estimated by the commission at $328,943, which amounts to 2.21% on the total payroll exposure. The administration cost was 8.5% of all the premiums collected. The mining premiums averaged 3.3%, giving an administration cost of 0.27% on the payroll. The total cost then becomes 2.21% plus 0.27%, or approximately 2.5%. The commission steadily lowered the mining rate from 3.5%, until on Oct. 1, 1918, it again reached 2.5%, which the commission states is "believed to represent the actual cost of furnishing the compensation provided in the act for mining operations under the present scale of benefits and wage conditions." However, the milling rate, which was originally 1.25%, and which was increased in 1917 to 2.0%, was again increased on July 1, 1918, to 2.25%, as the estimated compensations alone in the two-year period amounted to 1.92%. From these figures it is apparent that the mill man in Nevada has nearly as dangerous an occupation as the miner.

Ample Reserve Is Accumulated

As a result of the sharp increase in mining rates in 1917, giving an average of 3.3% for the two years, the premiums collected exceeded the 2.5% actual cost by over $110,000. The commission shows a much smaller excess in other individual industries. This gives a ample reserve for a $100,000 catastrophe fund, and the commission suggests that the excess over this amount be prorated to the industries.

The commission has over $500,000 invested in first-class county, state, and national bonds, this amount being more than enough to cover all book reserves for pensions allowed and liability for pending claims.

Administration Cost Is Low

The administration cost of 8.5% of the premiums collected is a low figure and reflects credit upon the state and the commission. The marked advantage of state insurance over that in private companies lies in the small percentage of the premiums required to conduct the business. A reliable authority on liability insurance companies states that the rates are usually set so that the losses are not more than 40% of the premiums. In the case of private companies seeking business, the usual commission to agents alone is 5.0% of the premiums collected. One of the largest and best mutual life insurance companies in the United States shows on its recent annual statement a total administration cost of 30% of the premiums collected, which includes, among other expenses, commission to agents, taxes, and office rents. With state insurance these heavy items are eliminated. However, with state insurance, as with other state-controlled industries or departments, there is lacking the incentive to economize for the purpose of increasing earnings that is nearly always present in private enterprises, and there is the temptation to employ much unnecessary help and to be generous or even prodigal in the payment of fees, traveling expenses and the like, to gain political prestige and to fatten the rather slim salaries prescribed by the state.

The excellent record of the Nevada Industrial Commission for economy and efficiency should be a matter of pride to the people of the state. Credit should be given also to Governor Boyle, himself a mining engineer, and to the Nevada Mine Operators' Association for their interest in the success of the industrial insurance act, and for their aid and advice to the commission.

THE NEVADA CONSOLIDATED COMPANY

The Nevada Consolidated Copper Co. did not at first elect to come under the provisions of the act. On account of its large number of employees, the company was able to insure with private companies at a low rate, and its officials were probably skeptical of state insurance. Later the commission gave the company a special rating by putting it in a class by itself. In the last two years this company has paid an average premium of 1.82% on a total payroll of over $9,000,000. The total compensation for injuries amounted to 1.60%. As this leaves only 0.22% for administration, it is evident that the company has had insurance at cost without the annoyance and the friction of damage suits that accompany the usual industrial insurance.

All the other mining and milling companies of Nevada in the same two years paid an average premium of 2.95% on a total payroll of over $19,000,000, and the compensation for injuries amounted to 2.0%. It is probable that the average employee of the Navada Consolidated, with its caving system, open-pit operations, and its mill and smeltery work, has as great an inherent hazard in his work as the average employee in the other mines and mills of the state, and, therefore, the smaller percentage on the payroll paid out for compensation at the Nevada Consolidated is probably the result of a persistent safety-first campaign and excellent first-aid and hospital facilities.

It is probable that several of the large mines of the state had as low an accident record as the Nevada Consolidated, but other less fortunate or less careful companies had an undue number of accidents. By Sec. 22 of the amended act, the commission is given the right to advance the premium rates of any establishment that is more dangerous than other similar works. The commission has wisely hesitated to use this authority, but has recommended that it be allowed to give special lower "merit" ratings to the contributor that makes special provisions for avoiding accidents and shows less accident compensation than other similar contributors.

The original act primarily dealt only with compensation for injuries, and did not provide for the cost of medical attention and hospital facilities. As these items are necessary to keep minor injuries from developing into compensation cases, and upon the theory that if the industry is morally liable for compensation for accidents to its employees it is also responsible for medical and hospital attention, the act was so amended in 1917 as to make it compulsory upon the industries to give such attention to their employees in case of accident, and to provide for state insurance, as in the case of compensation, for accidents. To cover the cost of this insurance, the employer pays an accident-benefit premium upon his gross payroll, but the law allows the employer to collect not over $1 a month from each employee as the workman's share of the cost of this protection.

Companies having their own hospital are not required to insure with the state, but they must furnish the same benefits to the injured employee, which are defined as prompt "medical, surgical, and hospital or other treatment, nursings, medicines, medical and surgical supplies, crutches, and apparatus, including artificial members, as may be reasonably required at the time of injury and within 90 days thereafter, which may be extended to one year by the Nevada Industrial Commission." These companies are also allowed to collect $1 a month from their employees. The commission is given general authority over the hospital associations in respect to the physicians employed in case complaints are made by employees as to the medical treatment received. In the case of the small companies insuring with the state, the commission sets a scale of fees for medical and hospital attention, and the injured employee is taken to the nearest place equipped for proper treatment. The injured man is given his choice of physicians. It is obligatory on the employer to render first aid and to take the employee to the doctor or hospital if necessary.

ACCIDENT-BENEFIT PREMIUM

The commission set the accident-benefit premium at 75% of the compensation-premium rate. In the year period 1917 to 1918, a total of $29,095 was collected on a gross payroll of about $3,300,000. The cost of all medical treatment was under $10,000, leaving an unexpected surplus. As a result, the rates for 1919 are materially reduced, except that in the mining and packing-house industries the rate remains the same. As the mining rate for 1919 is 2.5%, the accident benefit rate is 1.875 per cent.

Only about one-fifth of the employees covered by state compensation insurance are covered by the state accident-benefit insurance, owing to the large number of hospital associations. For an employee earning $5 per day working for 30 days the insurance costs $2.80, of which the employer is allowed to collect $1 from the employee, making the net cost $1.80. With the hospital associations the cost to the companies will average from 50 to 75% of this amount. The higher cost of the state insurance is due to the fact that it covers all the more remote and isolated mines of the state and does not have the compensating advantage of the large mines and camps. The larger hospital associations give the employee for his $1 per month not only medical and hospital attention for accidents, as the law requires, but also for nearly all forms of sickness and ill health. The smaller associations as a rule have an agreement whereby the employee pays an additional dollar for this extra service.

Before 1913 Nevada was a backward state in the matter of industrial insurance. The courts were filled with damage suits. The matter of compensation for injuries was a sore spot between employer and employee, and the first step in the case of an accident was to prepare for a legal battle. It was incumbent upon the company to prove, if possible, that the accident was the result of the man's own carelessness, whereas the injured man tried to prove that it was due to the negligence of the company or one of its employees. Many an engineer and company employee have been placed upon the witness stand as an unwilling witness either by the request of the company or by an injured fellow workmen. Such trials fanned the flames of mutual distrust and animosity between employer and employee. The damage suits were always for large sums, out of all proportion to the present compensation rate, as the injured employee or his heirs ran the risk of losing the suit and by agreement signed away the lion's share of the possible judgment to the attorney as his fee and court expenses. A jury trial was usually demanded, and the employee was likely to win in the lower courts, which resulted in more expense and long delays for appeals and review of the case by a higher court. One case went to the U. S. Supreme Court.

The result as to compensation was a great inequality. A discouraged employee either settled for a pittance, or was given an excessive amount by a legal judgment. In any case the employee had high medical and hospital bills that he could not usually pay, thus throwing him upon the charity of the company, his friends, or his union. With a family man even a minor accident was to be dreaded by the whole family. The mining engineer who has seen the carefully nursed profits of months wiped out by lawyers' fees and a judgment, or has witnessed the pitiful poverty and hopelessness of a home where the wage earner is laid up by a serious accident, can realize what a blessing accident relief and compensation laws with state insurance are to both employer and employee.

Nevada is now one of the foremost states in industrial insurance. Today an injured man is given the best of care from the moment of his injury; he and his dependents are assured that they will not suffer from actual want, and his mind is relieved of the worry and fear that delay recovery. The employer no longer dreads the trouble and cost of damage suits and is no longer deeply concerned as to the relative responsibility of the man and the company for the accident, but his one concern is to see that the man gets the best of care. Though the cost of the insurance is relatively high, all other employers in his industry have the same expense, and therefore, in a measure, the cost is added onto or figured into the selling price of his product.

NECESSITY FOR WORKMEN'S PROTECTION NOT RELIEVED BY SAFETY FIRST

The importance of this protection to the workman in the metal mines is shown in the fact that, in spite of all the safety-first work and safety appliances of the last two years, the report of the commission shows that the average mine worker will meet with one accident in approximately every five and a half years that will lay him up from one week to eternity, with the chances of it being the latter about 1 in 32.

Only 10 years ago the first state industrial compensation act for the purpose of transferring to industry the cost of accidents arising in that industry was declared unconstitutional by the Appellate Division of the Supreme Court of the State of New York. It is strange that the old doctrines of common employment, contributory negligence, and acquiescence that had been discarded years before by the monarchies of Europe still found acceptation in the courts of our country and that the only method of obtaining compensation was by the employer's liability under the common law.

The old monarchies of Germany and Austria had for years not only industrial compensation laws, but also required employers to insure with the state against these risks. However, when the justice of it all struck home to the American people, and American legislators became more imbued by the Roosevelt idea of the "square deal," the progress was rapid and the country can expect still more rapid progress along humanitarian lines, because the American people have been awakened and broadened in their sympathies by their sacrifices for the sake of humanity in the Great War. It is now possible to look forward with confidence that the new laws will not place too heavy a burden of taxation upon American industries and state governments, because the high cost of government in the last two years, and the present method of direct income taxes reaching nearly to the income of the average laborer, have awakened the American citizen, by a direct touch upon his pocketbook, to the necessity of an honest, economical government.

Uses of Mercury*

The use of mercury for thermometers consumes, according to F. L. Ransome, only a small fraction of the total quantity produced. Mercury is a constituent of many drugs and chemicals, including calomel and corrosive sublimate, and mercuric oxide and mercury salts are used in the manufacture of certain chemicals of which the mercury itself does not form a part. For example, in one process of producing glacial acetic acid, acetylene is oxidized with mercuric oxide, the same lot of mercury being used repeatedly. Mercury is used also in making phthalic anhydride and phthalic acid, organic compounds which are employed in the dye industry but which themselves contain no mercury.

The use of mercury fulminate as a detonator has expanded enormously with the increase in the variety and efficiency of the high explosives now manufactured for industrial and military purposes, and, although primers have been made of other materials, especially for small arms, no substitute has found general acceptance.

Quicksilver is now used extensively in the manufacture of anti-fouling ship-bottom paint. The consumption of quicksilver in gold-dredging and other placer operations is still large. In gold-quartz mills, however, the amalgamation process has been partly supplanted by cyanidation.

Among the varied uses to which quicksilver is put may be mentioned also its employment in dental amalgams; in the manufacture of laboratory air pumps and other scientific instruments; in thermostats, gas governors, and similar appliances; in mercury-vapor electric lamps; in compounds for preventing scale in steam boilers; in cosmetics; in certain electrolytic processes for the manufacture of chlorine, caustic soda, and picric acid; in primary batteries, electrolyzers, rectifiers, and other electrical equipment; and in felt making.

---

*Excerpt from *Bull.* 666-FF, U. S. Geological Survey

Alsatian Potash Industry

SOON after the United States entered the Great War, one of the German newspapers advanced the claim that the reason for America's entry was to secure a supply of potash from the Alsatian potash deposits. Ridiculous as this claim may have been, it is interesting to note that French engineers have already visited the Alsatian potash mines to survey the damages caused by the late intensive operations of the Germans, and to determine the best methods of rehabilitating this Alsatian industry. Their reports are not yet available; but Charles Bonnefon, a special writer for the *Echo de Paris*, followed the French engineers and has written an account of his trip. Though his point of view is that of the layman, some parts of his articles are of especial interest and are reproduced herewith:

"The Alsatian potash deposits are found at depths varying between 450 and 760 m. The shafts are generally twin shafts and communicate. . . . There are two superimposed potash beds, the upper having an area of 90 sq.km. and the lower covering about 200 sq.km. The first has an average thickness of 1.8 m. and the second 4 to 5 m. The salts contain 20 to 22% of pure potash on the average, but vary from 9 to 40% or even higher.

"I descended the Théodore shaft, the richest in the district, to see if the rumors that the Germans had 'gutted' the mines were true. . . . Stepping out of the cage, our party entered a rose-colored gallery in which small cars were in operation. To the right and to the left on the walls, the vein was exposed in thin horizontal but regular bands of yellowish rock salt and sylvinite (sylvite). One sees the whole gamut of hues, from the most delicate rose to a bright red, cut by white bands. Along the slate roof of the gallery the timbers give evidence of the crushing weight of the mountain, and presently it is necessary to stoop. Then the gallery enlarges, and we find ourselves in a chamber 6 m. in height with the gray arch supported by rose-colored pillars cut in the solid salt. This attractive color is not due to the potash content but to the iron which the salt has absorbed. On the right and the left are black openings obstructed in some cases by blocks of broken salt. In one of the openings a drilling machine is being operated by two workmen. Twenty holes have been drilled to a depth of 1.5 m. The holes are later loaded, and, after taking up the track, everyone leaves. The dynamite does the work; not a pick is needed.

"In general, the damages caused by the Germans in the potash mines have not been great, except through intensive operation without proper regard to the work of conservation of the mine openings. It is necessary to do much repairing, to reconstruct incline planes, battle with the crushing weight of the mountain and the water and to do other nonproductive work. The workers now receive from 8 to 19 fr. per day and work underground six hours per day. These reasons, the rise in wages, the increase in the number of workers, and necessary restoration of the mines, explain why the potash industry here is today losing money.

"In the Reichsland works I observed the rose-colored crystals being transformed into the purified white salt of commerce. The larger blocks of crude salt are delivered to a crusher, the product from which passes over a moving grizzly. The small pieces go directly to a roller mill. The product is then screened and passed to a second mill. Oversize is returned until it is ground sufficiently fine. The ground mixture of rock salt and potassium chloride contains from 9 to 22% potash, figured as pure K_2O. A common grade is 14%, and this appears in commerce as 'kainite,' though in reality the Alsatian product is sylvinite (sylvite) and does not contain a trace of sulphate.

"The lower-grade salt is dried in long furnaces and sold, without refining, to the agricultural industry. The richer salt running up to 22% is treated for the separation of rock salt and potassium chloride. An Archimedean screw conveys the powdered salts into a series of vats under which a fire is maintained. The salts there encounter a current of water saturated with common salt. The potassium chloride is taken into the solution, which refuses the common salt. After 'cooking' slowly in the vats, the mixture flows away and is delivered into long storage reservoirs or vats. At the end of several days, when the solution has become cold, the bottoms of the storage vats are covered with a white bed about 50 cm. thick. This deposit is taken up with shovels and loaded into cars. It is KCl of 80% tenor, or may be even up to 98 per cent.

"The Alsatian potash industry will bring back to the country, if our exploitation attains a half of the German exportation, a net profit of 40,000,000 fr. per year, but there remain to be solved the problems of manpower, and the refinancing of these enterprises.

"In the archives of the Reichsland works I found some statistics which characterize the activity under the German régime. General estimates have placed the value of the Alsatian potash industry at from 20,000,000 to 60,000,000 fr., but little reliance can be placed on these estimates, as the Germans have been anxious to include this in their final accounting. Tomorrow such estimates might have to be reduced one-third—if one discovers additional deposits or manufactures or finds a better fertilizer. Before the war Germany had a monopoly which permitted her to maintain remunerative prices. Whether the competition that will certainly ensue between Alsace and Stassfurt will come to a head in a new convention or not, the total value of the potash mines will be affected by this changed ownership. Although the Franco-Alsatian group occupied second place in the number of concessions, nine-tenths of the production was in the hands of the Germans. The value of the German investment in this industry, counting all elements, such as amortization, interest on capital, and like charges, reached 65,000,000 fr. This is the sum we shall have to give the German owners or have the German government reimburse the German stockholders.

"The statistics show that the Alsatian potash industry was only at the beginning of its development. If the Alsatian output formed only a small part of the German sales before the war, this was due to the fact that all the shafts were not yet sunk, nor were all the refining works completed.

"In 1914 there were 210 shafts in Germany and Alsace. Only a single Alsatian shaft possessed a complete installation giving it the right to a quota-part or definite allotment of the production. All the other Alsatian shafts—Amélie II, Joseph, Else, Max, Marie-Louise, Marie, Théodore, Prince Eugène, Alex, Rudolph, Reichsland Est, Reichsland Ouest—12 in number—had received a provisional quota-part which would not exceed in any case 2.380 thousandths of the total production, i e., one-half of the definite allotment obtained by dividing 1000 by 210, or 4.760 thousandths.

"All the Alsatian shafts that attained completion during the war obtained their definite allotment, which was raised to six or eight thousandths of the German production. Their capacity was thus judged superior to that of the average installation. The Alsatian deposits are, in fact, richer than the German.

WORKING SHAFTS IN 1919

"In April, 1919, five shafts were working: the Reichsland, Théodore, Alex, Max, and the Marie-Louise. Of these, three had complete installations: the Reichsland, Théodore, and the Max. The actual production is 2000 tonnes per day. In three months the French officers have been able to double the Alsatian production. In July, 1919, Amélie I, Amélie II, Marie, Joseph, and Else will be repaired. The production will then exceed 5000 tonnes. By January, 1920, Reichsland and Prince Eugène will again be in working condition, which should bring the production up to 6000 tonnes. By 1922, Anna I, Anna II, Enisheim I, Enisheim II, and Rudolph having completed their shafts, the total Alsatian production should reach 9000 tonnes per day.

"Germany in 1914 extracted 16,000,000 tonnes of crude products, from which she obtained and sold 1,110,309 tonnes of pure potash (theoretical figure obtained by adding the amount of pure potash contained in the various mixtures). She exported 484,254 tonnes of concentrated and purified potassium chlorides (80% KCl). At this time the Alsatian output represented 48-1000 of the German production.

"We are thus in the presence of an industry at its beginning and which we receive from the hands of the Germans in a state of nearly complete preparation. We can produce daily only 400 tonnes of purified potassium chloride (80% KCl), and it is only this product that the United States needs. The area of France is slightly smaller than that of Germany in 1913, and if we wish to enrich our land as Germany has hers we should produce about the same amount as she uses at home. It would be necessary for us to place in order the flooded or obstructed shafts (nine in number), to secure in the shortest possible time mechanical drilling machines, to repair the reduction works damaged by our shells, to sink 40 or 50 new shafts, and, in short, to increase our facilities to a point capable of producing 300,000 tonnes of 80% salt per annum. The official figures indicate that it will be necessary to provide large capital in order to enter into serious competition with the German industry.

"The concessions accorded in Alsace up to the present number 112, of which 33 belong to the Société Franco-Alsacienne (Group Sainte-Thérèse). The other 79 concessions are held by the three German groups as follows: Deutsche Kali-Werke (the Stassfurt trust) 51 concessions; Wintershall, 13 concessions; Roechling, 15 concessions. Different opinions have been offered as to how we should exploit these rich resources, but, whatever solution is adopted, a serious financial effort is necessary to place France in the first rank of potash production."

Underground Mechanical Loading

Underground shoveling by mechanical means has received considerable attention during the last few years, and it is believed that the following notes, abstracted from "The Use of Shoveling Machines in Underground Mining" (Myers-Whaley Co.), will be of interest in that connection:

In a magnetic iron-ore mine a Myers-Whaley machine, working in a stope, loaded from 150 to 170 tons per eight-hour shift, and was operated by a crew of two men. The machine was frequently stopped while waiting for cars; also during the time that the track was being cleaned and the boulders were being blasted. In development work, during 213 shifts of operation of the machine, 18,517 tons was shoveled, an average of 87 tons per shift, at a cost of $3530.81 or 19.07c. per ton.

In a red hematite iron ore mine, one of these machines loaded 87 cars, or about 148 tons per shift, working on a 12% grade. The ore here occurs in a pitching formation, main levels being driven from the slope opening to the right and left across the pitch. From these auxiliary slopes are driven down the pitch, and the rooms from which the production is obtained are turned off from the auxiliary slopes across the pitch, so that the room tracks are on a grade of not over 3 to 4 per cent.

The system of hauling is by ropes on the slopes, and horses are used to shift the cars in the rooms. Rooms are 24 ft. wide and about 10 to 12 ft. high. The weight of the rails used is about 40 lb., and 24-lb. steel is used for balance rails. The room space is drilled with 6-ft. holes, and the entire face of the room is shot down at one time, making approximately 150 tons per shot. The tracks are laid up within about 10 ft. of the standing face before the face is shot, so that the ore is shot down upon the tracks. Under these conditions and during 12 working days when the machine was under operation the mine was operating on single shift, and each machine loaded an average of 200 tons per shift.

The machine crew consisted of one operator and two car shifters. The operator was paid 26c. an hour plus a bonus of ½c. per car up to 100 cars and 1c. a car for each car over 100 cars. Car shifters were paid 25½c., with the same bonus. The total cost of the crew on a basis of 200 tons for a ten-hour shift was $10, or a labor cost of 5c. per ton. Hand loading is done on the same basis. The hand shovelers are paid 25½c. per hour, plus a bonus as follows: On the first 10 cars, 25½c. per car, and if they load more than 10 cars they are paid 1c. a car additional. The average loading was 10 cars, or 15c. per ton for the hand loading.

An example of the capacity and cost of shoveling with one of these machines in tunnel work is given in connection with a 10 ft. x 14-ft. tunnel in a gold mine in South Africa. At this place the shoveling machine competes with cheap labor, the Kafirs being paid 62c. for eight hours' work. The time for cleaning up a shot with machines was from 2 to 2½ hours, making the saving in the time of mucking about three or four hours, as it required from five to seven hours to muck out a shot before the machine was installed. Previous to the installation of the machine, the heading had been advancing about 130 ft. per month. The work was immediately increased after the installation of the machine to about 170 ft. per month. The labor cost of mucking with the machine was $3.22 per round. The cost of mucking by hand was about $12.60 for the same work.

Car Dumpers*

By JAMES A. JACKSON†

Although the present use of car dumpers in the metal-mining field is not extensive, there may be considerable application for them in that industry, especially where it is desired to empty cars with dispatch and the capacity handled by the dumper is sufficient to warrant such an installation. The operation of car dumpers in general is outlined and the outstanding features of different types are discussed in the following article, which recommends electric-power operation.

CAR dumpers are used for dumping coal, ore, limestone, or other kinds of free-flowing bulk freight from open-top standard railway cars commonly known as gondolas. The operation is carried out by inverting the car until its entire contents are dumped. The devices for this purpose may be divided into two general classes, the side-dump type and the end-dump type, the latter being little used, in this country.

The side-dump type can be further divided into two general classes, the turn-over type and the lift-and-turn-over type, each of which can be either movable or stationary. The first of these does not elevate the car more than is actually necessary to turn it into an inverted position. The stationary type usually dumps into transfer cars or on conveyors; but, if movable, these auxiliary devices can be omitted, and the dumping take place directly on stockpiles or into boats. The second type elevates the car vertically before starting to invert it, so that the car will be high enough to discharge directly into large vessels or high storage bins. This type is seldom made movable, on account of its height.

General Construction of Car Dumpers

The general construction of all types of dumpers consists essentially of a structural steel framework, rectangular in form, and containing a cradle to which the car is securely clamped during the dumping cycle. This clamping is done entirely automatically by an ingenious system of clamps, actuated by counterweights, which are so arranged as to accommodate themselves to all sizes of cars. In most dumpers, these counterweights serve two other purposes, the first being to assist in starting an overturned car in the downward direction, and the second having for its purpose to slide the car sidewise and hold it firmly against the side of the cradle.

To accomplish the sidewise sliding, the track on the cradle is carried on a platen which is supported on wheels and moves in guides to keep it in alignment. Some of the clamp counterweights are connected by ropes to this platen in such a manner that, as soon as the cradle starts to move upward, the platen and car move sidewise until the car comes up against the wooden bumpers on the side of the cradle. It is then held there throughout the dumping period until the cradle arrives at a point a short distance from the bottom, where a series of mechanical arms are used as a means of pushing the platen back against the action of the counterweights. This aligns the dumper tracks with the stationary tracks, and, as the top clamps have been automatically released, the car is ready to be pushed off the dumper by the next loaded car bumping into it. From the foregoing, it will be seen that a car is supported on the bottom, top and one side throughout the dumping period.

Differentiation of Motions Necessary in Operation of Car Dumper

The operation of a lift-and-turn-over dumper is similar to that of the turn-over type, just described, in so far as the rotation and the action of the platen and counterweights are concerned. In addition, however, the cradle and car are first lifted vertically to the desired height, at which point the hinge on the cradle engages the rotation pin and stops the vertical motion. The roping is so arranged that the motion of the cradle is immediately changed to one of rotation, thus dumping the car. In lowering, the reverse operation occurs, that is, the cradle is first rotated to a horizontal position, at which point the hinge and its pin are unlocked, permitting vertical motion downward to the starting level. One method of roping, the use of which prevents severe shocks and strains, is to reduce the speed of the cradle at the moment when the hinge pin engages in hoisting and when it disengages in lowering. When disengaging, wheels on each end of the cradle come in contact with vertical guides, which maintain the alignment of the cradle during the vertical lift, and, unless the speed is low, a severe side thrust is thrown on the dumper framework. With electrically operated dumpers, these slow-downs are obtained automatically by limit switches.

Factors Affecting Power Consideration

The power required to operate a car dumper is necessarily large, both on account of the heavy weight to be handled and because of the speed which must be made to make the dumper a profitable investment. Ordinarily, power requirements for the cradle hoist alone are from 400 to 800 hp., and even to 1000 hp. in some cases, to which must be added the requirements for any auxiliary equipment, such as the Barney haul, pan hoist, revolving chutes, conveyors, and other machinery.

Throughout the operating cycle on any specific dumper, the power requirements are continually varying, owing to the shifting center of gravity of the load, to the changing lever arm on which the rope acts, and to the action of the counterweights. Graphically, this makes an irregular power curve which varies in shape according to the physical dimensions and design of the cradle. In other words, almost any two different designs of dumpers will give different shaped power curves.

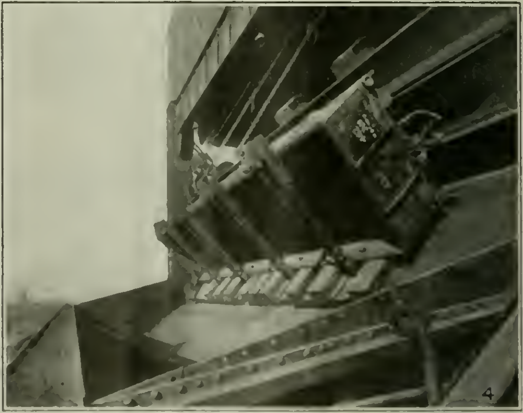
For some reason which does not seem to be entirely clear, the majority of dumpers installed up to within the last few years have been steam operated. A plausible reason seems to be that electric power in sufficient quantities has not been available in many places. However, where obtainable, electric power is more economical than steam, for no power is consumed unless the dumper is actually moving.

---

*Abstracted from *General Electric Review*, May, 1919.

†Power and mining engineering department, General Electric Company.

Electric power is more flexible, for the control can be entirely automatic after the dumper has once been started by the operator. It requires less ground space, for all the electrical machinery can be installed in a house on top of the framework which supports the cradle. Lowering can be accurately controlled by dynamic braking, and can be varied over a wide range of speed if necessary without special attention on the part of the operator. Maintenance cost is low and the labor requirements are small, as, aside from the operator, it is only necessary to have an electrician give the equipment a regular daily inspection and renew such wearable parts as contactor tips, controller fingers and segments and motor brushes when necessary. Another advantage is that the operator's cab may be conveniently located at the most desirable point. Electric power is essential on the movable type of dumper, for in this case the entire dumper structure, with its machinery, travels on tracks so as to dump at different points, which makes it necessary to conduct the power to the dumper by trolley wires.



HIGH LIFT ELECTRICALLY EQUIPPED CAR DUMPER AT SEMET SOLVAY COKE PLANT, INDIANA HARBOR, INDIANA
1 General view of the plant 2 Showing cradle in lowest position with car in place 3 Showing cradle just passing the rotation pin. 4 Car in completely dumped position.

If electric power is determined upon, the question of direct current versus alternating current must be decided. Direct current has some advantages for this service, although an alternating-current equipment can be designed which will give satisfactory operation. Braking is required throughout the entire lowering cycle. This action can be obtained simply and safely by dynamic braking with direct-current motors; whereas, with alternating current, dynamic braking requires a more complicated equipment, and is not so safe as with direct current. Furthermore, the torque characteristics of direct-current motors are somewhat more favorable for the service, and the torque is independent of the voltage. Direct-current control equipment can be laid out to give emergency dynamic braking, which will prevent a runaway should the power supply fail and the solenoid brake fail to hold the load. This cannot be done with alternating-current power, and the solenoid brake must be depended upon to prevent damage in emergencies. Positive low speeds while starting, stopping, and at the rotation pin are easier to obtain with direct-current than with alternating-current equipment.

A typical direct-current installation would consist of one or more motors of heavy design, with solenoid brakes such as are used in steel-mill service, regulated by magnetic control, and operated from a master switch in the operator's cab. The motors should preferably be compound wound, with sufficient shunt field to give a no-load speed of about 150% full-load speed, although series motors are often used successfully. Compound-wound motors give a more uniform speed, regardless of the weight of the car being handled. Also, dynamic braking and a "kick-off" can be obtained more efficiently, as the shunt field can be depended upon to insure excitation, instead of separately exciting the series field, as would have to be done with a series motor.

The service is such as to require an open-frame motor, as the heating is too severe for a totally inclosed motor. In figuring a duty cycle, the rest period between trips plays an important part in determining the best size of motor and should be given careful consideration. It is advisable in many cases to work out two duty cycles, the first of which would be based on handling the maximum number of cars possible for two hours, that is, the rest period would be a minimum. The second cycle would be based on the average number of cars which the dumper would be likely to handle in a 10-hour day. This would give a longer rest period, as it is unusual to be able to bring loaded cars to a dumper as fast as it can handle them for 10 consecutive hours. Motors could then be selected which would handle the average 10-hour load continuously and the maximum load for two hours without overheating. This would result in an economical electrical lay-out.

The motors should be equipped with full-torque shoe-type solenoid brakes, usually shunt-wound, to secure more economical operation in lowering.

The magnetic control equipment must be laid out to give automatic acceleration in the hoisting direction by cutting out series resistance, and must give at least one positive low-speed point by a resistance shunting the motor. In the lowering direction, a "kick-off" torque must be provided to accelerate all parts to full-speed rapidly, after which the torque must change to dynamic braking automatically, and thus lower the load safely at the correct speed.

ABSOLUTE CONTROL OF VARIOUS PHASES OF OPERATION NECESSARY

Automatic deceleration should be provided in the lowering direction, to prevent too high torque and current peaks, with consequent dangerous mechanical strains when the master switch is thrown suddenly to the "off" point. The control must have a speed protective relay to prevent too high a speed when it is found necessary to lower a loaded car. It should retain dynamic braking connections in the "off" position of the master switch and also maintain a dynamic braking circuit in case the power fails. A limit switch geared to the hoist drum must automatically provide an automatic slow-down and stop at each end of the travel; and, in the case of a lift-and-turn-over dumper, it must also provide an automatic slow-down and acceleration when passing the rotation pin in each direction.

CONSIDERATIONS IF ALTERNATING POWER IS USED

If alternating-current power is to be used, the motor must be of the wound-rotor slip-ring type, with open frame, and be equipped with a full-torque shoe-type solenoid brake. The control should be full automatic and provide current-limit acceleration in the hoisting direction. In lowering, either of two different methods can be practiced. The first uses dynamic braking throughout the entire lowering cycle by applying direct current, from a small special motor-generator set, to one phase of the stator winding of the induction motor. The second uses regenerative braking except during the slow-down period, when dynamic braking would be applied by supplying direct current to the stator winding, as in the first case. This second plan has the advantage of being more economical in power, and it provides a "kick-off" to get the car started down quickly. It has the disadvantage that in changing over from regeneration to dynamic braking there is an instant when no power at all is applied to the motor, and means must be provided to prevent the solenoid brake from setting at this time. Furthermore, it is more complicated than the first method. If the first scheme is used, the dumper must have sufficient downward pull in any position to break the static friction and accelerate all the machinery, as no "kick-off" can be provided. This slows up the cycle. With either operating method, the solenoid brakes must be depended upon to stop the load if power fails, as no emergency dynamic braking can be obtained. For this reason it is advisable to have a separate powerful emergency brake, weight set, and operated through a suitable trigger which will trip from a flyball governor if the speed attains a definite amount above normal. Both schemes require a special motor-generator set for supplying direct-current excitation at the proper voltage.

TWO OR MORE MOTORS IN PARALLEL

The shape and general lay-out of a car dumper are such that two or even four small motors operating in parallel work to better advantage than does a single large motor, and consequently dumpers are generally built in this way. The characteristics of direct-current series motors are such that two or more operating in parallel will inherently divide the load equally when hoisting, and it is not at all difficult to make them divide the dynamic braking load by adjusting the resistors. Compound-wound motors will usually divide the load near enough for all practical purposes when hoisting, and they also can be easily made to divide the braking load when lowering by resistor adjustment. Alternating-current slip-ring motors, however, have characteristics which do not favor parallel operation, as their speed-torque curve is too flat over a wide range of torque; hence the layout of an alternating-current operated dumper might have to be such as to sacrifice some good points in the machinery design and arrangement to make it adaptable to one-motor operation.

Where two or more direct-current motors are operated in parallel, it is customary for each one to have its own contactor panel and resistor and to operate all the panels in parallel from one master switch. With such an arrangement a disabled motor or panel can be quickly cut out by disconnecting switches and the operation continued at reduced capacity.

Recalculated Payable Ore Reserve at the Government Areas, according to the *South African Mining Review*, is given as 9,445,000 stoping tons, assaying $8.27 per ton over a stoping width of 78 inches. This constitutes the largest ore reserve ever developed by a Rand mining company, the reserve of the New Modder, which has long been preeminent in this respect, being 9,000,000 tons (as of June 30, 1918), valued at $8.90 per ton over 65 inches stoping width.

The United States Assay Office

THE U. S. Assay Office, New York, pays for each ounce of pure gold 1000 fine, $20.671,834,625, which figure is used in all calculations. Silver 1000 fine was paid for at the rate of $1 per oz. recently when the market was at the fixed price of $1.01⅛ for silver bullion, 999 fine. All silver deposits, which have been paid in silver certificates during the war, on and after May 1 will be paid in silver bars, 999 fine or over. Manufacturers who have had to pay bullion brokers a premium will find this an advantage. No deposits of less than $100 in value will be received. No platinum is handled by this office. The office is self-supporting through charges made for services to the public.

The average fineness of all the refined gold from the New York Assay Office has been 999.65 during the last year. Gold which when received is 999 fine or over is usually not refined but kept in stock. The greater proportion by far of the gold received is used for purposes other than currency. During the month of April, $4,000,000 in gold bars was sold, largely for dental and jewelry work. These bars are made from 5 oz. in weight up, but the usual size is 20 to 25 oz. Certificate bars are made with slight variations of a weight equivalent to about $8000 value per bar, and these are deposited with the Government, against which paper certificates are issued, thereby avoiding the minting operation, effecting a considerable saving, and relieving the bank and Treasury Department from the necessity of holding the coin.

Copper and platinum are recovered from the bullion, but lead is not, as the cost of recovery would exceed the value. Deposits are weighed on scales sensitive to .001 oz. for each draft, the maximum draft being 10,000 oz.

The melting and various other charges involved in the selling of bullion to the mints and assay offices of the United States are given in the following, which is reprinted from a circular issued by the Director of the Mint and effective Jan. 1, 1919:

MELTING CHARGE

On each deposit of bullion a melting charge of $1 shall be imposed for the first 1000 oz. or fraction thereof, and 10c. additional for each 100 oz. or fraction thereof in excess of 1000 oz., computed on the after-melting weight: Provided, That no melting charge shall be imposed on deposits consisting of uncurrent United States coin or stamped mint fine bars; or on silver bullion free from gold, of the fineness of 998 thousandths or over, when a satisfactory assay can be obtained without previous melting.

On deposits carrying nonmetallic material or separate particles of nonprecious metals, when the melting loss exceeds 25%, an additional charge of $1 for each deposit shall be imposed when the deposit weighs 150 oz. or less. On such deposits weighing over 150 oz. the charge shall be in accordance with the extra expense of melting operations.

TOUGHENING CHARGE

Deposits which fail to give concordant assays shall, at the discretion of the officer in charge, be subject to an additional charge equal to the cost to the Government for fuel, labor and materials used in remelting and treatment by the deposit melter. Impure deposits which fail to give concordant assays on dip samples from the second melting shall be returned to the depositor and the expenses incurred in treatment collected.

WITHDRAWAL AND REJECTION OF DEPOSITS

Deposits may be withdrawn by depositors at any time before payment is tendered for same, and thereafter at the option of the officer in charge of the mint or assay office, subject to payment in cash of such charges for melting, etc., as have been incurred up to the time of withdrawal. Rejected deposits (all those containing 800 thousandths or more of base metals must be rejected) are subject to payment in cash of such charges as have been incurred up to time of rejection.

PARTING AND REFINING CHARGE (RATE PER GROSS OUNCE OR FRACTION)

Class A.—Bullion containing gold and silver

Gold Content		Base Content	
Thousandths	Charge	Thousandths	Additional Charge
¼ to 250	$0.005	For each 100 or fraction thereof in excess of 50 up to 150	$0 005
250¼ to 500	.02	For each 100 or fraction thereof in excess of 150	01
500¼ to 949¾	.04	For each 100 or fraction thereof in excess of 150	.01
950 to 991¾	.02	.....	.....
992 to 1,000	...	(No allowance for silver content)	......

Class B.—Silver bullion free from gold

Silver Content	Charge
700 thousandths or less	$0.04
700¼ to 850 thousandths	.02
850¼ to 950 thousandths	.01
950¼ to 997¾ thousandths	.005
998 thousandths or over, if payment is demanded in bars of a higher fineness or if it is necessary to refine such bullion	.003

Upon bullion with but one precious metal present and having base content which is suitable for coinage alloy, including foreign coin and domestic mutilated or uncurrent coin, a refining charge will be imposed only when payment is demanded in fine bars, viz.:

Silver deposited for fine silver bars	$0.005
Gold deposited for fine gold bars	.01

When bullion contains less than one-fourth thousandth of gold and less than 8 thousandths of silver the gold or silver content shall be reported for benefit of depositor.

Gold coin containing over 8 thousandths of silver acquires the status of bullion and is subject to appropriate charge for refining.

ALLOY CHARGE

Two and one-half cents per ounce for the copper required for alloy, to be determined by taking one-tenth of the fine weight of gold, except when the base in the deposit is suitable for alloy purposes and the fineness above standard, in which case the alloy shall be determined by taking the amount of copper required to reduce the bullion to standard fineness.

BAR CHARGES

Bar charges as below shall be imposed when bars are sold or when a depositor requests, directly or indirectly, special size bars in payment for a deposit.

Gold bars may be sold only when of standard fineness or above, for gold coin or gold certificates only, and in lots of not less than $5000.

Silver bars may not be sold except upon special authorization.

GOLD-BAR CHARGES

	Per $100 Value
Bars of $5000 in value and over	$0 05
Bars of less than $5000 to $500, assorted sizes	05
Bars of less than $500, assorted sizes	07
Bars between $300 and $200, in lots of 20 bars	09
Bars of a fineness of 999.9, not over $5000	09
Bars of a fineness of 999.9, over $5000	08

SILVER-BAR CHARGES

	Per Ounce, Gross
Bars of standard silver	$0 00[illegible]
Bars of fine silver, not less than 500 oz	00[illegible]
Bars of fine silver, between 125 and 500 oz	00[illegible]
Bars of fine silver, 125 oz. or less	00[illegible]
Bars of unparted bullion	00[illegible]

ASSAYS OF BULLION AND PLATED WARE

	Charge
Gold samples	$2.00
Silver samples	2.00
Plated ware, rolled or filled (may be refused)	4 00

ASSAYS OF ORES

	Charges
Gold and silver	$1 00
Copper, tin, zinc, iron, lead, and tungsten (each)	1.00

Assays of ores will be made at the minor assay offices and the mints at New Orleans, La., and Carson, Nev., charges based on metals determined in sample.

The charges and regulations in the circular are as officially approved by the Secretary of the Treasury under date Nov. 25, 1918.

The Lance Creek Oil and Gas Field Of Wyoming

A detailed examination of the Lance Creek oil and gas field, in east-central Wyoming, about 25 miles west of the east line of the state, was made in September and October, 1918, by E. T. Hancock, of the U. S. Geological Survey, and a report describing and mapping the field is now being prepared. The purpose of this examination was to supplement the general information available by making detailed studies of the geologic structure, to determine as definitely as possible areas in which oil and gas may be found in commercial quantity.

The center of production in the Lance Creek field is about 75 miles nearly east of the Big Muddy field and about 90 miles east-southeast of the Salt Creek field. The discovery well in the Lance Creek field, in Sec. 36, T. 36 N., R. 65 W., was brought in at a depth of 3665 ft. by the Ohio Oil Co. on Oct. 6, 1918. At that time the yield of the well was estimated at about 1200 bbl. a day. Recently the Illinois pipe line was completed to the well, and, according to reports published in oil and gas journals, the well is producing about 2000 bbl. a day. The oil is low in sulphur, is of high specific gravity, and contains from 35 to 40% of gasoline.

About 2½ miles southwest of the discovery well the Ohio Oil Co. drilled another well, which is reported to be producing 8,000,000 cu.ft. of gas per day. Between that well and the discovery well is a big gas well brought in by the Buck Creek Oil Co. According to reports, this well is capable of producing about 60,000,000 cu.ft. of gas per day. The recent drilling of another 2000-bbl. well in the NW. ¼ Sec. 3, T. 35 N., R. 65 W., seems to show that the oil pool extends at least 2¼ miles further southwest. This well was drilled by the Ohio Oil Co. and is owned jointly by the Ohio Oil Co., the Midwest Refining Co., and the Buck Creek Oil Co. The Ohio Oil Co. is drilling another well in Sec. 33, T. 36 N., R. 64 W., about 3½ miles further east, and the Glenrock Oil Co. is drilling in Sec. 36 of the same township, almost exactly six miles east of the discovery well. The drill at each place is reported to have reached a depth of about 4000 ft. As these wells are far east of the productive area, they are naturally being watched with great interest.

On Oct. 6, 1918, when the discovery well was brought in by the Ohio Oil Co., about 22 rigs had been completed, but according to the *Wyoming Oil News* for Apr. 5, 1919, at least 125 rigs had then been completed and 35 wells were drilling below 1000 feet.

Geologic Structure in the Field

The field which is being tested with a view to ascertaining the limits of productivity occupies a great arch, or anticline, of sedimentary beds, the crest of which can be traced with considerable accuracy for about 18 miles. This crest forms a reversed or sigmoid curve which is believed to extend from Sec. 5, T. 35 N., R. 65 W., northeastward to the Ohio No. 1 or discovery well, near the northwest corner of Sec. 36, T. 36 N., R. 65 W., and from the discovery well almost due east to a point one-eighth of a mile south of the center of Sec. 25, T. 36 N., R. 64 W., and from that point a little east of north to the point where Buck Creek cuts across the Fox Hills escarpment, in Sec. 29, T. 37 N., R. 63 W. The extension of the crest of the arch southwestward is somewhat obscured by the overlap of White River beds.

The beds on the northwest flank of this great arch gradually steepen from a dip of 3° near its north end to 27° on Lance Creek, and from Lance Creek southwestward the dip is fairly uniform. The beds on the opposite flank of the arch dip southeastward for an indefinite distance at an angle of 2½° to 5°.

Outcrops Indicate Major Uplift

The outcrops of granite and overlying Paleozoic limestone at and north of Lusk, at Rawhide Butte, and near Hartville, all in direct line with the Old Woman anticline, strongly indicate the existence of a major uplift extending from the Old Woman anticline a little west of south for many miles. As the axis of this great uplift is only six or eight miles east of the Lance Creek anticline, the gently dipping beds southeast of the axis of that anticline doubtless soon become horizontal as they approach the larger uplift.

The Fox Hills sandstones, which at one time arched over the Lance Creek anticline, have been eroded away, and the surface along the crown of the arch has been formed on beds that lie several hundred feet below the top of the Pierre shale. The relatively low and even surface eroded on the shale is limited on the north by the conspicuous ridge formed by the Upper Cretaceous Fox Hills sandstones and on the south by younger Tertiary beds, which conceal the older formations in that direction for many miles.

Identity and Depth of the Productive Formations

Most of the work now being done to obtain oil is confined to the relatively low area between the outcrop of the Fox Hills sandstones on the north and the rim of Tertiary beds on the south. The beds that outcrop at the discovery well lie about 1300 feet below the base of the Fox Hills formation, and this depth, added to that of the well, 3665 ft., gives 4965 ft., the depth of the principal oil sand stratigraphically below the base of the Fox Hills formation.

If future development in this field shows that the oil comes from a sand higher than the Dakota, then the Dakota, Lakota, and still lower sands may be possible reservoirs of oil and gas. Even if the present supply of oil and gas is derived from the Dakota sandstone, there are still lower sands in Wyoming which contain oil and gas. In the Powder River field, for example, oil occurs in at least two sands in the Morrison and in small quantity in the Sundance formation. Furthermore, in the Old Woman anticline, about six miles from the Lance Creek field, considerable oil was found in what is believed to be the Minnelusa sandstone, a formation that lies much lower, belonging to the Carboniferous system.

French Imports of Lead in January, 1919, amounted to 432 metric tons, according to a recent issue of the *Ironmonger*. In January, 1918, and the same month of the preceding year, lead imports were 3117 and 5083 metric tons, respectively. According to the same source of information, lead ore was imported into France as follow: 76 metric tons in January, 1919; 4486 in January, 1918, and 4944 metric tons in January, 1917.

Making Sharp Drills Effective

By HARRY E. SCOTT*

CONSIDERING the amount of steel which has been sharpened by writers in the *Journal* and many other mining papers in the last year, there should be a large percentage of the drills in good condition. This being the case, would it not be a good idea to repair a few machines, and get them in condition to use this sharp steel?

The ability to take a pencil and figure out how deep a drill will penetrate the rock at each blow is not mine. From the time I used air drills on which the chuck wrench was nearly as heavy as the up-to-date machines, to the present, I have been kept busy trying to make the boss pull out a little more tape line each month and use a little less powder to pull the ground. So I have had no time to get down to $\frac{1}{16}$ and $\frac{1}{32}$ in. for each blow. The dark, deep-cut holes that would break were of more interest to the employer.

Writers on the subject never mention whether the tests have been made in a snow bank or in boulder granite, and consequently it is hard for a miner to tell whether he is keeping up to date or not. If the bit penetrates the rock $\frac{1}{16}$ in. at each blow, as some say it will, then the old timer will have to go, together with the piston drill, to the junk pile; as eight blows should clear the hole to *that depth*, 1200 blows a minute, well—pretty fast. The slides on the shell would begin to warm, and a motor would be needed on the feed screw.

No good drill man will use dull steel when he can get sharp steel, but there are times when it is necessary to fight a hole with dull steel for a few inches, when the steel is cut up into different lengths. In the shop, as a rule, drills are so made that one steel has to be run out before the next one will take hold. Should the gage become worn and the bit dull, on a starter or second before it is run in full length, one of the same kind will not go into the hole, as it is too large. The longer one will not go because there is not room; hence the dull one must be run out. This often happens in hard ground.

Many drill men are better off with dull steel than with sharp, as they cannot drill as deep holes with the dull steel, and consequently cannot get as much powder in them to waste. They put their holes in the easiest and most convenient place they can find, caring little how much ground they pull. All they are there for is to get in the shift. The question of footage never enters their gray matter.

Machines Must Be in Good Condition

There is no doubt that sharp steel is better than dull; but, if the machine has not the "kick," the work will not be up to the standard, regardless of the drills. The managers and superintendents of most mines give little or no attention to keeping the air drills in proper condition. They have the impression that as long as a machine will run it is all right, provided there are sharp drills.

In many mines the following conditions or similar ones prevail: A drill runner goes to his place of work when he goes on shift. In due time he gets a steel in the chuck and is ready to drill. He opens the throttle. The hammer may not strike a blow, or it may not hit with any force. The night shift has done something to it. The drill man on shift takes a monkey or Stillson wrench and goes after it. In taking it apart he loses the pawl plungers. The pawl springs look bad; the pawls are worn and the rifle bar is in bad condition. After a search for a cager or nipper, he sends for the parts, which *he thinks* the machine needs. By the time he gets the drill working again, from two to four hours of the shift are gone. No drilling has been done, and $10 worth of new parts have been used. In this case a sharp bit will accomplish no more than a dull one.

Another drill man finds himself in the same condition, but not being of a mechanical turn of mind he looks for another machine, and, if lucky enough to get one, sends his own on top. It eventually gets to the blacksmith shop, where it is thrown in the dirt until the blacksmith, his helper, or possibly some surface employee has time to work on it. It is put in the vise or, more often, lays on the floor while being repaired. It is taken apart, cleaned and put together with a few new parts from the storeroom—always new parts—at an expense of from $1 to $30, and the old parts are thrown on the junk pile.

Is this drill in good condition when it is returned to the mine? No one knows. There is no way of testing it in the shop. When the drill runner gets it he knows whether it has a good "kick" and if it rotates properly, but he knows nothing about the amount of air used to operate it. The air may be leaking through some part of the drill, or the valve may not be cutting off properly.

The idea that an air drill is "fool proof," and that any person on the job can repair it, is a mistake. A drill must be cared for properly, as well as any other piece of machinery. No matter how good the operator, it needs overhauling at certain intervals, in a shop fitted for that purpose and provided with a meter for testing the amount of air used. When a compressor making 2000 cu.ft. of air a minute has to be run at maximum speed to furnish air to a number of drills which, if in good condition, would use only 1500 cu.ft., there is something wrong. In most cases it will be found in the air drill.

Air Drill Repair Man

The air drill repair man, or machine doctor, as he is often called, is an important factor. The best repair men are those who have had a few years' experience running machines, and who are handy with tools and mechanically inclined. They know from experience the work to be done, and realize the troubles of the runner, which are many. A man of this kind who had become familiar with the cost of drill parts, and learned to throw nothing away that could be worked over and give efficient service, took a job. During the first 10 days he picked up over $900 worth of drill parts from the dump and junk-pile. These were used, and gave as good results as new parts from the storeroom would have done. They had been thrown away by the man who was repairing drills; and it had taken him only a short time to do it, and with only 16 machines on the job!

Any property using a small number of air drills can support a good repair man—one who can keep the drilling speed up (with sharp steel) and the maintenance cost down. With the machines in good condition, sharp steel, plenty of air and the right man on the crank, there should be no kick from the office concerning the number of feet drilled.

---

*Johnson, Arizona.

Fuel-Oil Distribution System

An arrangement for the control of fuel-oil distribution by compressed air which has proved flexible and yet free from all complications is diagrammatically represented in the accompanying cut. The equipment consists of three pressure-tight storage tanks. The high-pressure air (50 to 60 lb.) is piped to these tanks and is controlled by the valves *A*, *B*, and *C*. Valves *D*, *E*, and *F* (when *A*, *B*, and *C* are closed), permit the exhaustion of the pressure from any tank whenever it is desired to refill that tank. In addition, each of these valves serves as an overflow in case a tank becomes too full. The supply of oil from the three tanks to the service line is controlled by the valves *H*, *I*, and *J*. The valves *K*, *L*, and *M* are used in the filling or transferring of oil from one to the other of their respective tanks. The valve *N* admits oil to the manifold from the main storage or from an oil car. The valve *O* may be used for drainage or cleaning of lines. A few examples of the manipulation of the system will make its advantages more apparent:

1. To fill Tank No. 1 from main supply: Open *D*, making sure *A* and *H* are closed, and allow air pressure in tank to exhaust itself. Then open *N* and *K* and allow tank to fill by gage or until oil overflows at *D*; if there is no gage, then close *D*, *K*, and *N*.

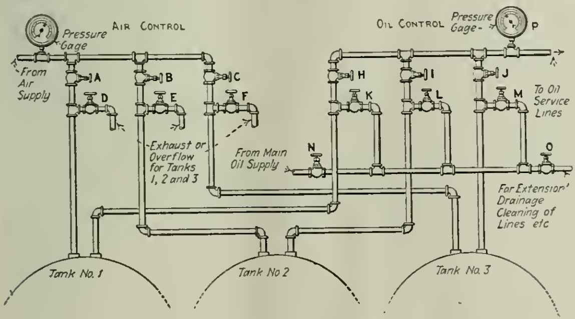


DIAGRAM OF OIL DISTRIBUTING SYSTEM

2. To supply service line from No. 1 which has just been filled: Open *A* and then *H*.

3. To "change over" when No. 1 tank is nearly empty to No. 2, which is full, without interrupting the supply to line: Open *B*, making sure *E* is closed. Then open *I*, after which close *H* and *A*.

4. To transfer oil from No. 3 to No. 1 while supplying service line from No. 2: Open *B*, making sure *E* is closed, then open *I*, thus supplying service line from No. 2. Open *D*, making sure *A* is closed, and exhaust pressure from No. 1; then open *C*, making sure *F* is closed; then open *M* and *K* and allow No. 1 to fill from No. 3. When No. 1 is filled, close *D*, then *K*, *M*, and *C*.

5. To fill No. 1 from No. 3 while supplying service line from No. 3: Open *C*, making sure *F* is closed; then open *J*, thus supplying service line from No. 3. Open *D*, making sure *A* is closed, and exhaust pressure from No. 1. Then open *K* and open *M* as far as possible without lowering the service-line pressure at gage *P* below the minimum required, and allow No. 1 to fill from No. 3. When No. 1 is filled, close *D*, then *K* and *M*.

6. To partly fill only one of the three tanks from either of the two others, without having an employee watching it, e.g. to fill No. 1 from No. 3 while supplying service line from No. 3: Open *C*, after closing *F*, then open *J*. Open *D*, *A* remaining closed. Open *H* as far as possible without lowering the pressure on service line below the required minimum, and after the air pressure has been exhausted from No. 1 tank, close exhaust valve *D* and allow No. 1 tank to fill, compressing the air in No. 1 tank from atmospheric pressure to the same pressure as No. 3 tank, thus having No. 1 tank almost full of oil with air pressure high enough to use immediately, and no possibility of an overflow.

This system of distribution is not only fundamentally simple, but covers every contingency and insures an uninterrupted flow to the service lines. It can be made up of standard pipe fittings, and is so arranged that it may be readily added to or extended.

Tin Mines of Malay States Close Down

Rumors have recently been current that, owing to the closing down of many low-grade tin mines in Selangor and Perak, several thousands of able-bodied Chinese have been thrown out of work, many of them finding it difficult to provide themselves with food and shelter. A report to the Bureau of Foreign and Domestic Commerce states that confirmation has now come from Perak and Selangor correspondents, the former stating that a number of low-grade mines in Ipoh district have been closed, and the latter telegraphing that over 3000 men have been thrown on the labor market in Selangor since the Chinese New Year, owing to the closing down of mines in Sungei Besei and Salak South districts. Presumably a good many of these men will be able to get work on rubber estates, but many hundreds seemingly have not yet done so.

As regards the cause of this crisis in tin mining, it seems that though it paid miners at current prices of tin to work low-grade mines before the war, at present, with charcoal, rice, wages, and all kinds of expenses doubled and trebled as a result of the disturbance of trade, such mines can be worked only at a heavy loss.

Le Roi No. 2, Ltd.

The accounts of Le Roi No. 2, Ltd., for 1918 show a profit for the year of £4918 10s. 3d. During the period covered by the report 19,642 tons of ore was shipped to smelters, the average value per ton being $17.91, as against 10,984 tons, of an average value of $22.86, shipped during the previous year. Mining costs and smelting charges, after allowing for depreciation, aggregated $15.05 per ton, as against $15.82 per ton for 1917.

In view of the ever-increasing cost of production, combined with the serious fall in the price of copper, and also the uncertain market outlook, the directors declare that they do not feel justified at present in recommending the payment of a dividend.

Federal Aid for Prospectors

BY E. J. RISTEDT*

DISCUSSION and formulation of plans and proposed legislation for the purpose of giving citizens of this country, more especially those who have been in the service of the United States during the war, a better opportunity of acquiring and developing Government land for agricultural purposes, affords an appropriate occasion for the consideration of proposals having for their object the extension of the scope of the project to the inclusion of mineral lands. To accomplish this purpose timely aid should be given the prospector.

The race of prospectors is a vanishing one. The younger generation is not attracted to that vocation, and the lack of interest is due in large measure to conclusions that are the results of personal observations. The old-time prospector has so grounded himself in the conviction that some day it will be his turn to win, that he has foregone the pleasures of life and been content to roam, stake his claims and do his assessment work, trusting that he will make enough out of one of his claims to develop the rest sufficiently to attract the capitalist or even to be able to operate them himself. In most instances he had little or no technical education, and his training along geological and mineralogical lines was often of a local nature, making it hard for him to apply his learning in some other district.

The young man of the present day who decides to follow a mining career is more thoroughly prepared than the old timer. A wider education makes him desire better living conditions and a more promising and positive outlook for the future. Then, too, the investing public, so often caught by unscrupulous promoters, demands a more thoroughly developed prospect than formerly before it will relinquish its money. During the readjustment period which the country is experiencing an excellent opportunity is offered for the stimulation of an interest in this initial and essential stage of mining under proper conditions.

The business men of the country express the opinion that conditions are changing. Numbers of them who have held places for their employees until their return are learning that these men, who have had probably their first real experience at out-of-door work, are not content to return to office or indoor tasks, but are willing to accept places at less pay that they may have outside employment. There are many others whose physical condition makes it advisable that they engage in out-of-door work: men who have been gassed or who are recovering from wounds, and who require a year of two years in the open to effect a complete recovery. It is much better that these men be engaged advantageously than to allow them to put in time at a hospital or sanatorium. They could be taught the rudiments of geology, mineralogy, and other necessary branches at the vocational schools in coöperation with the Bureau of Mines. The Bureau should extend this vocational training to others, as needs require, in order to maintain an efficient staff of men in the field and to perpetuate its work.

The Department of Agriculture is fulfilling its function so thoroughly that it is now looked up to by the average farmer as a final authority. It has accomplished this by becoming an aggressive institution, foreseeing conditions, conducting experiments, and then preaching its findings and doctrines directly to the farmer, advising as to the crops that will probably be in demand for the next season, and to a large extent directing the educational work in the country's various agricultural institutions and acting in conjunction with these schools in experimental work.

So it should be with the Bureau of Mines. Acting in an analogous capacity to the soil experts of the Department of Agriculture, the Bureau of Mines should have its prospectors, and so on up through each stage of the mining industry. Mining companies do a great deal more work, relatively speaking, on their technical and experimental problems than does the farmer, and they leave the initial prospecting stages for some one else, a choice that is usually left to chance.

One of the first and easiest steps for the Bureau to undertake in furtherance of a more extensive development of its field would be in the matter of publications, as, for example, in the issue of a clear, concise, and well-balanced "Prospectors' Handbook," describing geological structures that a prospector is likely to encounter, classes and forms in which various minerals occur, and simple tests for determining these; some mining law, the customs of various districts, elements of surveying, and any other information deemed helpful. Through coöperation with the U. S. Geological Survey, some publications covering mining districts could be condensed to a less technical form, which would describe accurately the district and its features in so far as the prospector is likely to be interested.

The actual employment of prospectors in the field by the Government is an important and necessary feature. The men should not be sent out until able to qualify above certain requirements. They should be of two classes, permanent and temporary, both to be paid by the Government. The permanent prospectors and investigators, who expect to do that kind of work permanently and will not be permitted to locate claims in their own names or to own any interest in sections that they have prospected, should be paid according to Government standards in the Geological Survey for work of that class. Those comprising the temporary class, which might well be the larger of the two classes, should receive their appointments for a certain definite period of time, from three to five years, and be allowed to locate a limited number of claims in any district in which they prospect. Their pay should be enough to permit them to live decently and provide means for subsistence while doing assessment work on located claims. They should be permitted leaves of absence from Government work for such periods each year as may be required to do assessment work. Or they might be given an option of working as prospectors for certain stated periods each year.

Prospectors of both classes should work under the direction of a district or state supervisor. They should be required to make regular reports on the districts they were working. The reports should include samples of geological formations encountered, with descriptions, and a compass survey of the section, noting its prominent topographical and geological features. The equipment furnished should be only such as is needed in the field. Any samples requiring qualitative or quantitative determinations should be sent to the supervisor for this purpose.

---

*First Lieutenant, Engineers, c/o Chief of Engineers, U. S. A., Washington, D. C.

The supervisor should be a high-grade engineer or equally qualified man and be provided with headquarters equipped for ordinary requirements. He should be instructed to further the interests of mining in his district, by means of lectures and demonstrations, or by bringing the Bureau of Mines into closer touch with the miner.

To carry this work one step further, a plan should be developed whereby a prospector could receive financial aid from the Government, provided he fulfilled certain necessary conditions. A few suggestions along this line are offered. The regulations should require that there must be sufficient evidence of ore to warrant continuance of operations, and that the claim must be patented and owned or controlled by the person applying for assistance. Corporations should not be eligible for this assistance. The amount that a person is allowed to request should be limited and regulations made regarding the amount of work required of the prospector. In the event that the property becomes productive, or is sold or transferred, the amount advanced by the Government should be refunded with interest. The Government should be considered part owner in the property as long as the borrower is indebted to it, and the amount of ownership should be covered by regulations. If work is discontinued by the owner, the claims should revert to ownership by the Government after three years. Examinations of properties to be so assisted should be made by Bureau of Mines engineers, preferably the supervisor or an efficient assistant, and all operations should be open for Government inspection at all times.

A plan worked out for the benefit of the prospector would result in acquiring an immense amount of valuable information especially useful in a time of emergency. This information could be published as the Bureau sees fit, and mining conditions would be further stabilized by the prevention of publicity having for its object the promotion of "wild-cat" mines.

The Platoro-Summitville District Of Colorado

By Charles S. Barnes*

The Platoro-Summitville district is one of the largest undeveloped mineral belts in Colorado, with well-defined fissure veins, carrying bunches of high-grade ore running several hundred dollars per ton. Shipments have been made to the smelteries in Pueblo and Denver. Some of the ore showed much free gold.

When the slump in silver came, and the rich surface ores changed to a medium grade, carrying considerable quantities of copper sulphides, activities began to slacken, and it was recognized by the operators that the ore in future must be milled on the properties or they would have to abandon the mines. Though large tonnages of surface ores, which were more or less oxidized and too low grade to ship, were treated in local mills at Summitville, by amalgamation and concentration, the larger part of the valuable material floated over the vanners with the tailing, and was lost.

Despite the fact that millions of dollars' worth of gold was saved on the plates and in concentrate form in these old-style stamp mills, fully one-half of the metal in the ore was lost in the tailings. When copper sulphides and antimony were encountered in the lower workings, nearly all the valuable mineral was slimed, and so lost. Milling operations ceased to be profitable, and mills were closed.

Summitville is near the northern limits of the mineral belt, in latite-andesite formation, and, the veins being oxidized to a considerable depth, and carrying free gold, the old-style amalgamation mills were fairly well adapted to the treatment of such ores.

The southern part of the belt in Platoro district is in monzonite-diorite formation of the San Juan volcanic series and an older-lower portion of the same. It is not markedly oxidized, but shows base sulphide ores at the surface. As a consequence, there is no free-milling ore in quantity, as at Summitville, and no mills have been installed. The distance from Summitville to Platoro is about six miles in a north-south direction. There is a giant fault about midway between at the Alamosa River, near Stunner, which is the dividing line between the upper andesite and the lower monzonite formations.

There are large bodies of refractory sulphide ores in the lower workings at Summitville, and also at Stunner, Gilmore, Jasper, and Platoro, awaiting the discovery of an efficient method of beneficiation. A great deal of experimenting with various new processes in the last few years has been done, but no satisfactory method of recovery has been developed. Recently, however, tests made by flotation have shown that the ores of this district are easily treated by this method, and that a high extraction can be obtained.

Many operators are planning to resume work this summer, to repair the roads, install new machinery, and resume development of orebodies. Flotation mills will be installed at an early date, and an effort made to revive a rich mineral belt that has lain dormant for years.

---

*Mining engineer, Monte Vista, Colorado.

Improvements on Mining Locations

By A. L. H. Street*

The right of the locator of a forfeited mining claim, or his assignee, to remove fixtures constructed upon the ground, as against a subsequent locator, was involved in the case of Watterson et al. vs. Cruse, (*176 Pacific Reporter, 870*), decided by the California Supreme Court.

A mines company, as owner of mill-site locations held in connection with lode-mining claims, erected a quartz mill, a dwelling house and a boarding house on the mill sites, and later purported to sell these improvements to plaintiffs, with a right of removal. The company forfeited its rights to the locations by non-performance of labor and non-construction of improvements, and defendant subsequently came into possession of the claims under valid relocations of mining claims.

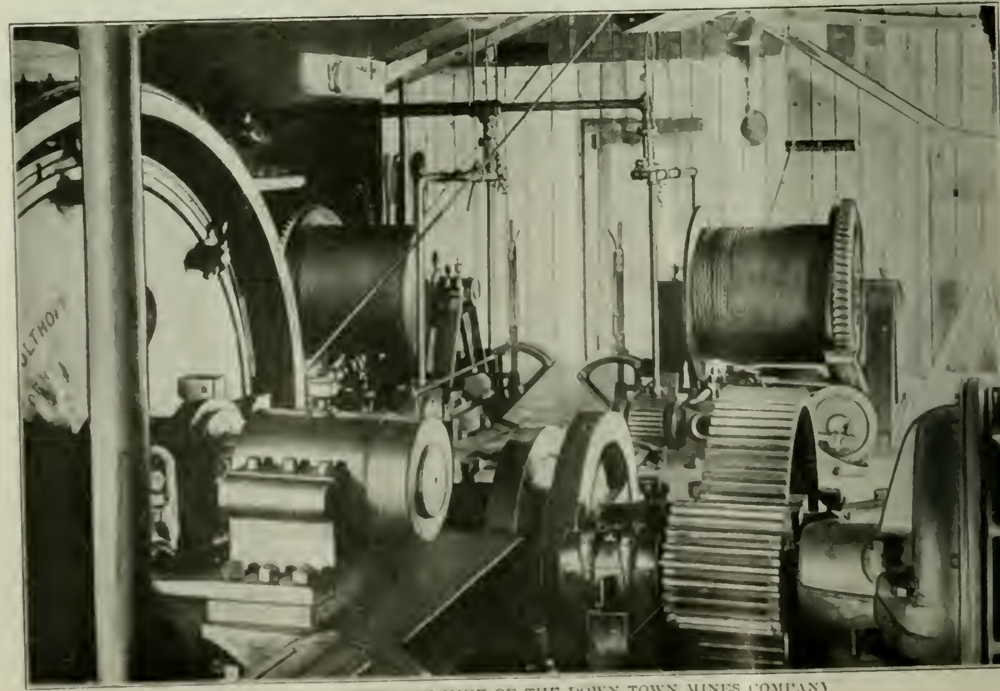
Under these circumstances it is held by the court that the plaintiff acquired no right to remove the mill and other structures as against the defendant. The court holds that where the locator of a mining claim abandons or forfeits the same, together with a mill site, a relocator has the right of possession and enjoyment of buildings and improvements so affixed to the land by the original locator as to become a part of it.

---

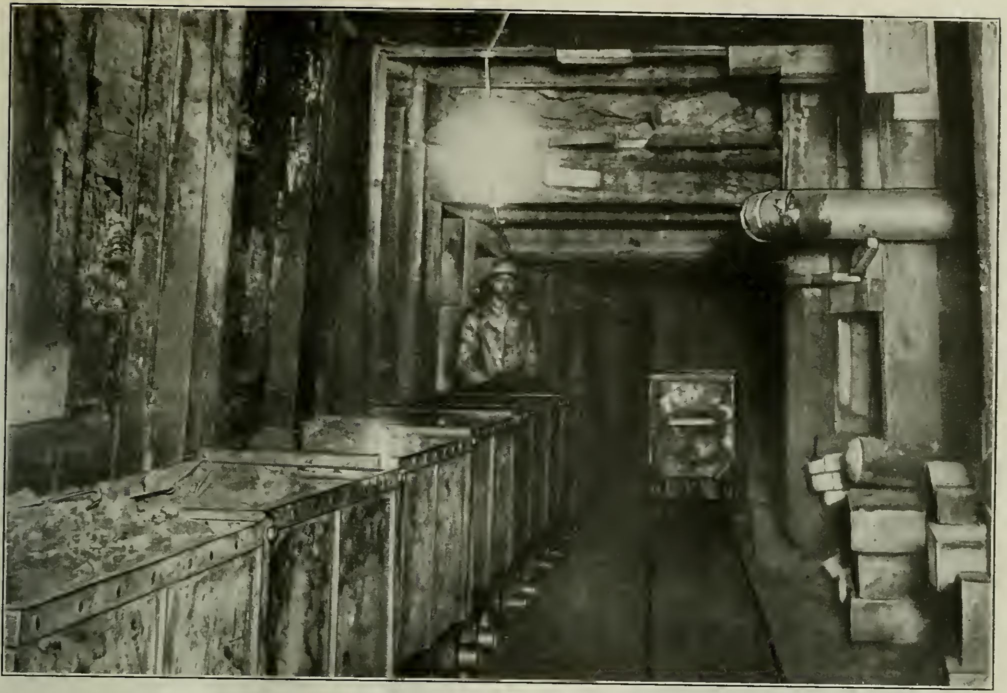
*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Penrose Mine at Leadville, Colorado

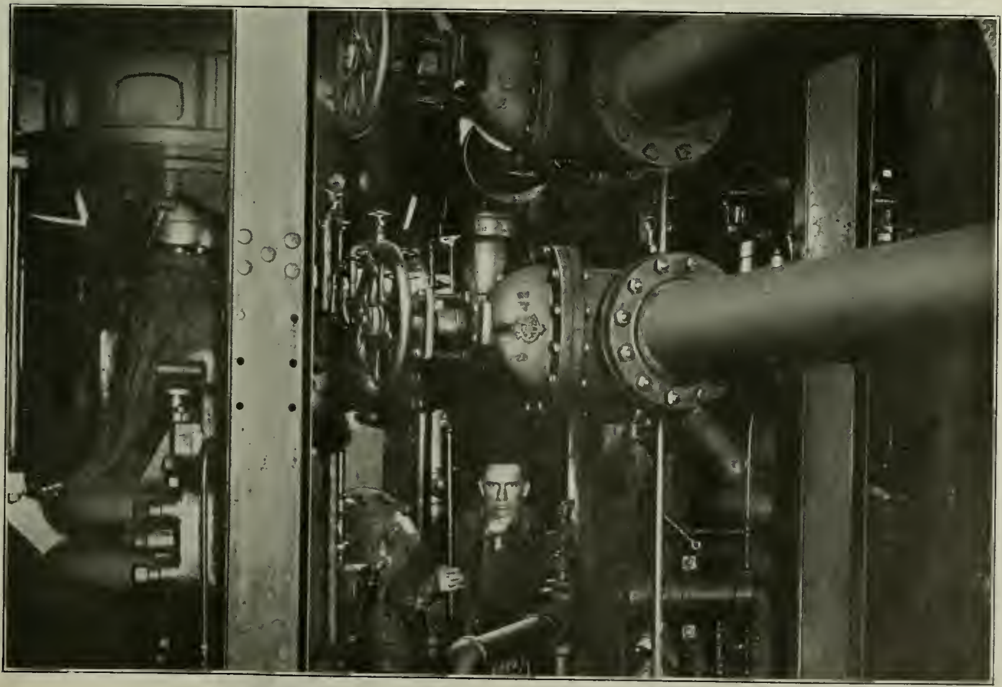
SURFACE PLANT AT THE PENROSE SHAFT, LEADVILLE, COLORADO



HOIST ROOM AT PENROSE MINE OF THE DOWN TOWN MINES COMPANY



EIGHTH LEVEL STATION OF THE PENROSE MINE, LEADVILLE, COLORADO



MOTOR-DRIVEN PUMPS ON THE NINTH LEVEL OF THE PENROSE MINE

The Position of Gold*

By H. N. Lawrie†

The declining production of gold, not only in the United States but also in practically all gold-producing countries, has excited the interest of economists and prompted inquiry into the significance of the annual gold production in relation to international trade. The increase in the cost of producing gold, the position of the United States as a creditor nation, and the fact that stimulation of trade will be of marked benefit to the mining industry are astutely discussed by Mr. Lawrie.

THE economic situation has been changing rapidly, and it is difficult to account for changes which are momentous and have a serious bearing upon the solution of problems of the present and of the immediate future. The better to analyze the situation, I have prepared some gold-production charts.

In 1915, the high point of the production of the world's gold was attained, $469,000,000 being credited to that year. The decline in gold production has since been rapid. The percentages of reduction of output in the last three years with respect to the production of 1915 are as follows: The total decrease in the world's production is 20%. The curtailment for South Africa was only 6.1%. The fact that the decline in South African production was so much less than in the total world production arises through South Africa being more remotely situated from the center of economic pressure. The operators of South Africa had probably accumulated large food and equipment supplies, which postponed the necessity of making purchases in the higher-priced market which followed. Another factor which may account for this condition is the improvement in recovery in the treatment of South African ores, which has tended to compensate for the economic conditions that have been so universally oppressive to the gold-mining industry generally.

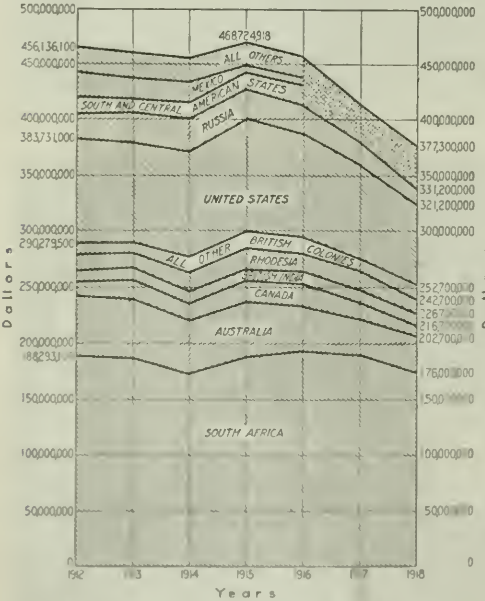


CHART 1. GOLD PRODUCTION OF THE WORLD

In Australia, a country which was no less remote from the center of economic pressure, but in which the resources of the gold mines are becoming rapidly exhausted, there has been a continuous decline for the last three years, totaling 45.5%. The decrease in output in Canada is 26% for this period of three years; in British India, 13%; and in Rhodesia, 15.8%. The entire decline in the gold production of Great Britain, including all of her colonies, amounts to $46,000,000 for the same period, and represents 15.4% of the total production for 1915.

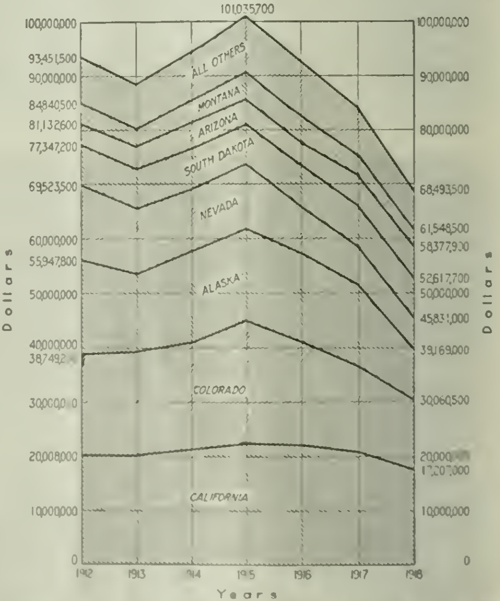


CHART 2. GOLD PRODUCTION OF THE UNITED STATES

In the United States the drop in production is 32.2%. Of the total decline of $92,000,000 in the world's gold production, that in the production of the United States accounts for one-third, or approximately 35% of the total, whereas normally the gold mines of the United States produce one-fifth of the world's gold output. This denotes the extreme economic pressure to which the gold-mining industry of the United States was subjected on account of the existing international situation and reflects the volume and rapidity of the financial mobilization of the United States upon entering the war. The effect was much more acute here than it was in some other countries that had felt the pressure from the beginning in 1914.

---

*The revised notes of an address delivered at the International Mining Convention, Vancouver, B. C., Mar. 18, 1919.

†Consulting mining geologist, Chairman Oregon Bureau of Mines and Geology Commission, Oregon Bldg., Portland, Oregon.

Russia naturally shows the effect of disorganized government. The Russian decline in gold production is 62% for the last three years, a drop from $26,000,000 to $10,000,000, and this indicates more eloquently than anything else the effects of Bolshevism.

The South and Central American states show an increase of 5.3% in gold output, and it is altogether likely that some of that gain has been attained by the increased recovery of byproduct gold from the treatment of copper ores. The Mexican crisis in gold production occurred in 1915, and happened to coincide with the year in which the high point of the world's gold production took place, and it is evidence of the chaos in which the Mexican government found itself at the beginning of the revolution. The production was a little over $6,000,000 in 1915, and in three years it has increased to $10,000,000, a gain in output of 66%. All countries of the world not heretofore mentioned show an aggregate decline in production of 4.2 per cent.

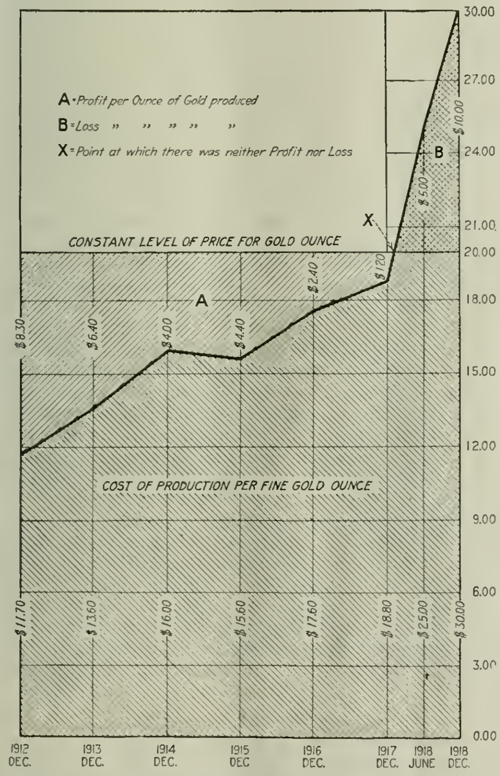


CHART 3. WAR INFLUENCE ON THE COST OF PRODUCTION PER FINE GOLD OUNCE, TYPE EXAMPLE

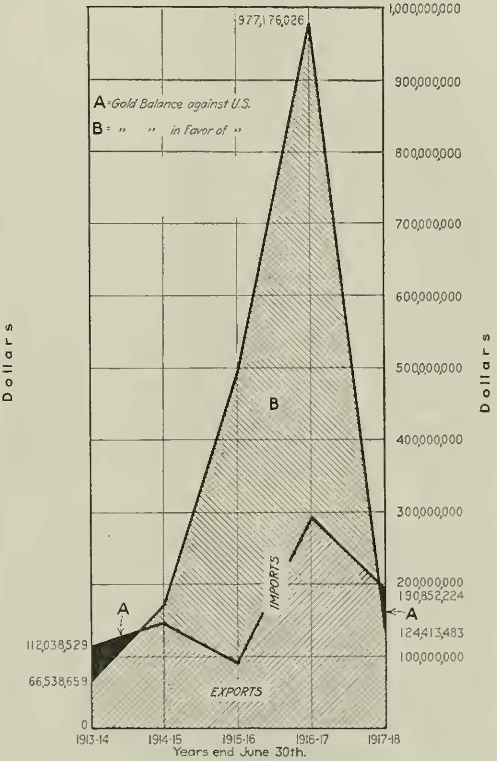


CHART 4. GOLD EXPORTS AND IMPORTS OF THE UNITED STATES, 1914-1918

To analyze the situation of the United States more carefully, I have prepared a chart on exactly the same principle as the world-production chart and covering the same years, from 1912 to 1918 inclusive. California is shown by the chart to have just about maintained its production ratio to that of the United States, in a somewhat similar manner as South Africa maintained its production with respect to the world, notwithstanding the fact that the economic pressure was so severe in the United States. This may be accounted for because of the fact that much of the Californian output comes from placer mining, in which labor is not as large a factor in the cost of production. Labor was also not as difficult to procure in California, because it was rapidly drawn from the interior states to the seaboard for other industrial purposes. The decline in California gold production is 23.7%. In Colorado the decline is 45%. This marked variation in ratio is due in part to the difficulty in obtaining labor and also to the complexity of ore treatment in Colorado, which involved the use of chemicals, the price of which advanced rapidly as the war progressed.

In Alaska there is recorded a decline of 45.5%, which corresponds exactly with the decline of Australia, and it can be accounted for not altogether by the economic pressure, but also by the closing down of the Treadwell mine, which was an important factor in contributing to the Alaskan output. Nevertheless, the decrease in production since 1917 shows the tremendous effect of the war on Alaskan gold mining.

In Nevada the decline of 44% in gold output was due largely to the complex treatment of the ores of that state, and the fact that its mines are situated far from the coast, thereby making labor difficult to retain.

In South Dakota, the Homestake mine, which is well developed and has a large reserve of homogeneous ore, was able without difficulty to maintain the normal output. The production of this mine contributes by far the larger portion of the gold output of South Dakota, and the decline for this state was only 8.3 per cent.

The copper production of Arizona has expanded rapidly in the last three years, and to that expansion must be accredited the increase of gold output, in the period under review, of 26.4%. Montana recorded a decline of 36.3%, and all of the states and dependencies of the United States, not before mentioned but combined, show a loss of 33.4%, which corresponds closely to the general loss for the entire production of the United States, which was 32.2 per cent.

THE INCREASE IN THE COST OF PRODUCING AN OUNCE OF GOLD

The third chart is devised to show the effect of a combination of factors which explain in part the decline of the gold production throughout the world in the last three years. In 1912, the hypothetical quartz gold mine which I have chosen as an example yielded $12 per ton, and the total cost of production was $7 per ton. The cost of production per oz. was $11.70, and the profit was $8.30 per oz. I have assumed the price of gold at $20. The depreciating value of the ore with depth, and the increased cost of production with depth, are factors frequently encountered in gold mining, and both operate to increase the cost of production regardless of any change in the economic conditions. As a consequence, in 1913 I have assumed a recovery of $11 per ton at a cost of $7.50 per ton. In this case there is a production cost per oz. of $13.60, and the net profit was $6.40 per oz. For 1914 I have assumed a recovery of $10 per ton and a cost of production of $8.50, which combine to make a cost of $16 per oz. and a net profit of $4 per ounce.

At this time the management realized that the company was rapidly approaching the economic limit, and though operating on a 3000-ton basis per month, decided to reduce the cost of production by increasing the output to 6000 tons per month. In 1915, therefore, with a double output, I have assumed a recovery of $9 per ton and a cost of production of $7 per ton, which indicates a reduction in the cost of recovery from the previous year of $1.50 per ton and gives a cost of production of $15.60 per oz., with a net profit of $4.40 per oz. From that time on it is necessary to consider the third component of economic pressure. The sharp decline in the purchasing power of the dollar, both with respect to labor and material, began to be felt. This was attributable to the fact that the country was under a severe pressure to obtain war materials at a rapid rate, which forced an expansion of credit and corresponding inflation of currency. These factors combined to cause automatically a rise in commodity prices. The economic pressure became intense in 1915, and in 1916 the cost to produce 1 oz. of gold was $17.60, and the net profit per oz. had fallen to $2.40. In that year the recovery was $8.50 per ton and the cost of production had increased 50c., to $7.50 per ton. In 1917 the same amount of $8.50 was recovered per ton, but the total cost of production had risen 50c., making it $8 per ton and the total cost per oz. was $18.80, leaving a profit of $1.20 per oz. In June, 1918, six months later, the total amount recovered was $8 per ton and the total cost of recovery was $10 per ton, provided the mine had continued operation. Many properties shut down at this time, which was wise business policy. In June, 1918, there was, therefore, a total production cost of $25 per oz. of gold, which it is apparent would have made a net loss of $5 per oz. In December, 1918, six months later, the assumed recovery is $8 per ton and the cost of operation had risen to $12 per ton, an increase of $2 per ton over the cost in June. Had the mine continued to operate in December, 1918, the cost of producing an ounce of gold would have been $30, or a net loss of $10 per ounce.

GOLD EXPORTS AND IMPORTS

The last chart, No. 4, shows the gold imports and exports to and from the United States from the fiscal years 1913-14 to 1917-18, ending June 30. The year ending June 30, 1914, shows a gold balance against the United States of $45,000,000, but in the next year, ending June 30, 1915, there is recorded a gold balance in the country's favor of $25,000,000. There would have been a still greater amount for that year had it not been for the fact that all United States foreign securities were liquidated against the trade balance which was then in the nation's favor.

In the next year, ending June 30, 1916, there was a gold balance in favor of the United States of $404,000,000, which indicated that the period of security liquidation had ceased and that gold was being paid to offset a still larger trade balance in favor of the country.

The year ending June 30, 1917, shows a gold balance in favor of the United States of $685,000,000, the total import of gold for that year amounting to $977,000,000. Much of this gold was paid by neutral nations, which contributed to strengthen the financial position of the United States upon the country's entrance into the war. In no other way is it clear that these neutral nations could have more effectually contributed to the Allied cause.

I want particularly to point to the fact that from June 30, 1917, a rapid decline took place in the movement of gold either to or from the United States. In fact, the country developed an adverse balance of $66,000,000 in actual gold in the year ending June 30, 1918, America's first year of the war, and since that time the gold movement has been practically negligible, on account of the uncertainty of the outcome of the peace treaty.

THE UNITED STATES A CREDITOR NATION

It can be readily seen that the United States has become, by having liquidated its obligations in foreign countries, by having negotiated loans, and by having so large a gold reserve in custody, a creditor nation. And it is important that the world be informed as to what attitude it may expect the United States to assume because of the tremendous responsibility that has been thrust upon the country by the war. But before going into the matter of international trade and commerce, I would like to call attention to a condition which now exists, and which is based altogether upon a misconception as to what may be expected of commodity prices in the next two years.

Some persons have assumed that prices are bound to drop, and are waiting to see what the trend of prices will be before they expand production. The result of this tendency to withhold investment has created a condition of stagnation in development which is just as artificial as were some of the tremendous gains made in commodity prices due to the erection of economic barriers and the imperative war demand. Had the nation at this moment concluded the period of readjustment and new construction, it might expect to be able to contract the currency, but it has not yet reached that period, and must still expand its credit structure and correspondingly expand its currency to meet that exigency.

THE POLICY OF MARKING TIME

Temporarily, while the American people are "marking time," waiting for the peace treaty to be adopted, the door of international commerce has been closed. For that reason commodity prices in this country have dropped slightly, but they will increase because of the fact that the nation must still expand its currency and credit. For the enlightenment of the gentlemen who are waiting, and the municipalities which are waiting, and of the provinces and states that are waiting for lower prices—in behalf of all to whom it seems conservative to wait—it is expedient to consider what will result from that watchful-waiting policy.

With the signing of the peace treaty there will be a tremendous demand for the delivery of a great variety of commodities to the European countries. Those who have waited will find themselves in the same market in competition with this great demand to obtain delivery of their equipment. Aside from the delay, however, they will have passed through a period of high prices, and should be able to pay what little excess of price is now demanded for their equipment.

When the foreign demand arrives, it will receive precedence of delivery over domestic requirements for the same products. And why should this not be so? These devastated countries of Europe are entering upon a period of reconstruction that is altogether vital to their existence, and they should have the first command of all needed materials. And American industry, should, therefore, be prepared to place its orders during this present period, when the domestic demand may be met without conflicting with foreign delivery.

This condition reminds me of the fact that, generally speaking, industrially America is "marking time" at a moment when the country should be "going over the top."

The boys in France were not ordered to "mark time." They were commanded to go "over the top," and they are returning better citizens and more capable men to assume the responsibilities of their country's new constructive industrial life. They do not want to take part in "marking time" at home. They are not looking for charity. They are not expecting anything but an opportunity to enter upon a most progressive program of new development. And why not? They have seen too much activity to be willing to take part now in any program which is not progressive.

Among the various developments that could be made, the mining industry is one of the best and most promising in which the men now released from military service may participate. In times of peace the mining wage has always been the top-notch wage. There is not a cleaner business and there is not a business in which they can engage with more enjoyment, because of its outdoor life, than the mining industry. I believe this convention is well-timed to have a most marked effect in accomplishing a satisfactory result in expanding the mining industry. To the people of British Columbia is due the credit for having recognized the necessity for allocating to the mining industry its proper place in the general and progressive development of the domestic program.

THE INTERNATIONAL SITUATION

In reviewing the international situation, I will be frank. This is no time to withhold the truth. The future of the United States depends largely on the ability of the citizens of the country to form a right conception of the truth and to act in accordance with it.

In the matter of international trade, I have said that the United States has become a creditor nation. The United States has always, as a nation, expressed an advanced enlightened self-interest in its international relationships. I do not wish to convey the idea that there is anything altruistic in the plans which have been formulated by the economists and financiers of the United States concerning the future, but I want to call attention to the breadth of vision shown by these gentlemen.

The country has goods abroad and is unable to get them home; and must, therefore, do certain things to offset this condition. It will be necessary to educate the American people, and it will likewise be necessary to educate the people of Canada to the need of absorbing the investments of foreign countries in Canada and the United States. Why? Because foreign countries with which both Canada and the United States wish to trade have not gold to deliver. They have not goods to deliver, because their industries are paralyzed and the trade balance is against them. To draw on the currency in circulation would cripple their internal financial structure. With what will they pay? They have nothing with which to pay until a broad policy has been developed to absorb in the United States and in Canada the industrial securities of those countries in order to offset this adverse trade balance.

EXCHANGE RATES AND GOLD EMBARGOES

The great variation in commodity prices in the United States has been due largely to the erection of economic barriers. Price fixation by government is always a temporary artifice. It met the requirements of war, but it does not meet the requirements of peace. These artificial barriers must be eliminated. Let the good old immutable law of supply and demand govern the situation. While, during the war period, these economic barriers have been erected as a matter of domestic policy, in a large measure similar barriers have been erected internationally. What is the result? The United States put an embargo on gold and has been paying a premium of 7% to obtain a draft on Buenos Aires. The Canadians know that they have been paying 2% exchange on account of the fact that they put an embargo on gold, and this simply represents a physical difficulty in making the exchange. This 2% is a penalty on both imports and exports and is chargeable against the going industry of Canada.

More money will be needed for industrial development and improvements, and I am wondering if it will not be found advisable to consider whether the influx of capital which is desired and which it is necessary to have would not greatly offset any advantages of maintaining such an embargo on gold. It is evident that this large volume of capital will not be so likely to invest if the penalty of 2% is allowed to continue. This argument applies to every country. The future course of trade will be much hampered until the proper action is taken to remove the embargoes on all products. I hesitate to use the words "freedom of trade," because I might be misunderstood, but I mean that condition of trade which imposes no burden upon the transportation of products between any two countries in the world.

It is alarming to consider what some of these exchange rates have been and are now. George E. Roberts, of the National City Bank, says in a recent publication that "it has been necessary to pay as high as 50% premium for a draft on Spain, and in Italy it has been necessary to pay a premium of 100% for a draft on New York. In Paris today it is costing about 5% to obtain a draft on New York, and it has been as high as 10%. In London a New York draft costs about 2%, but it has taken constant lending by this country for the last two years to hold it down to that point." This more favorable exchange rate may also be due partly to the fact that 62% of the world's gold output has been continually flowing to the British Exchequer to enlarge the gold reserve.

FREEDOM OF TRADE AND THE MINING INDUSTRY

The first condition that is going to assist the gold-mining industry is freedom of trade, which is premised upon the resumption of a sound financial relationship with foreign countries. The demand for American and Canadian materials in foreign countries is great. As evidence of this fact the companies which are holding copper at the present time, and carrying extensive margins in order to hold it, must have certain knowledge of a foreign demand which will soon materialize and absorb their product. The effect of putting gold on the open market would be to give the gold miner what he justly should have, and I wish to emphasize the fact that while other metals have dropped gold has been at a constant level of price. That is an excellent omen. Some people have held the opinion that there is not gold enough to satisfy the country's present much inflated monetary system. Others would seek relief through bimetallism. It has yet to be demonstrated that there is not gold enough, provided the necessary precaution be taken to maintain the normal output and to insure proper distribution of the metal. Bimetallism would not only not minimize the difficulties but would not be acceptable to the nations which must redeem their debts on a gold basis and which have the greatest obligations to meet.

Most of the nations of the world are on a gold basis at this time, and other nations will find it necessary to adopt the gold standard, in order that they may be able to speak in the same language as that of the majority, and they will necessarily have to adopt the same monetary vocabulary. The fact that the British pound, through more than a century of international commerce, has won for itself an unparalleled reputation for stability would indicate that Great Britain would not accept any proposal to tamper with the gold standard. The United States in a similar way through years of honest finance has won for the unit of its monetary system, the gold dollar, an enviable reputation for its stability in international trade. Likewise the United States would have everything to lose and nothing to gain by considering a change in the gold standard. Gold is the only least common denominator by which the costs of war and the costs of reconstruction, in terms of pre-war standards, may be accurately measured, and gold will remain the unit by which all debts will eventually be liquidated.

I find in analyzing the various systems that have been made by economists that those people who believe that the country's debts ought to be repudiated and its gold standard changed are far from the fact. The ship must be held to the shore.

So far as I can see, the extension of Bolshevism is one of the menaces with which civilization is confronted, and this "marking time" on new investments is not setting a back-fire to Bolshevism. The best back-fire to Bolshevism is to create a condition of employment that is universal and to allow a margin of profit which represents a good living to labor. The Bolshevists are operating with a draft that is being blown by their own bellows, and it does not get them anywhere. Even in their ranks the radical of today becomes the conservative of tomorrow.

The A. E. F. School of Mines

The newest American school of mines is at Beaune (Côte d'Or), France. Nearly 20,000 U. S. Army students (officers and enlisted men) are now in attendance at British, French, and American universities in Europe—approximately 2000 to British universities, 7000 at French universities and about 10,000 at the American university, started about three months ago. and having more students than many institutions of learning that are musty with the dust and mold of centuries. "*Tout à fait américain*," the French say The American E. F. University was established for those members of the American Expeditionary Force who are being held in Europe to await the outcome of the Peace Conference—men whose education was interrupted by the war, or who have chosen to take post-graduate work while awaiting Germany's decision. The American E. F. University was established at Beaune because one of the American large base hospitals had been there, and the buildings were practically ready for students and professors to step into, when the Army Education Commission decided to take over the Y. M. C. A. plan for the education of the men during the waiting period. Incidentally, it may be mentioned that model post and divisional schools are being conducted at Beaune, as well as the college work. The American E. F. University being in the Côte d'Or (Golden Slope), it would seem to be an ideal place for a school of mining. This thought is further confirmed by the fact that Beaune is in the center of the old Province of Burgundy, the sparkling product of which inspired many students in American universities before the spectre of aridity arose to cast its somber shadow on student days. As may be imagined, Beaune is not a prohibition town; and yet report has it that 10,000 students are there, and none is in the gutter, notwithstanding that the students have the freedom of the town. But perhaps their previous training in France accounts for this. The Côte d'Or derives its name not from the gold in the hills but from the richness of its vineyards. This does not detract from its qualifications as a site for a mining school, for it is within easy reach of the principal French iron mines and of the southern coal mines, and is less than 40 km. from the famous Creusot metallurgical works. The school of mines is officially known as the Department of Mining, College of Engineering, American E. F. University.

Correspondence and Discussion

Conditions in Sonora, Mexico

Arrived back from the land of cacti and mescal last evening, after two busy weeks in that country of sunshine, rattlesnakes, and rocks. I did not write from there, because I feared that the little I might have to say would not get across the line and that my efforts would be wasted on the desert air.

Let me see if I can give you an impression of what I saw and felt in Sonora. Quiet, yes; but the quiet of death, rather than that of peace, broods over much of the state. "Things are looking up quite a bit" is the reply one gets from almost every man, but this comes from the feeling that things are about to be done rather than that anything new has been started.

Perhaps it was unfortunate that my stopping place was La Colorada, the town at the property of the Creston-Colorada mine, the Minas Prietas, and the Butters cyanide plant, all owned by the Mines Co. of America. An hour's visit to this property, and the stockholders would understand why their stock is worth minus $1 or less per share. It may be well to recall that the State Department advised at one time that all Americans withdraw from Mexico. I think it was when the Vera Cruz incident occurred. The Americans from Creston-Colorada were sent away, and the company, to retain and maintain its force, put all the married men, nearly a half of the crew, on as watchmen on twelve-hour shifts.

There was considerable friction between state and company officials about this time. The company was ordered, I understand, to put back all men on eight-hour shifts, but it discharged practically all of the men. The state then said, "When a mine is not worked by the owners it may be operated by any one"; in other words throwing the mine open to looting by miners, so that not only the mine but all of the plants have been much damaged. Underground, all pillars that contained ore worth packing out have been destroyed, and caving naturally resulted. Not satisfied with this, the pillagers set fire to the shaft sets, and they were burned to the surface. The mines are a wreck; $1.20 silver will not reopen them. The remaining ore was rather low grade, and if it were physically possible to open the property, it could probably not be done for less than $500,000. Above ground, the wreck has been no less complete, though the buildings have not been destroyed by fire. Brass and copper were the first to go. Not a nut, valve, rod, or rivet is in evidence. And so far as cold chisels could reach the copper on the motors, they too were wrecked.

The cyanide tanks were all utilized as fire wood, and carboys made good marks to shoot at. It required considerable work to get out some of the heavy bearings, but so long as the task was that of destruction, the destroyers did not care—they seemed glad to work.

There is not an engine, pump, motor, or other piece of machinery or equipment in the camp that could now be put in operation for less money than it cost originally. Corrugated iron, windows, doors, and even the framing of the buildings have been carried off. As I walked through one of the old mills, I found a man, a woman, and two boys busy getting firewood with a crowbar from the mill floor. I believe that there was still quite a little of the ore in the tailings that could have been cyanided again, and would have been, but it's "*hasta mañana*" with those tailings now. Our State Department was at fault primarily, and then Mexico, or the State of Sonora, was equally culpable.

Soldiers and citizens have been equally destructive, and always the Mexican soldiers have been camped here to preserve order and keep off the Yaquis. Sometimes there was nothing with which to pay the soldiers, each one's pay for a day being equivalent to the hide of one cow. This was quite easy while the stock in the neighborhood lasted. Steers and cows were driven in and slaughtered for their hides, and the poor people got what meat they wanted and the buzzards took the remainder. The country in that section is now destitute of cattle, and wanton destruction is evident on every hand. These people had never heard of Bolshevism, but they practised it to the queen's taste.

Lying to the east of La Colorada and for a considerable extent north and south, there is a section of eastern Sonora that is almost prosperous. This section is north of the Yaqui country, and yet the Yaquis go there for cattle, clothing, and food when they need them, and they have the reputation of infesting the country.

All of the time we were in La Colorada, there was continued talk of the depredations of the Yaquis. How much truth or falsehood the stories contained we could never learn, and the Americans are equally ignorant of what is going on around there or, rather, of *who* is doing the dirty work. There are several operating properties, and more would be working if they had reasonable protection. The Mexican government has plenty of soldiers there, but, as in the oil country, it would be a blessing to the country if they were taken away. They protect nothing and themselves indulge in pillage.

Here is a sample of the stories coming in over the telephone on the morning of May 10:

First report: A band of Yaquis attacked a Mexican camp; 32 Mexicans killed.

Second report: Eighteen Mexicans killed; 2 Yaquis killed.

Third report: Six Mexicans in the camp with two women, no one killed; Yaquis got one of the women.

Fourth report: Six Mexicans with two women in the camp. Three Mexican men killed and 11 Yaquis killed.

The freighting into this country is done by trucks driven chiefly by Americans. They said nothing much about hold-ups while they stopped with us at La Colorada, and started out armed to the teeth.

The American boys have no fear of the Yaquis; in fact they do not think them responsible for any of the devilment, but attribute it all to the Mexicans. A few days after we were there, H. S. White, one of Schroeter's men, started in with a truck load of stuff and was shot with his Mexican helper, the murder occurring east of La Colorada. There is no warrant for assuming that the Yaquis were responsible, all the evidence leading to the conclusion that Mexicans were responsible for the outage. A well-informed and prominent Mexican gave me this story: A general wrote him recently that Sonora troops had been ordered by Carranza to go into Chihuahua to attack Villa. But in the letter he said "I don't think we will have to go." Now, the Yaquis will shoot up the Mexicans every time they get a chance, but not Americans, and no fuss is made when they shoot Mexicans. If an American be shot, some notice of the act is taken in Mexico City and the Sonora troops are ordered to stay in Sonora; hence they don't have to go into Chihuahua.

I was out one day on the Yaqui trail in the care of a local Mexican. He sent men out the day before "to clean the brush from the trail." After coming away from the mine, I found they had been posted on neighboring hills while I was at work. This Mexican was surely afraid of the Yaquis.

Here in Nogales and Tucson the idea prevails that the United States will have to occupy Sonora sooner or later. The most reasonable scheme that I have heard came from a Nogales man yesterday. His idea was that when the trouble in Europe had subsided, England and France would demand action over here. The United States would assume all Mexican debts, and take a mandate for Mexico until those obligations were discharged, by which time Chihuahua and Sonora and perhaps other states would be so thoroughly Americanized that they would ask for admission to the Union.

The Southern Pacific in Sonora is doing a good business, both in passenger and freight. It runs a passenger train every other day, carrying three or four coaches, well filled. On June 1 the company will put on a daily train, and on the same date a Pullman will be added, the first since trouble began in this country. Now, the Pullman people are said to be very careful and take no risks in Mexico. This is an indication that they think that their cars will be safe and useful down there.

However this may be, with every freight train south of Torres comes one or two armored cars full of rifles. Yesterday on the way up we carried a car full of rifles all the way through with us. Why troops are carried I do not know. Whether it is just to give jobs to colonels or major generals or whether some trouble is feared, I do not know. But of one thing I am certain: to the man traveling through the country, armed soldiers on every hand do not give the impression of peace and order. Politically, Sonora is somewhat separated from the other states, and her governors count for more. They have just tried to have an election. Two parties claim the election, each calling the other grafters. And so far as I can understand, the biggest grafter is going to pull the thing off as he wants it to happen.

Nothing except American money circulates in Sonora. Mine taxes must be paid in gold, which sometimes goes to a premium of 10%. One must buy it at the banks. Government officials sell it back to the banks and then one must buy it again so as to be able to pay taxes. It is necessary to go to one window in the Federal building to buy Mexican money, and then take it over to another window to buy stamps or send telegrams. Only for these three purposes does one handle Mexican money.

Labor is fairly plentiful at some points, and scarce at others. At one mine producing 25,000 oz. silver per month, the manager told me that his various taxes about equalled his payroll. He is leasing the mine, and the government gets more out of it than does the owner.

My general impression is that it is a better time to buy than to operate mines or ranches in Sonora. Conditions are surely not so bad as they have been, but they are still far worse than before the war, with no prospect for rapid improvement. F. F. **SHARPLESS.**

Nogales, Ariz., May 24, 1919.

Army Gas Masks

I am greatly interested in the article on "Army Gas Masks" which appeared in the Apr. 19 issue of the *Journal*. The Fire Department of this city has several of the masks in use, and finds them entirely satisfactory in smoke commonly encountered in burning buildings. When the chief bought the masks he asked where he could buy the material to recharge the canisters when they become exhausted. The man who sold the masks promised to send him the address of the people who handle the coconut charcoal and "purple" soda lime, but he failed to do so, and up to this time the chief has been unable to find where to buy it.

Will you kindly send me the address of some one who manufactures or handles the material with which to recharge the canisters? **SAMUEL MORTHLAND.**

156 W. Main St., Decatur, Ill., May 2, 1919.

Inquiry by the *Journal* concerning the utility of the Army gas mask in fighting fires elicited the following additional and pertinent information:

Replying to your letter of May 6, regarding the use of Army gas masks for working in smoke in burning buildings: There is an element of danger in using the Army mask for this purpose, because of the possibility of carbon monoxide being present in the products of incomplete combustion. The Army mask will remove particles of smoke, tar, and irritating vapors present in smoke. It does not remove carbon monoxide. Smoke produced in small smudge fires and where there is opportunity for dilution with air seldom contains more than 0.1 or 0.2% carbon monoxide, and under such conditions the Army mask is useful in protecting men from the choking effect of smoke. The Bureau has made actual tests, in which men wearing the Army mask remained in dense smoke, produced from damp wood and straw, for a period of ten minutes without discomfort. Army masks have also been used successfully in fighting forest fires.

It is, however, entirely possible that conditions may develop in burning buildings under which the fire gains headway in a room and burns out the supply of air, so that further combustion takes place with restricted ventilation, thus producing a condition favorable to the production of carbon monoxide. Five-tenths of 1% of this gas in air will render a man unconscious in a few minutes. The gas is insidious, gives no warning, and does not irritate the air passages, so that a man simply sinks down unconscious without warning. Herein lies the danger in the use of a gas mask for working in smoke in burning buildings. In probably nine cases out of ten, there would be no carbon monoxide, and the mask would give good protection, and would prove a valuable appliance.

Recently, the Bureau's chemists at the Pittsburgh Station made a test in a 1000-cu.ft. gas chamber in which some waste rags and excelsior were ignited and then dampened, so as to smolder, and kept in this condition for a period of three hours. At the end of this time, a sample of the atmosphere in this closed chamber was taken and analyzed, and 1½% of carbon monoxide was found. A sample was drawn through a gas mask canister, and then through a large bottle, in which a canary bird was placed. The bird was immediately overcome by the gas from the chamber, although the visible smoke particles were all removed by the canister. This proves that conditions may arise in which the gas mask is useless.

Just how often firemen meet dangerous conditions is a question for statistical investigation. It would, of course, be much better for them to rely upon the half-hour type oxygen breathing apparatus. This would give positive protection under all conditions. The only known commercial manufacturer of coconut charcoal in this country is the National Carbon Co., of Cleveland, Ohio. Purple soda lime was made by the Chemical Warfare Service of the Army. The purple color was due to permanganate, a constituent which is not necessary for gas masks for industrial purposes. White industrial soda lime is being manufactured by the Mine Safety Appliances Co. of Pittsburgh.

VAN. H. MANNING,
Director, Bureau of Mines.
Washington, D. C., May 15, 1919.

I referred in my previous letter to the fact that the relative occurrence of dangerous amounts of carbon monoxide in the ordinary fires combated by firemen was unknown and that it was a matter for further statistical investigation. Some of the prominent fire chiefs in the country are taking the attitude that though in a certain small percentage of cases there may be grave danger from carbon monoxide, yet today they are taking these chances without the mask, and, further, that the mask would be of tremendous value in a majority of their fires. Under these conditions they are inclined to feel justified in using the mask as a general protector against smoke, taking the chances that must come under certain conditions. If they do this with the knowledge that a certain percentage of the cases must be dangerous, I do not know that the Bureau is justified in taking any further step than to call attention, as we have done, to the fact that the mask is a protection against smoke particles, but will not protect against carbon monoxide which may be present in certain smokes and fumes arising from fires.

VAN. H. MANNING,
Director, Bureau of Mines.
Washington, D. C., May 23, 1919.

Copper Slag Research

To C. G. Maier and G. D. Van Arsdale are due the thanks of the copper-smelting fraternity for the publication of their very thorough work on Copper Queen slags. At the plant of the Tennessee Copper Co. some years ago we tore down a settler, and found several masses of white metal between the bricks. Converter slag had never been poured into this settler, and the furnace had been smelting during this settler campaign ore charges making only a low-grade matte. Maier and Van Arsdale now give us a scientific explanation of this peculiar circumstance.

Can some one explain the violent action that takes place in a settler when cast iron is dropped in it? I append a panning test I made on Cananea slag:

"A composite sample of settler slag taken June 4, 1907, from all the settlers at a time when no converter slag was being poured, assayed 0.50% Cu, and 200 gm. of this slag crushed to 20 mesh was panned to 9 gm., which assayed 1.10% Cu. Recovery, 9.9%. Then 200 gm. of this slag crushed to 60 mesh was panned to 10 gm., which assayed 1.33% Cu. Recovery, 13.3%. A sample of settler slag obtained the same date when converter slag was being poured assayed 0.54% Cu, and 200 gm. of this slag crushed to 20 mesh was panned to 13 gm., assaying 0.77% Cu. Recovery, 4.27%. Then 200 gm. of the same slag crushed to 60 mesh was panned to 13 gm., assaying 1.06% Cu. Recovery, 12.76 per cent."

GEO. A. GUESS.
University of Toronto, Toronto, Canada,
May 15, 1919.

Wages at Bisbee, Arizona

In the May 17 issue of the *Journal*, p. 877, an extract is printed from the "Monthly Labor Review" of April, 1919, on wages and labor conditions in gold mining, and in that article a table of rates of wages was given. In so far as the Phelps Dodge Corporation is concerned, eight of the twelve quotations of wages are incorrect.

I am sending you a copy of a letter I have just written to the Department of Labor, containing the corrected table, and I would be very glad if you would publish this list in some future issue of the *Journal.*

CHARLES F. WILLIS,
Consulting Supervisor, Phelps Dodge Corporation.
Bisbee, Ariz., May 22, 1919.

May 22, 1919.

U. S. Department of Labor,
Bureau of Labor Statistics,
Washington, D. C.

Gentlemen:

I have noted in your "Monthly Labor Review" for April, 1919, an article on the wages and labor conditions in gold mining. In that article you have a table entitled "Rates of wages per day in certain branches of metal mining where gold is a product or a byproduct." This table contains quotations of wages of the Phelps Dodge Corporation at Bisbee, and of the twelve rates quoted eight are incorrect. The following are the corrections:

		Quoted Rate	Correct Rate
September, 1913	Machine men	$4.00	$4.00
	Muckers	3.75	3.75
September, 1914	Machine men	4.00	3.60
	Muckers	3.75	3.35
September, 1915	Machine men	4.10	4.10
	Muckers	3.85	3.85
September, 1916	Machine men	5.32	5.35
	Muckers	5.07	5.10
September, 1917	Machine men	5.60	5.35
	Muckers	5.35	5.10
September, 1918	Machine men	5.50	6.10
	Muckers	5.25	5.85

We do not object in the least to having rates of wages published, but we desire that they should be correct. Your table, published as it is by the U. S. Department of Labor, might be considered authoritative and be the source of many quotations in the future which would be in error. We should greatly appreciate a correction being made in a future issue of the "Review."

Also, we should be glad to know where you obtained the figures quoted.

(Signed) CHARLES F. WILLIS,
Consulting Supervisor,
Department Industrial Relations, Phelps Dodge Corporation

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Relief Commission

Just prior to the closing of the docket of the War-Minerals Relief Commission to further claims, an avalanche of applications for relief was received. The records are far from complete. Before departure of the commission to hold hearings at various cities, all claims will have been listed and precise information will be made available as to the total amount of the claims and as to how the claims are divided among the different minerals and the several states. The larger claims docketed since compilation of the list published in last week's issue have been filed by the following: Aguilera & Co., Santiago, Cuba; Georgia Iron and Coal Co., Atlanta; M. E. Johnson, Muskogee, Okla.; N. A. Adler, Batesville, Ark.; C. J. Shank, Hazel Creek, Calif.; Georgia Copper Co., Lincolnton, Ga.; Red Mountain Chrome Mining Co., Eureka, Calif.; Kirchman & Crawford, Silver City, N. M.; Chatham & Britten, Seattle; Kendall, Jackson, Johnson & Wise, Sapulpa, Okla.; Dubakella Mining Co., Berkeley, Calif.; L. R. Payne & Co., Fresno, Calif.; Pocahontas Manganese Corporation, Bluefield, W. Va.; A. D. Brinkerhoff, Dallas, Tex.; Holmquist & Johnson, Denver; Maydew Mining Co., Green River, Utah; R. S. Handford, Batesville, Ark.; James A. Ross, Pleasant Grove, Calif.; W. W. Dailey, Wickes, Mont.; E. E. Hoeft, Nevada City, Nev.; United Tungsten-Copper Mines, Los Angeles; W. A. Ewing, Medford, Ore.; Parker & Shetter, Nogales, Ariz.; James E. Higgins, Butte; Edward A. Silberstein, Duluth; J. H. Heron, Denver; Cypress Chrome Co., Anacortes, Wash.; Manganese Metal Co., Tacoma, Wash.; Elanore Manganese Co., Roanoke, Va.; Hillside Mine, San Francisco; Ralph W. Goodhue, Indian Falls, Calif.; and the estate of Harvey W. Cowan, Chicago.

Potash and Magnesite Embargoes Are Removed

The War Trade Board has announced, according to report of the American Mining Congress, that it has no further power to extend the licensing control over potash or magnesite. Large shipments of potash are due from Alsace this week. Dyestuffs are still under control of the War Trade Board and will so remain until peace is signed. Magnesite, which before the war was furnished to the United States exclusively by Austria, can now be imported into the United States, in the face of the fact that Austria is still an enemy country. The Shipping Board authorizes a freight rate for magnesite in ballast from Austrian ports at $7.50 per ton.

A request has been made by the Congressional delegation from the State of Washington to the War Trade Board for replacing the embargo on magnesite. This request has been refused. It is said that a large quantity of Austrian magnesite is ready for shipment to this country. The development of magnesite in Washington and California to meet the war demand created a heavy investment in this industry. The American Mining Congress is asked to assist in securing the passage of legislation which, through embargo or tariff, will prevent the destruction of the American magnesite industry, which seems certain, if Austria is allowed to ship under the above rulings.

Pan-American Conference Program

A large number of business and technical men particularly interested in Latin America attended the second Pan-American Commercial Conference, held at Washington, June 2-6, and the mining industry was well represented. The program in general was as follows:

I. GENERAL REVIEW OF PAN-AMERICAN EXPORT AND IMPORT SITUATION

II. TRADING METHODS FOR BOTH EXPORTS AND IMPORTS
(a) Business ethics.
(b) Merchandising.
(c) Commission service and direct trade.
(d) Export and import combinations.

III. SHIPPING AND OTHER TRANSPORTATION
(a) Steamship lines and ships.
(b) Other transportation, including aeroplanes as an aid to commerce.

IV. FINANCING TRADE, INVESTMENTS, LOANS
(a) Banking.
(b) Credits.
(c) Investments, loans.
(d) Government aid to commerce, including the War Finance Corporation.

V. ENGINEERING AIDS TO COMMERCE
(a) Railways and highways.
(b) Waterways and harbors.
(c) Irrigation.
(d) Sanitation.

VI. PARCEL-POST AND TRADE REGULATIONS
(a) Parcel post.
(b) Patents and trademarks.
(c) Consular and other trade regulations.
(d) Packing and insurance.

VII. COMMERCIAL INTELLIGENCE
(a) Advertising and publicity.
(b) Newspapers and periodicals.

VIII. EDUCATIONAL AND SOCIAL AUXILIARIES TO COMMERCE
(a) Vocational training.
(b) Language study.
(c) Exchange of students and professors.
(d) General influences.

Committees on Mines and Mining

The committees on Mines and Mining of the Senate and House, respectively, as finally constituted, are as follows:

Senate: Miles Poindexter, Washington, chairman; Thomas Sterling, South Dakota; Howard Sutherland, West Virginia; Medill McCormick, Illinois; Lawrence C. Phipps, Colorado; Truman H. Newberry, Michigan; Charles B. Henderson, Nevada; Thomas J. Walsh, Montana; Henry F. Ashurst, Arizona; James D. Phelan, California.

House: Mahlon M. Garland, Pennsylvania, chairman; Moses P. Kinkaid, Nebraska; Marion E. Rhodes, Missouri; J. G. Monahan, Wisconsin; L. B. Echols, West Virginia; J. M. Robison, Kentucky; Edwin B. Brooks, Illinois; William J. Burke, Pennsylvania; Oscar R. Luhring, Indiana; Otis Wingo, Arkansas; Milton H. Welling, Utah; Peter J. Dooling, New York; Lucien W. Parish, Texas; E. B. Howard, Oklahoma.

Imports of Potash To Be Retarded

Though little is being said about it, every legitimate effort that can be made by Government agencies is being put forward to retard the importation of potash until Congress can have a chance to take action. In the meantime, members of Congress friendly to the domestic potash industry have taken the Henderson bill of the last session as a basis and are attempting to work out a measure which will have the greatest possible chance of passage.

It is the understanding among officials at Washington that the President, who was anxious that the exchange of potash for food shall begin at the earliest possible moment, is now willing that Congress be given a reasonable opportunity to take action in the matter, before steps are taken to stimulate the importation of potash.

Tariff on Zinc

The following bill presented by Congressman McPherson, of Missouri, has been referred to the Committee on Ways and Means (H. R. 1246):

"A bill to provide a tariff and obtain revenue in connection with the metal contents of zinc ore.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that on and after the day following the passage of this act there shall be levied, collected, and paid upon the metallic contents of all zinc ores imported from any foreign country into the United States or any of its possessions a tariff of 2c. per pound."

Exposition at Washington

Wide attention has been attracted to the exposition being conducted by the Interior Department. The extensive lobby of the new Interior building is being used for the exposition. If the present rate of attendance continues, it is believed that no less than 100,000 persons will have visited the exhibit.

Minerals and the industries, in their production and preparation, occupy an important portion of the exhibit space. The war minerals are featured, as it has been on them that important portions of the department's work has centered during the last three years. The petroleum industry also is given prominence in the exposition. Large models of drilling rigs are on display and every step in the refining of petroleum is shown graphically. Oil shale is the basis of an important exhibit, which includes the field equipment for testing oil shales.

The Geological Survey sums up on large charts some of the most striking features of its work. Among other things, it is shown that more than 8500 letters are exchanged each month with the producers of minerals. The Survey's distribution of maps during the last year has exceeded 600,000, of which 450,000 were sold.

Extensive landscapes in relief show characteristic surface plants at metal and coal mines, at oil wells, and at stone quarries. In the same landscape are shown prospecting operations and stream gaging; and topographers and geologists at work.

One of the most striking features of the Bureau of Mines' exhibit is the display of all stages in the handling of metals and other minerals, from the crude raw material to the finished product. Copper, nickel, tin, lead, antimony, zinc, potash, sulphur, mica, abrasives, and other minerals are thus shown.

Gas masks, oxygen-breathing apparatus, dust and fume respirators, as well as a complete collection of the absorbents used in protection against gases, are on display. The explosives exhibit is one of the most complete ever shown, as is the display of types of mine safety lamps. A section of the Bureau of Mines exhibit shows how coal analyses are made and how fuel inspection is conducted.

Tin-Ore Importations

On May 28, the War Trade Board announced that applications would be considered for licenses to import tin ores and tin concentrates subject to the following conditions:

1. That such licenses will permit the importation only of shipments made from points of origin on or after June 8, 1919; and

2. That such import licenses will not be valid for entry until July 1, 1919.

Alaskan Mineral Statistics

A complete statistical compilation on Alaskan minerals will be made in connection with the taking of the census. The distribution of the questionnaires will be begun in July by the mineral-resources division of the U. S. Geological Survey. Arrangements have been made for the census enumerators to look up those who are delinquent in replying to the questionnaire. W. F. Lopp, superintendent of education in Alaska, will be in charge of the enumeration of population in Alaska and is perfecting arrangements which will insure the most complete returns possible on the status of the mineral industry of Alaska.

Tariff on Tungsten

The following bill by Congressman Charles B. Timberlake, of Colorado, according to the report of the American Mining Congress, has been referred to the Committee on Ways and Means (H. R. 2949):

"A bill to provide revenue for the Government and to promote the production of tungsten ores and manufactures thereof in the United States.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that on and after the day following the passage of this act there shall be levied, collected, and paid upon the articles named herein when imported from any foreign country into the United States or into any of its possessions, except the Philippine Islands and the island of Guam and Tutuila, the rates of duties which are herein prescribed, namely:

"First—Crude tungsten, ores and concentrates, $10 per unit of tungsten trioxid therein contained, a unit being herein defined at 1% of tungstic acid in a short ton of 2000 pounds.

"Second—Ferrotungsten, powder, tungstic acid, calcium, tungsten steel salts, and compounds of tungsten, and all other manufactured materials containing tungsten, not especially provided for in this section, $1.25 per lb. of tungsten contained therein.

"Sec. 2. That so much of any heretofore existing law or parts of law as may be inconsistent with this act is hereby repealed."

May Mining Dividends

Dividends paid in May, 1919, by 16 United States mining and metallurgical companies making public returns, amounted to $5,616,244, as compared with $10,543,897 paid by 22 companies in May, 1918.

Canadian and Mexican companies paid $749,340 in May, 1919, compared with $1,534,963 in the corresponding month of last year.

Greene Cananea did not pay the dividend which would have been due at this time, and the following companies made reductions in their payments: Anaconda (from $1.50 to $1 per share), Chief Consolidated (from 12½c. to 6½c.), Miami (from $1 to 50c.), Mohawk (from $2 to $1), United Verde Extension (from 75c. to 50c.), Granby Consolidated (from $2.50 to $1.25).

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Am. Zinc, Lead & Sm., pfd	U. S.	$1.50	$120,810
Anaconda, c.s.z.	Mont.	1.00	2,331,250
Barnes King, c.g	Mont.	.10	40,000
Caledonia, l.s.	Ida.	.01	26,050
Chief Cons., l.s	Utah	.06½	57,475
Cresson Cons., g	Colo.	.10	122,000
Golden Cycle, g	Colo.	.03	45,000
Homestake, g	S. D.	.50	125,580
Internat. Nickel, pfd	U. S.-Can.	1.50	133,689
Miami, c.	Ariz.	.50	373,557
Mohawk, c	Mich.	1.00	100,000
Nevada Wonder, s g	Nev.	.05	70,423
New Jersey Zinc	U. S.	4 00	1,400,000
Reorg. Booth, g s	Nev.	.05	50,000
United Eastern, g	Ariz.	.07	95,410
United Verde Exc.	Ariz.	.50	525,000
Canadian and Mexican Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	.04	80,000
Coniagas, s	Ont.	.12½	100,000
Granby Cons., c	B. C.	1.25	187,500
Hollinger, s.g	Ont.	.05	246,000
Lake Shore, s	Ont.	.02½	50,000
Lucky-Tiger Comb., g	Mex.	.12	85,840

Reorganized Booth paid 5c. a share, its first dividend since 1916, and, in addition, distributed one share of Tonopah Divide stock for each 50 shares of Booth stock.

The totals for the first five months are as follows, the figures for the corresponding period of last year being given in parentheses: United States mining and metallurgical companies, $40,076,176 ($65,100,172); holding companies, $696,572 ($743,433); Canadian, Mexican, Central and South American companies, $6,613,091 ($7,066,244).

Chicago Meeting of the A. I. M. M. E.

Plans for the meeting of the American Institute of Mining and Metallurgical Engineers at Chicago next September are assuming definite form, and the committee in charge announces the following schedule of events:

On Monday, Sept. 22, the opening day, the morning will be devoted to registration of members and guests at the convention headquarters, the Congress Hotel. Monday afternoon the first session for presentation and discussion of technical papers will be held, and in the evening a smoker, at which the committee guarantees all traces of glaciation will be dissipated.

It is planned on Tuesday to make an excursion in a body, by a boat chartered for the occasion, across the south end of the lake to Gary, for a trip through the famous steel mills. Wednesday will be devoted to technical sessions, morning and afternoon, and in the evening the banquet will be held at the Congress Hotel, at which all members of the institute and their wives will be the guests of Chicago.

On Thursday, a special train will convey the members and guests to La Salle and Depue, Ill., where the zinc smelteries, coal mines, and cement works will be visited. For those to whom these industrial operations are not of particular interest—this may include many of the ladies—there will be a trip by automobile to Starved Rock and other points of historical interest in the vicinity of La Salle.

For Friday, the 26th, several optional excursions have been planned to local industrial plants. One trip will take in the lead refineries at East Chicago and the Standard Oil Refinery at Whiting. Another excursion will be to Milwaukee, to the plants of the Allis-Chalmers Co. and the Power and Mining Machinery Co. This trip will also include the metallurgical works at North Chicago of the Fansteel Products Co. where the company's novel electrothermal processes in the production of metallic tungsten, molybdenum, cerium, and tantalum will be demonstrated.

For those interested in coal mining it is planned to have an excursion to the fields in Franklin and McCoupin counties, leaving Chicago late Friday evening and spending Saturday at the mines.

Caldwell Bill Reintroduced

The Caldwell bill, which aims to provide for further educational facilities by requiring the War Department to loan certain machine tools and scientific instruments, not in use for Government purposes, to trade and technical schools and universities, and for other purposes, was reintroduced in the House on May 26 and has been referred to the Committee on Military Affairs. The bill provides further that each institution so equipped shall be responsible to the Government, under regulations to be prescribed by the Secretary of War, for the proper care and safe return of such equipment when demanded, ordinary wear and tear excepted.

British Pig-Iron Output in 1918[*]

The British pig-iron output in 1918, according to the statistical bureau of the National Federation of Iron and Steel Manufacturers, was 9,939,429 gross tons, as contrasted with 9,420,254 tons in 1917. The following table gives the production by grades in 1916, 1917, and 1918:

BRITISH PIG-IRON PRODUCTION BY GRADES

	1918	1917	1916
Forge	772,321	864,899	899,467
Foundry	1,296,394	1,162,982	1,418,824
Basic	3,166,556	3,082,562	2,290,549
Hematite	3,538,435	3,993,374	4,042,014
Spiegeleisen, ferromanganese and ferrosilicon	246,943(a)	296,524	291,845
Direct iron castings	18,780	20,053	105,284
Totals	9,039,429	9,420,254	9,047,983

(a) Includes 23,078 tons of ferrosilicon.

The Cleveland district is credited with 2,424,139 tons of the 1918 total, most of it basic iron; the Scotland district made 1,062,645 tons, mostly hematite iron.

Lake Superior Safety Conference

The first general safety conference of mining interests in the Lake Superior districts is to be held at Duluth, Minn., June 19 and 20, according to an announcement by B. O. Pickard, mining engineer in charge of the Lake Superior district for the Bureau of Mines. The meeting will be held under the auspices of the Bureau. It is expected that the conference will be attended by mine managers, superintendents, and safety engineers of all the metal mines of Upper Michigan, Wisconsin, and Minnesota.

---

[*] From *Iron Age*, May 1, 1919.

In this connection, Mr. Pickard announces that the State Industrial Commission of Wisconsin has agreed to coöperate on mine inspection with the Bureau of Mines. The Bureau is asked to name a state mine inspector and two assistants, and the Industrial Commission will divide the expense with the Bureau.

The results of mine inspection in Michigan and Minnesota, in the saving of lives and limbs through the enforcement of safety regulations, have convinced the Wisconsin commission that such inspection is desirable for the protection of workers in Wisconsin zinc and iron mines and quarries.

John Hays Hammond for High Wages

John Hays Hammond has authorized the Department of Labor to circulate the following statement of his views with regard to the wage situation and its bearing on industrial and social conditions:

"The immediate problem that confronts us is the resumption of business, including, particularly, building construction, manufacturing, and mining. Business is being retarded because we are hoping for—or fearing—lower prices. Whether these fears, or hopes, are to be realized, no one can, perhaps, adduce convincing argument, but above the mass of conflicting contentions that are being applied to the situation one fact stands out preëminently: we can return neither to pre-war conditions nor to pre-war prices.

"As regards the future wage scale: I am of the opinion that we should not expect any significant reduction; nor should we desire such a reduction. We should not expect a lower wage scale, because there can be but little doubt that America faces a new era in her national development; that the future holds immeasurable potentialities; that at no time in the life of the nation has the outlook been brighter.

"Nor, as I have said, should we desire a general reduction of wages; as high wages bring with them greater purchasing power and higher standards of living among the wage earners of the nation. The economic importance of the increased purchasing power of our industrial wage earners is evident when we recognize the fact that this class numbers about eight million, and with those directly dependent upon them more than thirty million, or nearly one-third of the entire population of our country.

"From a social and political point of view, high wages are of inestimable advantage, in that they make possible a higher standard of living, which assures social contentment, industrial peace, and higher standards of citizenship.

"To maintain a high wage scale, wise and scientific tariff legislation is indispensable, in order to protect our national industries from the dumpings of the products of cheap foreign labor upon our home market.

"But when it comes to the development of an export trade, where we are to meet the competition of underpaid labor, we must rely upon the superior efficiency of our wage earners, and success can be attained only by the earnest coöperation of wage earners and employers, to increase in every way possible the productivity of our national industries."

Butte & Superior Decision

By R. C. Canby*

The Supreme Court of the United States handed down a decision on Monday, June 2, in the Minerals Separation, Ltd., vs. Butte & Superior Mining Co. case. At that time the court announced that owing to the technical nature of the case the opinion would not be read. The court merely announced its conclusion and decision.

From this announcement it would seem that the court had decided that the use of oil in any fraction of 1% on the ore constituted an infringement when said use is in conjunction with the disclosed purpose of the patent. This is in accordance with the contention of Minerals Separation. The court has apparently held, however, that the agent of the patent is any oil or oily substance which has the characteristic of preferential affinity for metalliferous mineral over gangue. On this point the court seems to have upheld the contention of Butte & Superior. The decision, as a whole, would seem to favor the Minerals Separation, Ltd., in so far as the Butte & Superior Co. will have to account for the use of the process during the last three years.

Whether the decision will develop to be entirely satisfactory to Minerals Separation will not definitely appear until the opinion of the court has been obtained and carefully studied. The synopsis given out at this date hints at a restriction of the process to the means disclosed in the patent. If this is so, it will have an important bearing on the question as to whether the pneumatic process is within the disclosed means.

The District Court in the Butte & Superior case, which has just been reviewed by the Supreme Court, introduced the question as to effectiveness of the oil used as well as to quantity, deciding that the petroleum oils used by the defendant were inert and useless and therefore not to be counted as the oil of the patent in determining quantity used, but stated that if the oil was efficient any oil in excess of 1% would be of that abandoned to the public.

The Circuit Court of Appeals reversed the District Court and held that the oils used by the defendant were effective, and that the use of such oils in quantities in excess of 0.5% was not within the patent. It is clear that the Supreme Court has reversed the Circuit Court of Appeals in so far as the Circuit Court of Appeals had held that the use of oil in quantities between 0.5 and 1% were not infringing, but has sustained that court as to its holding where the use of oil exceeds 1%. It would seem that the Supreme Court has further upheld the Circuit Court of Appeals upon the question of the character of the agent used, for it has refused to find, as requested by Minerals Separation, that the character of the oil is critical to the ore.

From our Washington correspondent we received the following telegram relative to the decision:

> What is regarded as a further victory for Minerals Separation, Ltd., came June 2 in the opinion of the United States Supreme Court in the case of Minerals Separation, Ltd., vs. the Butte & Superior Mining Co.
>
> It is believed in legal circles in Washington that the validity of the patent has been established for all time. Minerals Separation enjoyed further advantage in having the scope of the patent broadened to cover any use of oils up to any fraction of 1% of the weight of the ore. On the other hand, the court held that the process employed by the Butte & Superior Co. which made use of oils in excess of 1% did not constitute an infringement.

---

*Consulting metallurgist, Wallingford, Conn.

Editorials

National Economy

TO ASCRIBE to the Government an almost limitless power to spend is an all too prevalent habit. Few outside of those who pay Federal and State taxes keep in mind the pertinent fact that what the Government spends it must also collect from its citizens. When John Smith buys goods and the bills are presented he naturally expects to pay for them, and he knows that, if he does not, a collector will come after the money due, or through process of law a persistent attempt will be made to enforce payment.

Individually the bills of the nation are not presented to all of the Smiths, and the Joneses, and the Browns and others who make up our citizenry. The Government acts as our agent, and in that capacity determines what it shall buy for us, makes payment for us, and then turns around to us and collects from us the money with which to make payments. As an agent, the Government, or, rather, its employees, must be paid for their services. What the taxpayer gets from this agent is therefor what he has paid to the Government less what it has cost to maintain the agency. As with any other agency, the greater the amount of business, the greater the sum which is spent for the maintenance of the agency and as payments for its employees' services.

During the war we were importuned to exercise thrift and to economize to the limit. Most of us in one way or another did so. Some of us undoubtedly experienced a questioning way back in our minds as to whether the thrift lectures might well have been turned upon the Government itself, but during the course of the war little direct criticism was made. There was a general feeling that nothing should be permitted to interfere with the speedy termination of the war in a satisfactory manner. We acquired the habit of accepting the judgment of the Government in determining the purpose for which the money of the taxpayer should be spent, and the amount as well. Of course, we expected that the men whom we sent to Congress would keep in their minds the fact that they were spending our money as well as some of their own, and that they would use due caution in keeping expenses down.

Curiously enough, there does not seem to be any other effort now than the invention of new methods of spending not less but more money. It is an opportune time for the public to turn to and give a few thrift lectures to Congress itself. In fact, if thrift lectures make any impression at all, it might be well worth while to provide a lot of them for Congress.

We also believe that a thorough course of thrift lectures should be given in every governmental department. We believe in the budget system, and as a part of that system the strict limitation of each governmental department to a definite number of activities. Departments have a way of spreading out and still further spreading out. We seriously question the necessity of this expansion, although not in all instances, for account must be taken of the growth of the country.

Senator Smoot has sounded a warning note that the Government's expenditures are far outrunning its income. He declared that a beginning toward economy must be made somewhere. Pointing out that the expenditures during the next year will amount to twelve billion dollars, of which only four to five billion can be raised by taxation, he said: "With such a situation confronting this country it would be suicidal for the Government to continue to spend money as it has been during the last two years. Congress must reduce appropriations all along the line." The Senator further expressed the view that his colleagues were fully aware of the situation and would coöperate with him and other members of the House and Senate who are trying to economize.

This is a hopeful sign. We must, however, get behind the members of Congress who feel their trusteeship sufficiently to take effective steps to reduce our expenditures. It is necessary for the practice of Government economy to spread to the state legislatures, and on further to the municipal governments.

Thrift on the part of all of our officials in governmental expenditures should become the prevailing custom.

Happenings in Mexico

WHEN school teachers strike and soldiers have to be ordered out to quell an unruly mob of teachers striking for pay long withheld, the event may well be considered the last straw in a long series of happenings any one of which might seriously disturb a much better-balanced nation than Mexico. The latest dispatches from that unhappy country state that Carranza has placed the city of Mexico under martial law. There is said to be a bitter feeling toward the military caste, and strikes and uprisings, according to latest accounts, are taking place.

The United States Department of State, in response to a request to permit over 2000 Mexican troops from Agua Prieta to pass through New Mexico, Arizona, and Texas into Juarez, has refused permission, on the ground that the presence of Carranza troops was necessary in Agua Prieta for the protection of American citizens against operations of Yaqui indians in that vicinity. Late accounts foretell greater activity on the part of Villa and contain the announcement that General Felipe Angeles, Villa's principal military leader, has been declared provisional president under the Mexican constitution of 1857, with Villa as Angeles' Secretary of War.

Though there is a dearth of accurate news of what is taking place in Mexico, sufficient information dribbles through to warrant the belief that the optimistic predictions of a short time ago are not soon to be fulfilled, or at best their fulfillment is to be postponed to some time in the distant future.

The fires of revolution have flamed forth at various times, and for a while it looked as if they had been quenched, but the conflagration has apparently broken forth again. How far it will go, and how serious will be its consequences, no one can tell. We hold no brief for Carranza, but we had hoped that he would develop sufficient strength to bring order out of the confusion left in the wake of the constantly recurring revolutions.

If the present situation in Mexico is going to grow worse, and the little progress toward better things which has taken place in the past year is to be lost, what is to be the attitude of the Administration toward Mexico? American mining interests and the rights of American citizens are involved. How are they going to be protected?

Industrial Insurance

IT AFFORDS us pleasure to be able to present a mining engineer's review of State Industrial Insurance in Nevada. The problem of handling personal injuries incurred in mining and other industries in an equitable manner has long been a source of annoyance and difficulty between employer and employee. That the whole subject is on its way to a rational settlement no one who has kept in touch with legislative events in the past five years can deny.

When industrial insurance was undertaken in Nevada, few had much hope that real improvement would result, but many mining companies were glad to make the experiment. The results have been excellent, and industrial insurance has now been accepted generally as the solution of the problem. Its success depends largely upon the men in whose hands the administration is placed. With due care in the selection of such men, as has evidently been the practice in the instance mentioned, an excellent result is assured.

Federal Aid for Prospectors

THE suggestion made by E. J. Ristedt in an article in this issue is at least worth discussing by mining engineers, the Bureau of Mines, and the U. S. Geological Survey. That the plan outlined will not find great support is our candid opinion, although we will be glad to hear from others upon the subject.

It occurs to us that a way can be found that will avoid the proposed governmental assistance and at the same time stimulate prospecting work. The familiar method of the "grub stake" and the prospector starting out with pick, shovel, and the hope of finding a rich deposit can undoubtedly be improved upon. Formerly, the discovery of a deposit was effected with comparative ease, as in many instances the oreshoot outcropped or gave pronounced evidences of its presence upon the surface. It is the prevailing opinion that most of the easily found deposits have been discovered, although there are undoubtedly some that still await the coming of the casual prospector.

Two things suggest themselves to us. One is to improve the ability of the prospector by selection and intensive training along the lines of the mining geologist, due regard being paid to the differences of point of view between the mining geologist and the prospector-geologist. The other is to put the prospector-geologist on a salary, just as a properly qualified engineer is so placed by a mining company.

To give a man his "grub" and the hope of a share in what he may discover might have been well enough in the day when discoveries were easily made, but this form of assistance is not sufficient to make the avocation worth while for a man who has the keenness to fit himself thoroughly for the task of searching out mineral deposits upon the subtle evidences that may now be discoverable.

Exploration companies have usually been such in name alone. Most of their work has consisted in the examination of discoveries already made, and in some cases they have continued the work started by the discoverer. An enlargement upon the field of these companies is much to be desired, and if they take the initiative by placing in the field well-trained men under remunerative salaries for the purpose of making discoveries they will, we venture to predict, be more successful than they have been in the past.

There are probably many young mining engineers who have excellent groundwork for the business of prospector-geologist and who would be glad of the chance to work along the lines suggested. Conservatism is an excellent thing, but often unexpected rewards come to the individuals or company that starts a new method of attacking an old problem.

The Townsend bill creating a Federal Highways Commission, consisting of five members, has for its object the coördinating of the highway construction and the highways of the individual states as parts of an integral system. It also provides that roads should be built on the basis of the present requirements, plus what might be reasonably expected of them in the future. To secure suitable construction and a proper conservation of the large sums that are being spent and will be spent in the near future is a worthy and commendable objective.

The situation of the railroads is rapidly reaching a climax. Walker D. Hines, Director-General of Railroads, on May 24 asked Congress to appropriate $1,200,000,000 in addition to the $500,000,000 already provided to meet deficits and to continue Government operation of the American railroads. Fewer trains, poorer service, and higher costs to both passenger and freight shipper, as well as an aggregate loss of $486,000,000 to the Government up to Apr. 30, 1919, in a few words represent what the experiment in Government operation has cost the country.

There was a time when the farmer paid little attention to his tools and when farm tools were made to last only a season. The increasing use of machinery in farming has put both manufacturer and farmer on the *qui vive* to get the most out of the mechanical equipment, the former to turn out a machine that would stand up to the work and the latter to care for it in such a way as to prolong its useful life and retain its efficiency. The miner has passed through a similar development. More and more mechanical equipment is being used in mining. More and more does mechanical upkeep determine the success of such equipment. In this issue Harry E. Scott emphasizes the importance of keeping air drills in first-class mechanical condition and the intelligent handling and conservation of repair parts. Undoubtedly many mines do pay particular attention to the mechanical efficiency of air drills and are equipped to make shop tests, but others give little attention to this vital matter. Sharp steel, good mechanical condition of the drill, and properly trained miners are three elements which contribute a not unimportant part in reducing mining costs, and which often determine the difference between a property which pays and one which is a burden to its stockholders.

BY THE WAY

We quote, from the *Sunday Mining Gazette* of Houghton and Calumet, Mich., the following, which may throw some light on the criticism to which the *Journal* has been subjected regarding the failure of our issues to reach their destination within scheduled time: "Here is one of any number of instances that cry out loud as part of the conspiracy to 'get' Mr. Burleson, the Postmaster General: George L. Walker's Boston *Commercial*, published a week ago yesterday, Apr. 19, reached the *Gazette* office through the mail, Saturday, Apr. 26. This is the third time within two months that we have observed similar delinquent treatment of this one newspaper. The *Engineering and Mining Journal*, issued 10 days ago, due to arrive in Houghton a week ago, reached here on Friday."

"My missus do feel pert these days, m'son," said Cap'n Dick. "An' can't say as 'ow I blames 'er, for, dam-me, tha women, bless their 'earts, 'ave done theyselves proud in h'all this 'ere war work. 'Ere they be 'oldin' man's jobs in tha factories, some o' they 'as gone in for politics an' h'even for 'igh finance. Firs' bloody time I 'eard tell o' they in finance wuz in h'Australia w'en Jan Tregar's missus bought shares in Royal Blue mine an' cleaned h'up a fortun'. Jan, 'e wus tribbitin' on eight-'underd level o' tha Royal, an' 'e nawed bloody well they wuz very like to 'it tha reef h'any day. 'E nawed, too, tha super wuz a 'ooken-snivey rascal, an' if 'e got firs' chance 'e'd give none to tha res'. So Jan an' 'is missus fixed a'tween them as to 'ow she wuz to naw w'en they'd struck tha h'ore. H'every day she'd meet Jan w'en come h'off shif', an' they'd walk 'ome together. But one day Jan didn't come on time, an' then tha missus nawed sumthin' wuz h'up; so she waited. Truth to tell, they'd 'it tha h'ore, but super sent word for tha men to work 'nother 'alf shif' so 'e an' tha directors could corner tha market a'fore tha news got raoun'. 'Baout that time, h'up come tha skip with a bit o' timber on un, one h'end h'all marked with candle soot. An' then Jan's missus nawed. So she flew to tha broker's an' put h'up tha savin's she an' Jan 'ad. 'Ow do I know baout this 'ere? Well, m'son, I 'appened to be at station gettin' bit o' fresh drill steel w'en Jan 'elped put they bit o' timber on tha skip. Super wuz there too, and' 'e sez, ''Ere, boys; let's tell 'em to send daown more timber to keep things gawin'.' An', min' you, 'e did, too—for Jan an' 'is missus."

D. E. A. C.

As an example of the perils that beset the path of the neophyte whose mind and pocketbook are astir to the tremendous possibilities of investment in the great unknown, we publish (verbatim) the following "Geological Observation," appearing in an advertisement which is taken from a Southwest newspaper: "A portion of the land examined by me I found to be a great land made within the last 1000 years. I found it to be pre-cambrian formation and overlaid with strand sand 25 ft. and next to the cambrian zone, is the carboniferous zone. I refer to the carboniferous formation for the jures toras age. After the water has pierced, sand has in this section overlaid the blue lime which belongs to the devonian formation, and is undoubtedly of animal age. There is intrusion that shows some oil on surface which can be found in the clay, the sun bringing out a greasy substance, which occurs only from 1 to 3 mm. in thickness. This indicates that oil must be here, or anyhow, not far. Therefore, it ought to be carefully prospected for oil and gas. The dolomite lime, or common named magnesium lime, a thickness of which is from 120 ft., overlying the devonian lime, a blue and brown shale which resembles lignitem, can be seen. All lime and sedimentary rock inspected has wonderful fossiteles and in this section, however, a broad, great thickness of oysters, which have lived on reefs in this inland sea, and in the calcium formation imbedded, and brought impression of petrification, which indicates a thickness of between 30 and 40 ft., as found in a well drilled up to 550 ft. Semi-anticline appears at a depth of 500 ft. There the carboniferous zone is overfaulted by the pre-cambrian in this section and slopes N. E. There is no need for anyone to hesitate to drill in this section near the arenas (half circles); as oil runs off from the anticline, gently sloping towards the arenas (half circles); therefore, a pool of oil is formed next to the sinaline along and in the arenas (half circles); and later building a contact wall with the anticline making one of the best trend and oil pools below the blue lime. And there oil is to be found in paying quantities. There has never been any volcanic action within 20 miles square. Everything is in its origin. Lime extends for a short distance, but I will not say, as it might be covered by strand sand, and further exploring will assure. Thence shale, thence silica, thence lime, thence black shale, thence blue shale with a little stray sand; thence blue lime and then a brown shale, very thick, 100 ft. I will refer to about 2700 ft. shall be drilled, and would not miss very many feet if I would say at 2500 ft., and will strike oil in large quantities. Geological observations have proved to me that the pressure brought on a rolling knoll in the eastern direction, forming (half-circles) and saddles, there oil has accumulated through great water sheets, leaving a deposit in the arenas which passed the dyke. This part should be carefully inspected, because a few blossoms of lead can be found close to the dyke. There is no need to prospect west about 20 miles from here, as there was volcanic disturbance and the dykes are broken and brought the mineral to the surface. This action occurred lately, within the last 1000 years, from time to time, and the last disturbance, I would say, was in the last 50 years, which indicates distinctly on the surface and may be remembered by old settlers in the vicinity at that time, and the oil disappeared. Therefore, I will say that all the oil which was brought down by the rivers is only on the east side of the river in paying quantities, as there was no disturbance, and any volcanic action on the east side, and everything slopes S. E., partly sinking towards the east of Columbus, there is the strongest showing. I recommend this to interest people and bring the greatest wealth to the surface. ——— ———,

——— Hotel."

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons, if so requested.

COPPER

101896—ALLOYS—The Properties of Some Copper Alloys. W. Rosenhain and D. Hanson. (Advance Copy, Inst. of Metals, Mar. 25, 1919; 12 pp., illus.)

101897—ARIZONA—Gold, Silver, Copper, Lead and Zinc in Arizona in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917—Part I; 42 pp.)

101898—IRISH COPPER-ORE DEPOSITS. (Statist, Apr. 19, 1919; 1½ pp.) 40c.

101899—LEACHING—Practical Considerations in Ammonia Leaching of Copper-Bearing Ores. Lawrence Eddy. (Chem. and Met. Eng., Apr. 1, 1919; 5¼ pp.) Description of Kennecott Copper Corporation plant and its operation.

101900—MILL—Unloading, Crushing, and Screening at the Arthur Mill of the Utah Copper Co. F. G. Janney. (Min. and Sci. Press, Apr. 5, 1919; 7¾ pp., illus.) 20c.

101901—REFINING—Ampere Efficiency in Copper Refining. M. H. Merriss. (Eng. and Min. Journ., Apr. 26, 1919; 1½ pp.) 20c.

101902—REFINING—Laboratory Electro-Deposition Plant. Carle R. Hayward. (Chem. and Met. Eng., Mar. 1, 1919; ¾ p.) Describes a set of tanks with glass sides used at Mass. Inst. of Technology.

GOLD AND SILVER—GEOLOGY

101903—MANITOBA—Prospecting Areas in Manitoba. E. L. Bruce. (From a pamphlet entitled, Manitoba's Northland, published Nov., 1918; 10 pp., illus.)

101904—ONTARIO—Larder Lake Gold Area. Percy Hopkins. (Can. Min. Journ., Feb. 5, 1919; 3½ pp., illus.) 20c.

101905—ONTARIO—Slate Islands, Lake Superior. Arthur L. Parson. (Ann. Report Ont. Bureau of Mines, 1918; 12½ pp., illus.)

101906—SULPHIDE ORE—Occurrence of Gold in Sulphide Ore. Walter S. Palmer. (Eng. and Min. Journ., May 24, 1919; 1 p.) 20c.

GOLD DREDGING

101907—CALIFORNIA—Latest Yuba All-Steel Placer Dredge. Lewis H. Eddy. (Eng. and Min. Journ., Apr. 26, 1919; 1 p., illus.) 20c.

101908—DREDGING AND RE-SOILING. M W. von Bernewitz. (Min. and Sci. Press, Apr. 5, 1919; 1 p., illus.) 20c.

GOLD AND SILVER—GENERAL

101909—ALASKA—The Nelchina-Susitna Region, Alaska. Theodore Chapin. (Bull. 668, U. S. Geol. Surv., 1918; 60 pp., illus.)

101910—ARIZONA—Gold, Silver, Copper, Lead, and Zinc in Arizona in 1917. V. C. Heikes. (Mineral Resources of the U. S., 1917—Part I; 42 pp.)

101911—CHOSEN—The Unsan Mines, Korea. H. J. Evans and K. F. Hoefle. (Min. and Sci. Press, Mar. 29, 1919; 9 pp., illus.) 20c.

101912—NEVADA—The Divide District. Jay A. Carpenter. (Eng. and Min. Journ., May 17, 1919; 3 pp., illus.) 20c.

101913—REFINING—The Electrolytic Refining of Silver and Gold. George G. Griswold. (Eng. and Min. Journ., May 3, 1919; 2 pp., illus.) A paper presented at a meeting of the Am. Electrochem. Soc., April, 1919. 20c.

101914—SOUTH AFRICA—Labor and Gold Mining in South Africa. (Eng. and Min. Journ., May 24, 1919; 4½ pp.) Address delivered by Sir Evelyn A. Wallers, president of the Transvaal Chamber of Mines. 20c.

IRON ORE DEPOSITS, MINING, ETC.

101914a—CANADA—A Proposed Bounty on Canadian Iron Ore. F. W. Gray. (Bull., Can. Min. Inst., May, 1919; 3 pp.) 40c.

101915—LUXEMBOURG—La Question du Luxembourg. (L'Echo Des Mines, Apr. 20 and 27, 1919; 4 pp.)

101916—MINNESOTA—Iron-Ore Super-Taxation in Minnesota. Dwight E. Woodbridge. (Eng. and Min. Journ., May 3, 1919; 4¾ pp., illus.) Abstract of a statement made to the Tax Committee of the House of Representatives, Minnesota Legislature. 20c.

101917—PRODUCTION—Iron Ore, Pig Iron and Steel in 1917. Ernest F. Burchard. (Mineral Resources of the U. S., 1917—Part I; 48 pp.)

IRON AND STEEL—METALLURGY

101918—ACID BESSEMER STEEL—A Technical Study of Acid Bessemer Steel. (Iron Age, Mar. 6, 1919; 2 pp.) Abstract of paper by Richard S. McCaffery, in the "Wisconsin Engineer." 20c.

101919—ELECTRIC FURNACE—The Greene Rolling Cylinder Arc Furnace. (Iron Age, Apr. 17, 1919; 2½ pp., illus.) 20c.

101920—ELECTRIC STEEL FURNACE.—The Vom Baur Electric Steel Furnace. (Iron Age, Apr. 24, 1919; 2 pp., illus.) 20c.

101921—FERROMANGANESE—Production of Ferromanganese in the Blast Furnace. P. H. Royster. (Bull. A. I. M. E., Feb., 1919; 13 pp., illus.) 40c.

101922—FOUNDRY PRACTICE—The Electric Furnace: Its Introduction into Foundry Practice. W. E. Moore. (Advance Copy, Am. Electrochem. Soc., Apr. 5, 1919; 6 pp.)

101923—LUXEMBOURG—La Question du Luxemhourg. (L'Echo des Mines, Apr. 20 and 27, 1919; 4 pp.)

101924—OPEN-HEARTH STEEL FURNACES, Water-Cooled Equipment for. Wm. C. Coffin. (Bull. A. I. M. E., Feb., 1919; 18½ pp., illus.) 40c.

101925—PHOSPHORUS—Le Dosage du Phosphore dans les Aciers, les Fontes, les Scories de Déphosphoration. A. Travers. (Chimie & Industrie, Feb. 1, 1919; 8¾ pp.)

101926—PRODUCTION—Iron Ore, Pig Iron and Steel in 1917. Ernest F. Burchard. (Mineral Resources of the U. S., 1917—Part I; 48 pp.)

101927—PULVERIZED COAL in Canadian Steel Plant. C. F. Herington. (Iron Age, Apr. 24, 1919; 5½ pp., illus.) 20c.

LEAD AND ZINC

101928—ARIZONA—Gold, Silver, Copper, Lead, and Zinc in Arizona in 1917. V. C. Heikes. (Mineral Resources of the U. S., in 1917—Part I; 42 pp.)

101929—ECONOMICS of the Zinc Industry: A Prophetic Discussion. Parker C. Choate. (Chem. and Met. Eng., Mar. 1, 1919; 2¼ pp.)

101930—MEXICO—Informe acerca de la "Planta Calcinadora" perteneciente a la International Ore Co., S. A., Saltillo, Coah. (Boletin Minero, Nov. and Dec., 1918; 5 pp.)

101931—RESIDUES—Sintering Zinc Residues. K. Stock. (Chem. and Met. Eng., May 15, 1919; 3½ pp., illus.)

101932—WEST AUSTRALIA—The Northampton Lead-Mining District, West Australia. C. M. Harris. (Min. Mag., Mar., 1919; 3 pp.) 40c.

OTHER METALS

101933—ALUMINUM AND MAGNESIUM—The Metallurgy of Aluminum and Magnesium. H. B. Pulsifer. (Salt Lake Min. Rev., Apr. 30, 1919; 4¾ pp., illus.) 20c.

101934—COBALT, MOLYBDENUM, NICKEL, Titanium, Tungsten, Radium, Uranium, and Vanadium in 1916. Frank L. Hess. (Mineral Resources of the U. S., 1916—Part I; 34 pp.)

101935—IDAHO—Tungsten, Cinnabar, Manganese, Molybdenum, and Tin Deposits of Idaho. D. C. Livingston. (Bull. No. 2, Univ. of Idaho, School of Mines, Jan., 1919; 44¾ pp., illus.)

101936—MANGANESE Ore Deposits in Cuba. Ernest F. Burchard. (Bull. A. I. M. E., Mar., 1919; 4½ pp.) 40c.

101937—MANGANESE: Ores, Uses, Production, Etc. T. G. Trevor. (S. Afr. Journ. of Ind., Jan., 1919; 8½ pp.)

101938—MOLYBDENUM—Preliminary Determination of the Thermal Expansion of Molybdenum. Lloyd W. Schad and Peter Hidnert. (Sci. Paper, U. S. Bureau of Standards No. 332, 1919; 10 pp., illus.)

101939—NICKEL—A Process for Electrolytically Refining Nickel. Geo. A. Guess. (Advance Copy, Am. Electrochem. Soc., Apr., 1919; 4 pp.)

101940—QUICKSILVER—Cinnabar Ore in Jackson County, Oregon. A. E. Kellogg. (Eng. and Min. Journ., May 3, 1919; 1 p., illus.) 20c.

101941—QUICKSILVER—Sobre la Industria Minera del Azogue en Italia y en los Estados Unidos. (Revista Minera, Feb. 16, 1919; 1½ pp.) 40c.

101942—RADIUM Production. Charles H Viol. (Science, Mar. 7, 1919; reprinted in Radium, Apr., 1919; 1½ pp.) 20c.

101943—TIN—Hydraulic Prospecting at the Rooiberg Tin Mines. E. R. Schoch. (Journ. So. Afr. Instn. Engrs., Nov.-Dec., 1918, and Mar., 1919; 10¼ pp.) Original paper and discussion thereof.

101944—TIN—The Mauss Centrifugal Separators. E. M. Weston. (Eng. and Min. Journ., May 17, 1919; 2 pp., illus.) 20c.

101945—URANIUM: Its Extraction From Pitchblende. Gustave Gin. (Advance copy, Am. Electrochem. Soc., Apr. 5, 1919; 6 pp.)

NONMETALLIC MINERALS

101946—GARNET in North Carolina and the Market for Abrasive Garnet. Frank J. Katz. (Eng. and Min. Journ., May 24, 1919; 3½ pp.) 20c.

101947—LIME in 1917. G. F. Loughlin. (Mineral Resources of the U. S., 1917—Part II; 31 pp.)

101948—MAGNESITE, Chromite, and Fireclay at Mount Pring, Bowen. E C. Saint-Smith. (Queensland Govt. Min. Journ., Feb. 15, 1919; 1 p.) 60c.

101949—PHOSPHATE—Fertilizers. B. De C. Marchand. (So. Afr. Journ. of Ind., Oct., 1918; 9½ pp.) Fifth article of series on sources of phosphoric oxide.

101950—POTASH in 1917. Hoyt S. Gale and W. B. Hicks. (Mineral Resources of the U. S., 1917—Part II; 88 pp.)

PETROLEUM AND NATURAL GAS

101951—ALBERTA—Oil Production, Sheep River Area. S. E. Slipper. (Summary Report, Can. Geol. Surv., 1917—Part C.; 3 pp.)

101952—ANALYSIS—Estimation of Benzene and Toluene in Petroleum. F. D. Thole. (Journ. Soc. of Chem. Ind., Feb. 28, 1919; 2¼ pp.)

101953—CO-OPERATION in the Petroleum Industry. M. L. Requa. (Address before the National Petroleum Congress, Mar 27, 1919; 31 pp.)

101954—RECORDS—The Use of the Graphic Well Log. Hugh A. Maeier. (Min. and Oil Bull., Apr., 1919, 3 pp.)

101955—TEXAS—The Oil Fields of Northeastern Texas. W. L. Watts. (Min. and Oil Bull., Apr., 1919; 4 pp., illus.) 20c.

ECONOMIC GEOLOGY—GENERAL

101956—IGNEOUS ROCKS—A Description of the Quantitative Classification of Igneous Rocks, with Tables for the Calculation of the Norm. Henry Stephens Washington. (U. S. Geol. Surv., Extract from Prof. Paper 99, 1918; 36 pp.)

101957—ONTARIO—Notes on Lake Abitibi Area. Percy E. Hopkins. (Ann Report Ont Bureau of Mines, 1918; 15 pp., illus.)

MINING LAW

101958—MINING RIGHTS—Peculiar Mining Rights. Chesla C. Sherlock. (Eng and Min. Journ., Mar. 29, 1919; 1 p.) 20c.

101958—UNIFORM MINING LAW for North America. T. E. Godson. (Bull. A. I. M. E., Apr., 1919; 12½ pp.) 40c.

MINING—GENERAL

101959—ACCIDENTS—Quarry Accidents in the United States. Albert H. Fay. (U. S. Bureau of Mines, Tech. paper 213; 1919; 59 pp.)

101960—ACCIDENTS—The Geophone. (Eng. and Min. Journ., May 17, 1919; 1 p., illus.) Describes a "listening" instrument now being used by the Bureau of Mines to aid in locating entombed miners. 20c.

101961—BLASTING—The Prevention of Misfires. Grant H. Tod. (Min. and Sci. Press, Apr. 12, 1919; 1 p.) 20c.

101962—BRITISH COLUMBIA—A Quarter Century of Mining in British Columbia. E. A. Haggen. (Min. and Eng. Rec., Jan., 1919; 5 pp.) 60c.

101963—BUREAU OF MINES—The Pittsburgh Bureau of Mines. Experiment Station. (Eng. and Min. Journ., May 24, 1919; 3½ pp., illus.)

101964—DRILLING—The Blow of the Drill Bit, Sharp or Dull. Frank Richards. (Eng. and Min. Journ., Apr. 26, 1919; 1½ pp.) 20c.

101965—EDUCATION—Teaching Discharged Soldiers Mining. Francis A. Thomson. (Eng. and Min. Journ., Apr. 26, 1919; ¾ p.) 20c.

101966—HOISTING—Monorail and Monocable Hoisting. C. C. Hoke. (Eng. and Min. Journ., Apr. 26, 1919; 1 p., illus.) 20c.

101967—PROSPECTS—Ventilation for Prospects. Charles E. Dutton. (Eng and Min. Journ., May 24, 1919; ¾ p., illus.) 20c.

101968—QUEENSLAND Mining Industry; Review of the Year 1918. (Queensland Govt. Min. Journ., Mar. 15, 1919; 16 pp.) 60c.

101969—RHODESIA—Minerals from Rhodesia. (Bull. Imp. Inst., Oct.-Dec., 1918; 20½ pp.) Statistics of production, and notes on occurrence of various minerals. 40c.

101969a—SHOVELING—A Study of Shoveling as Applied to Mining. G Townsend Harley. (Bull. A. I. M. E., Feb., 1919.) 40c.

101969b—TAXATION—Depletion of Mineral Deposits and the Federal Income Tax. (Eng. and Min. Journ., Apr. 26, 1919; 2 pp.) An abstract from a paper presented by Paul Armitage at meeting Min. and Met. Soc of Am.

101970—TAXATION—Principles of Mining Taxation. Thos. W. Gibson. (Bull. A. I. M. E., Apr., 1919; 9½ pp.; also Bull. Can. Min. Inst., Mar., 1919.) 40c.

FLOTATION

101971—EXPERIMENTS—A Device for Flotation Experiments. Will H Coghill. (Min. and Sci. Press, Apr. 12, 1919; 1¼ pp., illus.) 20c.

101972—FROTH REMOVAL from Flotation Cells. Claude T. Rice. (Eng. and Min. Journ., Apr. 26, 1919; ¾ p.) 20c.

ORE DRESSING—GENERAL

101973—CONTROL of Ore-Dressing Operations. George J. Young. (Eng and Min. Journ., May 24, 1919; 1¼ pp.) 20c.

101974—ECONOMICS of Concentration. A. P. Watt. (Eng. and Min. Journ., May 3, 1919; 5 pp., illus.) 20c.

101975—SEPARATORS—The Mauss Centrifugal Separators. E. M. Weston. (Eng. and Min Journ., May 17, 1919; 2 pp., illus.) 20c

METALLURGY—GENERAL

101976—ACCIDENTS—Les Accidents Causés par l'Électricite dans les Mines, Minières, Carrières et Usines Métallurgiques, (pendant les Années, 1913 à 1915). Joseph Libert. (Ann. des Mines de Belgique, Vol. 20, Part I, 1919; 35 pp.)

101977—CORROSION—Fourth Report to the Corrosion Committee of the Institute of Metals. Guy D Bengough and O. F. Hudson. (Advance copy, Inst of Metals, Mar. 26, 1919; 9 pp.)

101978—CRUCIBLES—The Use and Abuse of Crucibles. A. C. Bowles. (Min. and Sci Press, Apr 12, 1919; 1¼ pp., illus.) 20o

101979—LABORATORY—The Scope of the Works Laboratory. Fred C A H Lantsberry. (Advance copy, Inst. of Metals, Mar 26, 1919; 7½ pp.)

101980—REFRACTORY BRICKS—Preventable Defects in Refractory Bricks. C. E. Nesbitt and M L Bell. (Advance copy, Am Soc for Test Materials, June 27, 1919; 13½ pp., illus.)

101981—SINTERING—Recent Improvements in Sintering Equipment and Practice. (Eng and Min. Journ., Apr 26, 1919; 1¼ pp., illus.) 20c

FUELS

(See also "Petroleum and Natural Gas")

101982—COKE—Precautions Necessary in Grinding Samples of Coke for Analysis. A E Findley. (Journ Soc. Chem Ind., Apr 15, 1919; 1¼ pp.)

101983—FUEL BRIQUETTING in 1918. C E Lesher. (Mineral Resources of the U S., 1918—Part II; 3 pp.)

101984—GASOLINE—Motor Gasoline, Properties, Laboratory Methods of Testing and Practical Specifications. E. W. Dean. (Tech. Paper 214, U. S. Bureau of Mines, 1919, 33 pp., illus.)

101985—LIGNITE—Notes on Lignite, Its Characteristics and Utilization. S M. Darling. (Tech. Paper 178, U. S. Bureau of Mines; 18¼ pp.)

101986—NATURAL-GAS GASOLINE in 1917. John D. Northrop. (Mineral Resources of the U. S., 1917—Part II; 22 pp.)

101987—PULVERIZED COAL in Canadian Steel Plant. C. F. Herington. (Iron Age, Apr. 24, 1919; 4¾ pp., illus.) 20c.

101988—U. S. FUEL ADMINISTRATION—Work of the National Production Committee of U. S. Fuel Administration. James B. Neale. (Bull. A. I. M. E., Feb., 1919; 5½ pp.) 40c.

MINING AND METALLURGICAL MACHINERY

101989—BELTING—Specifications for Leather Belting. Harry A. Hey. (Ind. Management, Apr., 1919; 6 pp., illus.) Twelve requirements to control quality from viewpoint of use. 20c.

101990—CRANES AND HOISTS—Speed Control of Induction Motors and Cranes and Hoists by Means of Solenoid Load Brakes. R. H. McLain and H. H. Vernon. (Gen. Elec. Rev., Feb., 1919; 10 pp., illus.) 40c.

101991—ELECTRIC FURNACES of the Resistance Type Used in the Production of Essential War Materials. T. F. Baily. (Advance copy, Am. Electrochem. Soc., Apr. 5, 1919; 4 pp., illus.)

101992—REPAIRS—Thermit Repairs to a Rock Crusher. (Eng. and Min. Journ., May 10, 1919; 1 p., illus.) 20c.

101993—TURBO-BLOWER—Improved Turbo-Blower Unit at International Nickel Co. Plant. W. L. Wotherspoon. (Eng. and Min. Journ., May 17, 1919; 1 p., illus.) 20c.

101994—WELDING—Oxy-Acetylene Welding. J. H. Davies. (Engineering, Feb. 7, 1919; 1½ pp.) Paper before Instn. of Mechan. Engrs. 40c.

101995—WIRE ROPE—Investigation of Wire Rope. J. H. Griffith. (Eng. and Min. Journ., Apr. 26, 1919; 1 p.) Abstract of a report by the U. S. Bureau of Standards. 20c.

INDUSTRIAL CHEMISTRY

101996—CHLORINE—The Future of Electrolytic Chlorine. A. H. Hooker. (Advance copy, Am. Electrochem. Soc., Oct. 1, 1918; 5½ pp.)

101997—COAL BYPRODUCTS—Coal: Its Value as a Raw Material for Distillation Products. J. A. Wilkinson. (So. Afr. Journ. of Ind., Feb. and Mar., 1919; 15 pp.) 80c.

101998—NITROGEN—How the Nitrogen Problem Has Been Solved. Henry J. M. Creighton. (Journ. Franklin Inst., Apr., 1919; 26 pp., illus.; to be concluded.) 60c.

101999—SULPHURIC-ACID INDUSTRY, The. M. Rindl. (So. Afr. Journ. of Ind., Feb., 1919; 10 pp.) 40c.

MATERIALS OF CONSTRUCTION

102000—CEMENT—Influence of Gypsum on the Blast-Furnace Slags in the Manufacture of Cement. Euphime Bereslavsky. (Chem. and Met. Eng., Jan. 1, 1919; 3½ pp.) A report on the granulated slag-lime-gypsum composition cements as developed in Russia.

102001—CONCRETE—Proportioning of Pit-Run Gravel for Concrete. R. W. Crum. (Advance copy, Am. Soc. for Test. Materials, June 27, 1919; 17½ pp.)

MISCELLANEOUS

102002—CAPITAL—Nature and Uses of Capital in Mining. J. R. Finlay. (Eng. and Min. Journ., May 3, 1919; 6¾ pp.) 20c.

102003—LABOR—Industrial Coöperation. Charles P. Steinmetz. (Eng. and Min. Journ., Apr. 26, 1919; 2 pp.) A speech delivered at a special session of the Editorial Conference. 20c.

102004—LABOR—Mental Factors in Industrial Organization. Thomas T. Read. (Bull. A. I. M. E., Feb., 1919; 4½ pp.) 40c.

102005—LABOR—Notes on the Housing Problem. Charles Willis. (Eng. and Min. Journ., May 17, 1919; 1¾ pp.) 20c.

102006—LABOR—Organization in the Settlement of Industrial Disputes. V. Everit Macy. (Eng. and Min. Journ., May 10, 1918, 3½ pp.) Abstracts of an address at the Industrial Conference of New York Business Publishers' Assn. 20c.

102007—LABOR—Principles of Employing Labor. E. H. Fish. (Ind. Management, Mar. and Apr., 1919; 9½ pp.) 20c.

102008—LABOR—Reëducation vs. Compensation for Crippled Men. Douglas C McMurtrie. (Eng. and Min. Journ., Mar. 15, 1919; 2¾ pp.) 20c.

102009—LABOR—Social Betterment in Arizona. A. H Heckman. (Min. and Sci Press, Feb. 1, 1919; 2¼ pp.) 20c.

102010—LABOR—The Eight-Hour Day Defined. (Eng. and Min. Journ., Feb. 8, 1919, 2½ pp.) Abstract from Research Report No. 11, issued by the National Industrial Conference Board 20c.

102011—LABOR—Use of Cripples in Industry. James P Munroe. (Bull. A. I. M. E., Jan., 1919; 3 pp.)

102012—MANITOBA—Water Power Resources of Manitoba. M. C. Hendry. (From a pamphlet on Manitoba's Northland, published Nov., 1918; 8 pp., illus.)

102013—MEASURING WATER—Orifice Bucket for Measuring Water. (Eng and Min Journ., Mar. 29, 1919; 1¼ pp., illus.) Abstract from Bull. 105, Eng Experiment Station, University of Ill. 20c.

102014—MEXICAN SITUATION, The. (Eng. and Min. Journ., Mar. 22, 1919; 1¼ pp.) 20c.

102015—MEXICO—Early Indian Raids on Mexico. J. B. Tyrrell. (Eng. and Min Journ., Mar 15, 1919; 2½ pp.) 20c.

102016—MEXICO from Within. (Eng and Min. Journ., Mar. 22, 1919, 1¾ pp.) 20c

102017—MEXICO—Improved Conditions in Western Mexico. Bennett R. Bates. (Eng and Min. Journ., May 10, 1919; ¾ p.) 20c.

102018—PRICES—The New Price Revolution. Irving Fisher. (Eng and Min. Journ., May 10, 1919; 1 p.) Extracts from a paper read before a conference of governors and mayors at the White House. 20c.

102019—RAILROAD PROBLEM—One Phase of the Railroad Problem. N. H Emmons 2d. (Min. and Sci. Press, Feb. 8, 1919; 1¼ pp.) Suggestions regarding freight rates, and their fixing. 20c.

Personals

Harry J. Wolf is in New York.

A. W. Allen will sail from New York on June 13, for Chile as chief engineer for the Penyon Syndicate.

George K. Kimball, of Idaho Springs, Colo., is making examinations in the Lordsburg, N. M., district.

D. C. Jackling, president of Ray Consolidated, has been visiting the company's mines at Ray and its mill at Hayden.

Col. J. C. Rankin, who is planning deep tunneling in the Chloride, Ariz., district, was a recent visitor in Chicago.

Merton S. Kingston, mining engineer and operator, of Virginia, Minn., was in New York recently.

William W. Logan has gone to Alaska to take charge of the cyanide plant of the Gold Bullion Mining Co., at Willow Creek.

Bruno V. Nordberg recently visited the Lake Superior copper district, and has returned to Milwaukee.

Edward Keller has gone to Colorado, where he will spend several months, with headquarters at Montrose.

Charles E. Adams, former manager of Ray Hercules Mining Co. has gone to inspect tracts in the Texas oil fields.

Ira B. Jaralomen, geologist for Calumet & Arizona Copper Co., was in El Paso for a few days recently.

Charles Warner, director 85 Mine, has gone to Chicago to arrange the details of the steam plant at the mine.

J. B. Tyrrell, mining engineer of Toronto, is in the Kirkland Lake gold district, examining the Buffalo Kirkland, Hudson Kirkland, and other properties.

T. W. Osgood has been appointed superintendent of safety at the Los Angeles branch of the California State Industrial Commission.

E. E. Hunner, general manager of M. A. Hanna & Co.'s northern ore-mining interests, has successfully undergone an operation at Johns Hopkins Hospital, Baltimore.

Paul D. Willard, representative of the Day mining interests in Minnesota, has returned from a winter's vacation in California.

R. N. Dickman, of Chicago, recently examined the property of the Illinois Exploration Co. and the Gold Road Bonanza, in Mohave County, Arizona.

A. P. Watt, consulting engineer of New York, has returned from Colorado, where he has been in the interest of New York clients.

E. K. Soper, formerly dean of the Oregon School of Mines, at Corvallis, is now geologist for the Trinidad Petroleum Development Co., Port of Spain, Trinidad, B. W. I.

Harry F. Fay, president of the Mayflower-Old Colony Copper Co., has returned to Boston, following a visit to the Lake Superior copper district.

E. H. Clarke, president of the Homestake company, spent a few days in Lead, S. D., on his way from San Francisco to New York City.

Clarence Woods will be engaged until about the middle of June examining Antigua silver mines near Hermosillo, Senora, Mexico, for American clients.

C. S. Kirkpatrick, purchasing agent for El Tigre Mining Co., in northeast Sonora, has gone East on business. He reports conditions at the property as quiet and safe.

R. E. VanDruff, president, Boston-Hecla Mining Co., at Lordsburg, N. M., and who is an oil geologist, is in Fort Worth reporting upon oil areas in New Mexico.

Robert Fitz, of Los Angeles, is in Lordsburg, N. M., to attend the annual meeting of the El Centro M. & M. Co., of which he is president.

Edward Hoops, secretary of the San Toy Co. and Charles McKnight, of Pittsburgh, are in Lordsburgh, N. M., to inspect the Last Chance property.

Alfred R. Whitman, mining geologist, of New York, has been making an examination in the West Shining Tree gold area of northern Ontario.

E. P. Mathewson of New York, a director of the American Smelting and Refining Co., recently visited the plant of the Tacoma Smelting Co. on a tour of inspection of the company's reduction works.

C. W. Newton, manager and director of the Consolidated Interstate-Callahan Mining Co. at Wallace, Idaho, was recently in New York City attending the annual meeting of the company.

H. B. Patton, of Denver, formerly of the Colorado School of Mines and at present chief geologist for the Missouri, Pacific Ry., is making examinations in the Tularosa basin in Otero County, N. M.

Floyd W. Parsons has resigned as editor of the "Coal Age" after serving nearly eight years, since the inception of the publication, to conduct a weekly "Business and Science" department of the "Saturday Evening Post."

Frank M. Smith, general manager of the East Helena Smeltery, in Montana, has announced his leaving the plant on July 1, but he will still remain in the employ of the American Smelting and Refining Company.

Curtis Pigott has been appointed assistant superintendent of the A., S. & R. Co. plant at Monterey, Mexico. Mr. Pigott was formerly assistant superintendent with the United States Smelting, Refining and Mining Co. at Midvale, Utah.

C. L. Brower, chief engineer of the Chrome, N. J., plant of the United States Smelting, Refining and Mining Co., has resigned his position after 17 years of employment with the company. **J. V. Reese** has been appointed acting chief engineer.

A. E. Graupner has been appointed attorney for the California State Industrial Accident Commission at San Francisco, succeeding **C. M. Bradley**, resigned, who was attorney for the commission from the time of its organization.

Alfred A. Watson has returned from Spain, where he was engaged in the erection of a concentrating plant for the treatment of tin and wolfram ores. His present address is 81 Fourth St., New Dorp, Staten Island, New York; P. O. Box 156.

Oscar V. White has resumed his former position as general superintendent of the Silversmith Mines, Ltd. Mr. White is also supervising the Wakefield, near Silverton, B. C., for Clarence Cunningham, of Spokane.

A. H. Burroughs, Jr., mining engineer of New York, has been added to the staff of the Armstead Mines, Talache, Idaho. With **O. H. Hofstrand**, he is working on the flow sheet of the new mill to be built at Talache.

G. E. Stowell, assistant engineer for the Oregon Bureau of Mines and Geology, has returned to Portland. For the last two months he has been at the Seattle station of the U. S. Bureau of Mines, carrying on experimental work.

Martin Schwerin has been appointed general manager of the Spar Mountain Mining Co., at Cave-in-Rock, Hardin County, Ill., which will be his address for some time, although his permanent address remains, as heretofore, at 42 Broadway, New York City.

G. M. Butler, dean of the School of Engineering, University of Arizona, addressed the Southwestern Society of Engineers in El Paso, May 30, on the subject of oil geology. He has recently returned from an extensive study of the new Texas oil fields.

Dorsey A. Lyon, supervisor of experiment stations for the U. S. Bureau of Mines, was in Seattle last week on an inspection trip of the Northwest Station. This station is situated on the University of Washington campus and works under a coöperative agreement with the College of Mines.

James F. McClelland, professor of mining and metallurgy of the Sheffield School of Yale University and director of engineering research of the Hammond laboratory, has joined the staff of the industrial department of the Liberty National Bank, New York, as consulting engineer for the bank and the Liberty Securities Corporation.

Societies

Canadian National Clay Products Association held the 17th annual convention at Montreal, May 26 and 27. The following officers were elected: President, W. M. Burgess, Todmorden, Ontario; vice-presidents, Ryland H. New, Hamilton, Ontario; Millard F. Gibson, Toronto, and T. H Graham, Englewood, Ontario; secretary-treasurer, Gordon G. Keible, Toronto; Councillors, J. S. McConnell, Milton, Ontario; N. T. Gagnon, Montreal; W. H. Freeborn, Brandford; H. H. Hallatt, Tilbury, Ontario; F. B. Farran, Toronto; C. B. Lewis, Toronto; C. A. Millard, Toronto, and Andrew Dods, Mimico, Ontario.

Industrial News

American Cement Co., Keokuk, Iowa, has issued a new catalog showing the company's line of cement mixers. A special drive is described, the advantages of which are more strengthening on account of massive semi-steel gear made in two pieces and the pinion being racked with removable case-hardened steel pins and rollers. Also no loose or climbing chain or noisy quickly worn-out teeth, as in gear drive, nor sending gears to factory or having to tear machine down to get gears off for welding teeth, with resultant lost time.

The Black & Decker Manufacturing Co., Baltimore, Md., recently added a new size to its line of portable electric drills. This is a drill with a capacity of 0 to 9/16-in. in steel, and is provided with a No. 1 Morse taper socket. It will drill a 9/16-in. hole through machine steel at a rate of 1½ in. per min. without overloading the motor. In tests, pressure up to 500 lb. has been applied without stalling the drill. The housing is of Magnalite, an aluminum alloy of great tensile strength. Gears are packed in grease in a separate grease-tight compartment similar to an automobile transmission, and the drill spindle runs in a long bronze bushing and against a ball thrust bearing. Motor is air cooled, and, in testing, these drills have run continuously for 14 weeks, day and night, including Sundays and holidays, stopping only to renew brushes. The weight is 21 lb.; no-load speed is 600 r.p.m. An interesting feature of this tool is the attachment of the Morse taper socket. This is in the form of a separable sleeve secured in the drill spindle by means of a large knurled nut. By unscrewing this nut the entire taper socket is easily removed from the spindle. The drill shank protrudes slightly beyond the end of the taper socket, and a little tap on the end of the protruding drill shank frees it from the socket.

Material Handling Machinery Manufacturers' Association, 35 West 39th St., New York, announces a coalition meeting at the Hotel Astor on June 11. This includes all manufacturers of cranes, winches and hoists; elevators; gravity and power-conveying machinery and apparatus; industrial trucks, tractors and trailers; bulk handling machinery; and all makers of equipment and accessories such as storage batteries, bearings, ropes for hoists, buckets, electric controllers and apparatus. The advertising managers of the companies manufacturing these products are also invited to hold a preliminary conference at the Hotel Astor on the evening of Tuesday, June 10, beginning at 8 o'clock, at which time it is planned to form an advertising council of the Material Handling Machinery Manufacturers. A general "forum" discussion will be conducted in the afternoon. All manufacturers will be asked to participate in this. The discussion will take up the subject of ways and means for promoting a more general knowledge of the economies which may be effected through the use of mechanical handling equipment, the advisibility in conserving physical energy through the use of mechanical handling; the bearing which modern machinery has on the subject of foreign trade, and kindred topics.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Blasting—Tool for Miners' and Blasters' Use. Edward Godfrey, Montreal, Quebec, Canada, assignor to Canadian Explosives, Montreal, Canada. (U. S. No. 1,300,834; Apr. 15, 1919.)

Conveyors—Belt-Tightener for Conveyors. John H. Gilman and Albert E. Gilman, Ottawa, Ill., assignors to King & Hamilton, Ottawa, Ill. (U. S. No. 1,299,701; Apr. 8, 1919.)

Dredging—Nozzle for Sand Pumps. George E. Battisfore, Marquette, Mich. (U. S. No. 1,298,642; Apr. 1, 1919.)

Drill—Rock Drill. Thomas Gordon and Hugh William Simpson, Parson's Bridge, Vancouver Island, B. C. (U. S. No. 1,301,121; Apr. 22, 1919.)

Drill Sharpener. Jesse Ditson, Littleton, Colo., assignor to the J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,302,019; Apr. 29, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—May 29

Comstock Northend Reports for the week ended May 24 show total shipments to Mexican mill from Consolidated Virginia and Ophir amounting to 591 tons, of a total value of $14,476. Consolidated Virginia ore showed an average assay of $26.10 and Ophir, $22.35. Important improvement was shown in development in these mines and also in Mexican, Union, and Sierra Nevada

Quicksilver Production in California decreased rapidly since the armistice was signed. During the later part of 1918 it is probable that the output reached 2000 flasks a month, but at the present time not more than 500 flasks a month are being produced. The continued demand for the last few weeks has again stimulated production, and the New Idria Quicksilver Mining Co., whose mines are in San Benito County, is again starting work after a shutdown of several months. From 250 to 300 men will be employed when the furnaces are running to capacity.

DENVER, COLO.—May 29

Junking of the Denver, Boulder & Western Ry. may be avoided if the increase in tonnage from the mines of the Crisman, Salina and Caribou districts of Boulder County continues. Revival of activity in the camp served by this road will no doubt influence the state Public Utilities Commission to reserve judgment of a character unfavorable to the local mining industry. It now appears that numerous properties are being reopened under lease, and considerable development work has been undertaken, particularly at the Yellow Pine and Logan properties. Certain prospects are to be developed by Denver and New York capital, and the installation of considerable light mining equipment is under consideration. Lessees are becoming more active, and their operations are being reflected in the gradual increase in the quantity of ore produced. Every effort is being made by local operators to demonstrate by actual ore production the importance of maintaining the railroad in operation.

SALT LAKE CITY, UTAH—May 31

Park City Mines Are Still Closed Down, and the men are idle, but the strike appears to be wearing out, and an apparent desire on the part of the men to return to work is making itself felt. A committee of strikers seeking to meet some of the employers was refused audience, the ground taken being that any dealings with the strikers as a body would be interpreted as a recognition of the I. W. W., and that the matters to be settled lay entirely between individual operators and employees of the mines in question.

WALLACE, IDAHO—May 29

Lead and Silver Production for May compared with the average monthly production during the year 1918 indicates that the mines are now operating on a basis of between 60 and 65% of normal capacity. In the matter of zinc production, the district has practically ceased to be a factor, the only output being the amount recovered as a byproduct in connection with the lead mines, which is placed at about 5 or 6% of the average production last year. This situation is explained first through the collapse of the market for lead and zinc, following the signing of the armistice, and then by the shortage of labor, which holds production down even below what it would be even under the adverse market conditions. However, there are evidences of improvement in both respects. Operators are encouraged by the stronger demand for lead in the last week, and the higher price of silver has made a substantial addition to the profits. The advance in the rate of wages from $4.25 to $4.75 is having a beneficial effect, as indicated by the arrival of men seeking work. The scarcity of good miners is the chief trouble at this time. It is estimated that the actual shortage of men of all classes for underground work is fully 1000.

Optimism Prevails in the Coeur d'Alene district, owing to the belief that the outlook for zinc has improved. C. W. Newton, manager of the Consolidated Interstate-Callahan Mining Co., on his return from New York, where he attended a meeting of the directors of the company, expressed the opinion that spelter would soon go to 7c. and would probably remain around that level, at which figure there would be a fair profit in zinc mining, even with the present high costs. Therefore, with this encouraging outlook, improvements are being made to facilitate handling Interstate-Callahan ore which will place the company in position to resume operations without delay when market conditions are favorable. A new sorting plant is being built at the mine, where the waste rock will be removed from the ore before it passes to the tramway. The sorting plant at the mill will then be used exclusively for recovering the high-grade ore for shipment crude. Additional ball mills will be placed in the mill and several flotation cells also added. The mine is in excellent condition for production, and, with these improvements completed, the company will be ready for immediate operation when the market for zinc is sufficiently restored.

DULUTH, MINN.—May 31

Conditions on the Iron Ranges of Minnesota during May remained unchanged. The Steel Corporation continued to be the only operator working at capacity, its shipments nearly taxing to the full limit the carrying ability of its large fleet. Independent operators continue to be cautious, some shipping slowly, some at a fair rate, and some not at all. The state of mind seems to be entirely a waiting policy, and no gloom is in evidence. Organizations are being maintained except for the commonest labor. Unemployment is negligible.

U. S. Bureau of Mines will hold a conference at Duluth, June 19-20, at which the general subject of mine inspection and mine safety will come under discussion and to which all mine inspectors and mine managers have been invited. The conference will be in charge of B. O. Pickard, mining engineer, who looks after the interests of the Bureau in the district, and from assurances now held by him it is indicated that at least 100 mining men from Michigan, Minnesota, and Wisconsin will attend the meeting. It is of interest in this connection that the state industrial commission of Wisconsin has agreed to co-operate with the Bureau of Mines, and the Bureau is asked to name a state mine inspector and two assistants, the industrial commission to share the expense with the Bureau. This is the first step taken by Wisconsin in mine inspection and mine safety work which has proved so beneficial in Michigan and Minnesota, and it is expected that the zinc and other mines and the stone quarries of that state will quickly show the advantages of the system.

HOUGHTON, MICH.—May 31

Shipments of Copper have equaled the output of mines during the last week, and no inroads into the surplus at the mines of the district have been made. The policy of 50% curtailment in production will be evident in the June outputs, and the total for the district will be lower in that month than at any time since the strike, although this will not show itself in the figures of the Mohawk, Wolverine and Quincy, or the Copper Range mines, Baltic, Champion and Tri-mountain, as these properties are producing at approximately 85% of their best normal figures.

JOPLIN, MO.—May 31

A Two-Cent per Pound Tariff on zinc ore is to be sought by the mining and business men of this district. At a meeting held in Joplin this week, T. J. Franks, of this city, was made chairman of a committee that will send a delegation to Washington to work for the tariff. A bill providing this high tariff has been introduced by Congressman McPherson, of this district.

Decision Not To Exhaust Orebodies at existing low prices for zinc, caused the Butte-Kansas Mining Co. to close down its two mills and mines at Waco, Mo., on May 31. L. P. Buchanan, of Joplin, manager for the company, stated the mines would not be started up until ore prices improve decidedly, though the mines have been running regularly and have been showing a small margin of profit every week. The High Five Mining Co. has a new mill built upon a rich prospect just across the state line from the Butte-Kansas No. 1 mine, and the plant is ready for operation, but it will not be started until ore prices improve.

PHOENIX, ARIZ.—May 28

High Transportation Costs on bullion and supplies now paid by the Arizona copper producers may be the reason why surveyors have been put in the field between Ajo and San Jorge Bay on the Gulf of California, a distance of about 100 miles, with apparent intention of extending the 42-mile Gila Bend-Ajo railroad to tidewater. The line is crossed at Quitovaquita. No announcement has been made of any railroad concession by the Mexican authorities for such a railroad.

Little Non-Employment is apparent in Arizona, though the larger mines are hardly on half-force conditions. Soldiers returning have jobs at once, the local soldiers' club having found places for 500. Globe and Miami are reported short 750 men, needed mainly for development work. Jerome needs many expert miners, on its resumption of production. Employment is being given, however, only after strict examination concerning health, capability, and character, with the object of eliminating both incompetents and malcontents. At the possible expense of production, an effort is being made to work the Arizona mines with only the best class of employees. Thousands of former workmen have gone to the Texas oil fields.

WASHINGTON, D. C.—June 2

Three Leasing Bills have been introduced in the House by Congressman Taylor, of Colorado (H. R. 1831); Ferris, of Oklahoma (H. R. 496), and Raker, of California (H. R. 293), all of which are identical in language and are in text practically the same as the bill as agreed upon by the conference committee at the last session. Congressman Taylor, however, has introduced separate bills for coal and oil-shale leases, these being identical with the coal and oil-shale sections of his general leasing bill.

VANCOUVER, B. C.—May 29

Representatives of the Dolly Varden Mining Co., whose property is situated in the Alice Arm district, intend to appeal to the dominion government for the disallowance of the provincial legislation which gives the Taylor Engineering Co. power to take over the mine and other of the company's holdings in order to satisfy claims it has presented in respect to the construction of a line of railway from Alice Arm to the mine, according to authoritative information. It already has been reported that the time given the Dolly Varden company to meet the financial terms laid down by the Legislature has lapsed and that the Taylor Engineering Co. is proceeding to take possession.

LONDON, ENGLAND—May 31

Oil Found in England for the first time was reported in substantial quantities and of high quality at Chesterfield, in Derbyshire. Drilling began last October. The discovery was made in Hardstoft No. 1 boring at a depth of 3000 ft. The oil rose to a height of 50 ft. The discovery is due to Lord Cowdray and his experts, who are working as agents of the government, the firm giving the services of the staff free of charge, the other expenses being assumed by the government. The experimental borings were made on information gathered by Lord Cowdray and given by him to the government. A condition of the gift was the stipulation that promiscuous drilling should be prohibited, which has been done.

The Mining News

ARIZONA

Gila County

CASTLE DOME (Globe)—New York company drilling on Gold Creek, 16 miles west of Globe, finding much 4% chalcocite, with 350-ft. tunnel in ore for most of its length.

JUMBO (Globe)—Small cyanide plant being built below mill, to treat silver ores. Operating company, a Texas one, represented by W. T. Bessonnette, of Waco.

GREATER MIAMI (Miami)—New company organized with added Eastern capital, with guarantee of $2500 a month for development costs and possible mill erection.

MIAMI M. & M. (Miami)—Building 50-ton mill at new town of Doak on railroad.

Mohave County

GOLD DYKE, discovered by G. H. Roberts, 12 miles west of Chloride; mineralized ground 300 ft. wide, with stringers of rich ore. Original discovery optioned to J. H. Townsend and W. J. Cook, who are developing.

CHLORIDE TUNNEL (Chloride)—Enterprise capitalized by J. C. Rankin, to drive 10,000 ft. under eight developed silver groups, with expectation large mill will be built at portal.

CHLORIDE QUEEN (Chloride)—High-grade silver ore cut on 200 level.

HACKBERRY (Hackberry)—Mill handling 80 tons daily in one ten-hour shift, effective flotation, leaving only 80 cents a ton in tailings. Company capitalization being increased to secure added development and continuous mill operation.

WASHINGTON-ARIZONA (Kingman)—Opening stopes for mill run.

Pima County

W. B. HAGER has found gold ore at 8 ft. depth in 11-in. vein, two miles north of Gunsight.

EL TIRO (Silverbell)—The 300 level unwatered by lifting 7,000,000 gal. Percy Williams, manager, resumed shipment of ore averaging 8% copper. Production costs believed lowest known at all small southwestern producers, as ore goes direct to railroad car from shaft.

YELLOW BIRD (Tucson)—Local company headed by S. W. Purcell planning for silver-lead furnace for property 32 miles southwest of city.

Santa Cruz County

BLAND (Alto)—Owners, F. T. McGinley, W. S. Smith, and J. W. Garden, planning erection of mill. Property in Alto section now leased to McGinley.

AMERICAN BOY (Patagonia)—Building new wagon road and sinking double-compartment shaft, now about 60 ft. deep.

GREAT SILVER (Patagonia)—Under development by J. W. Wilson, of Nogales, and George F. Wieland, of Patagonia.

HARDSHELL (Patagonia) — Sinking 500-ft. shaft on property near Harshaw.

Yavapai County

GREEN MONSTER (Jerome)—Work to be resumed at once under Manager W. S. Humbert, with headquarters moved to Jerome from Phoenix. Water, 200 ft. deep, will be pumped from main 930-ft. shaft and exploration resumed on lower levels and on an incline shaft on Silver Tip claim, where an 18-in. silver-copper vein will be followed.

BIG PINE (Prescott)—Work to be resumed on property near Senator, under C. H. Dunning.

CALIFORNIA

Amador County

ARGONAUT (Jackson) — Reported fire now under complete control, and full crew being put to work as rapidly as conditions allow. Effect of temporary closing down for several weeks, and short closing down of Kennedy on account of the Argonaut fire, has been to reduce largely circulation of miners' wages among the merchandise stores of Jackson. The two payrolls approximate $30,000 per month and are the chief support of the town.

Inyo County

KEARSAGE (Independence)—Practically idle since 1870. Recently passed into control of P. C. Montgomery and associates.

CERRO GORDO (Keeler)—Large shipments of high-grade silver-lead and zinc ore being made regularly. New delevopment in virgin ground shows excellent results.

Kern County

YELLOW ASTOR (Randsburg)—Operations to be resumed after a shutdown of approximately six months.

Riverside County

HEMET (Hemet)—Ore reserves at magnesite mine south of Hemet said to be exhausted and work temporarily suspended.

San Bernardino County

RUNOVER (Calico)—Revival of this old silver district looks encouraging. Lane now shipping good grade of ore from Runover.

Shasta County

KEYSTONE (Kennet)—Twenty men employed in development. Shows unusual promise, and will be put in condition for heavy output.

IGO DISTRICT (Redding)—Old workings being reopened in the Silver King, Silver Falls, and Chicago properties.

Sierra County

ALHAMBRA AND SOVEREIGN (Downieville)—Gold Exploration Co., of Salt Lake City, has completed arrangements for extensive development.

MONARCH (Sierra City) — Twenty stamp mill running on good-grade ore from newly opened workings

IDAHO

Shoshone County

CEDAR CREEK (Murray)—Nine feet concentrating ore in east drift, mostly zinc, with several streaks of galena. Lead ore in two upper tunnels.

BULLION (Wallace)—Work resumed after suspension during war. Showing of ore in face of east drift indicates approach to large body of commercial copper ore disclosed in winze from upper tunnel and which has also been determined by diamond drill.

TAMARACK & CUSTER (Wallace)—Puritan crosscut intersected vein 500 ft. below present workings. Similar character ore as that on level above, where shoot proved 1500 ft. long, ranging from two to 25 ft. wide. Ore, lead-silver. Controlled by Days. Belief that drift in Sherman, also controlled by Days, which adjoins Tamarack & Custer on east, will be extended to make permanent outlet at Burke, eliminating two-mile tramway from mine to mill. Sherman drift considerably below Puritan crosscut.

MICHIGAN

Copper District

FRANKLIN (Dennon) — Small force sinking No. 1 shaft from 37 level. Drifts to be driven north to cut vein opened on 27 level. Assessment of $3 per share is due.

QUINCY (Hancock)—Transfer of 125 acres of mineral lands of Hancock Consolidated to the Quincy company for a consideration of $235,000 has been arranged. Mineral lodes underlying 90 acres occur on the dip below the 8500 level of Quincy.

MICHIGAN (Rockland)—Limited force working in ground on Butler lode.

Menominee Range

ARAGON (Norway)—New electric-driven Laidlaw Dunn Gordon air compressor installed at No. 4 shaft, now in operation. Capacity, 2250 cu.ft. free air per min.; pressure, 90 lb. Synchronous motor drive, power from hydro-electric plant at Quinnessec Falls. Duplicate of this unit will be installed at No. 5 shaft. High-pressure air system used for pneumatic locomotives underground will not be changed over to electric drive, but electric haulage may be installed later if mine developments warrant.

Gogebic Range

TILDEN (Bessemer)—Top of wooden headframe at No. 10 shaft was pulled off and mule on trestle killed by over-winding of loaded skip. Men on landing escaped injury. Shaft shut down from May 24 until probably June 3.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Underground iron ore property of John A. Savage & Co. producing at record rate. Savage company reported to have sold considerable tonnage of iron and manganiferous ores, which will tax properties to the utmost to produce.

IDA MAE (Crosby)—W. H. Fetzer, of Pittsburgh, representing new owners, visited property with view of putting it on shipping list.

NORTHLAND (Cuyuna) — Underground development from shaft proceeding at good rate. Hoisting and stocking manganiferous ore.

CUYUNA-DULUTH (Ironton)—Shipping stockpile containing 60,000 tons. Operated by American Manganese Manufacturing Company.

ROWE (Riverton)—Now operated by Pickands, Mather & Co. Expects to ship 125,000 tons milling and underground ore this season.

SAGAMORE (Riverton)—Stripping manganiferous open pit of John A Savage & Co. by Winston-Dear & Co., contractors. Expect to ship considerable tonnage later.

NORTH RANGE IRON COMPANY (Trommald)—One drill working in orebody on Section 4-46-29.

Vermillon Range

ZENITH (Ely)—Completed installation of Sirocco blower to facilitate ventilation.

MONTANA

Jefferson County

CARRIER MINE (Carrier District)—Strike of high-grade gold-copper ore made by James Currier, near Montana City.

LIVERPOOL (Clancey) — Developed to 750-ft. depth. High-grade ore known above lower level as well as below it. Shoot is exhausted above sixth level. Will soon be opened with Boston capital. Electric power.

FLEMMING MINE (in Warm Springs District)—Bonded and leased by Butte men.

Lewis and Clark County

HELENA MINE (Helena)—Contract for 400 ft. drifting at 400 level about completed; announced further sinking will begin soon. Shaft to go to 500 level.

PETE SOLORAI (Rimini)—High-grade silver-producing property. Bonded to Helena parties, who have started work.

PORPHYRY (Rimini)—Preparing to start mill on the dike soon. Ore reserves are large. Electric power. Dike not operated last season, because of labor scarcity and war conditions.

TONY LODE (Rimini)—Streak of galena ore found in Tony tunnel near Rimini. Being developed by shaft.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments for week ended May 22 were: Prince Consolidated, 25 cars; Virginia-Louise, 5 cars; Harney, 3 cars; Black Metals, 1 car.

VIRGINIA-LOUISE (Pioche) — High-grade bedded oreshoot, encountered some weeks ago, increasing in size and value. Has attained width of 20 ft. and thickness of 6 ft. Last 25 tons broken averaged 0.03 oz. gold, 28.7 oz. silver, and 27.9% lead.

NEW MEXICO

Grant County

PLAYAS (Hatchita)—In Playas basin, which lies southwest of Hatchita, over 100,000 acres of state lands leased by oil prospectors in rush, owing to report that small amount oil encountered in well on what is locally known as Playas Lake, which lies west of old gold camp at Sylvanite.

85 MINE (Lordsburg)—Continue shipments of about 200 tons siliceous ore to Calumet & Arizona smeltery at Douglas, Ariz. J. Jackson, superintendent.

LAST CHANCE (Lordsburg)—Mill shut down owing to scarcity of water; six-mile pipe line will be installed. Working small force in mine. B. Prescott, manager.

NORTH CAROLINA

Montgomery County

GOLD VEIN discovered at Sadberry property. Development consisting of cut along deposit reveals number of rich quartz stringers in apparently weathered rhyolite. Some years ago similar conditions found in stringer belt in property paralleling one recently found. Some rich ore removed, mill erected, and 100-ft. shaft sunk.

Randolph County

AT PORTER PROPERTY, 10 miles east of Ashboro, Marathon mill will be installed, and mining of low-grade gold deposit undertaken. Donald Cameron in charge.

OKLAHOMA

Miami District

LUCKY PAT (Lincolnville)—Building mill to be in operation in 30 days. W. L. Turner, contractor.

CANTON (Lincolnville) — Completed sludge mill to be operated separately from mill. Concentrating mill will be in operation soon.

HIDDEN TREASURE (Picher)—New mill completed and started in operation. John Grifford, of Baxter Springs, Kan., manager.

TIGER (Picher)—Subleased the ground at its No. 2 mine near Tar River to company of practical miners. The mill to be operated by Tiger Co. G. F. Glenn, Carthage, Mo., manager.

SOUTH DAKOTA

Custer County

CRAWFORD MICA (Custer)—Work resumed at Old Mike mines and following extensive development regular shipments of mica will be made.

RARE METALS (Custer)—Small concentrator using Bland screens and Bartlett tables dressing tin ores from the Oreville district.

Lawrence County

CUSTER PEAKE (Roubaix)—Concentrator completed and placed in operation. Mine development has opened sufficient copper ore to keep plant in continuous operation.

TEXAS

Brazos County

WEST COLUMBIA FIELD PRODUCTION was 17,600 bbl. per day for third week in May. Production increased largely over previous week by bringing in of Texas company's Eyers No. 3 well and Crown Oil and Refining Co.'s William Olschewski No. 2 well, both showing big flow.

CROWN OIL & REFINING (West Columbia)—William Olschewski well No. 2 brought in May 17, estimated making 3500 bbl daily. Oil of good quality. Third large well in field during that week.

GULF PRODUCTION (West Columbia) —Hogg well No. 2 brought in at 3000 ft. said to be making 250 bbl. a day

Harris County

HUMBLE FIELD PRODUCTION was 9700 bbl. daily during third week in May. Two small pumpers completed during week. Petroleum Refining Co.'s Stevenson No. 3 pumping 10 bbl. from 2765 ft., and Crown Oil & Refining Co.'s Herman No. 43 pumping 10 bbl. from 1010 feet.

CROWN OIL AND REFINING (Houston)—At meeting of board of directors May 13 dividend of 100 per cent. declared. Capital stock increased from $2,000,000 to $5,000,000. New directors elected: J. F. White, Lampas, Tex.; E. Rafael, Ennis, Tex.; Charles E. Merrill, New York City. Was organized Aug. 26, 1917, when it took over interests of Huffstutler Oil Co. First dividend, of 10 per cent., paid Aug. 26, 1918. Second dividend as above. Is building a $1,000,000 refinery on Houston ship channel, and has producing wells in Humble, Goose Creek, and West Columbia fields. Officers are: J. C. Stribling, president; J. W. Colvin, vice-president; R. L. Young, secretary and general manager; O. J. Douheck, treasurer. Board of directors comprised of officers and A. A. Huffstutler, and George E. Colvin, of Warren, Penn.

Liberty County

DAILY PRODUCTION OF HULL FIELD now about 9000 bbl. Houston Oil Co. recently brought in a large producer.

Matagorda County

THE TEXAS CO. (Markham)—Preparing to test its No. 6 Meyers at 1650 ft. In same field Clem Oil Co., working over its No. 3 Smith well, and P. S. Griffiths is drilling below 2700 ft. In this same county "Wildcat" well at Stewart's Switch is below 3700 ft. without results; drilling still under way.

Tarrant County

FORT WORTH CHAMBER OF COMMERCE, through its publicity department, shows 1012 wells drilled in that section during present period of activity. Figures do not include work done in Burkburnett, Electra, and other northern fields. Estimated cost of all development in central-west Texas at least $50,000,000.

UTAH

Beaver County

CAPITOL MINING (Milford)—Shaft now in vein and heavy iron sulphides showing in bottom. Down 225 ft., and 50 ft. more to go before starting drifting. Gold Crown and Magnolia, neighboring properties.

Grand County

KEARNS CLAIMS (Moab) — Uranium ores stockpiled by this property being sought, it is stated, by Minerals Recovery Co., which has bought Government plant at Denver.

Juab County

EUREKA MINES (Eureka)—New ore, silver-lead, opened between 900 and 1000 levels.

LEHI TINTIC (Eureka) — Air tunnel making connections with main workings in 700 ft. cut vein. Connections to be completed in about 30 ft. Fissure opened by winze from upper tunnel 4 ft. between walls and carries bunches of galena, with high contents in silver.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Narrow gage taking out 12 cars daily, equivalent to two regular cars.

MAY DAY (Eureka)—To be developed at depth. Work in progress on 1100, but several hundred feet additional depth desired.

TINTIC UNION (Eureka) — New company formed to operate in East Tintic district owns 22 claims. Capitalization, 2,000,000 shares, par value, 10c., of this 1,600,000 in treasury, and 600,000 shares taken by promoters for ground. H. G. Snyder, interested.

Salt Lake County

COLUMBUS-REXALL (Alta)—To begin shipping season with about 25 tons daily, to be increased later.

EMMA SILVER (Alta)—Emma Consolidated, Emma Copper, and Old Emma mines being reorganized under above name. McCornick & Co. paid and stock held by it transferred to F. R. Cook, of Columbia Trust Co., trustee. Enough money on hand to pay all approved claims, and June 7 fixed as date for hearing and determining these.

MICHIGAN-UTAH (Alta)—Shipping car of ore daily over cable tramway. All work on company account.

SECRET MINING (Alta) — Directors' meeting called for June 9 to consider increasing capitalization from 600,000 to 1,000,000 shares and reducing par value from $1 to 10c. a share. Owns 30 claims adjoining Albion. H. S. Hooper interested.

SOUTH HECLA (Alta)—Shipping up to 100 tons ore daily over Little Cottonwood Transportation.

WOODLAWN MINING (Alta)—Accumulating ore for shipment.

KENNEBEC (Salt Lake)—To be worked through Cardiff. Ezra Thompson, of Cardiff, interested.

Summit County

GLEN-ALLEN (Park City)—Mill building completed and machinery to be installed soon.

SILVER KING COALITION (Park City) —W. Mont Ferry appointed managing director, succeeding W. W. Armstrong.

tah County

AMERICAN CONSOLIDATED (American Fork)—Power for machine drills to be obtained from old Mineral Flat compressor, now owned by Albion Consolidated.

SOUTH PARK (American Fork)—Work started on ore showings about 450 ft. from portal of tunnel, total length of 700 feet.

WASHINGTON

Ferry County

LAURIER MINING CO. (Laurier)—Shipping carload copper ore this week. Dayton H. Stewart, president.

Grays Harbor County

KING OIL CO. (Hoquiam)—First load of machinery delivered at well site May 10. Landed about 12 miles from mouth of Queets River last season; now being moved from that point on scow of shallow draft towed by team of horses. Many thousand of acres have been leased for their oil rights in district, and many leases are being taken by private parties for speculative purposes. Not an acre of school land can be leased now, all having been taken up at $110 per section.

Snohomish County

ETHEL MINE (Index)—Former producer; idle for several years. Recently leased and exploration work carried on in small way to find continuation of oreshoot believed to have been missed by former exploration work.

SUNSET COPPER (Index)—Mine and mill idle for last three months. Dewatering just completed, and small crew carrying on exploration. Has good reserves of milling ore, but management awaiting more favorable copper market. Dale L. Pitt, manager.

Stevens County

BROWN LAKE MINE (Valley) — J. Richard Brown, of Spokane, reports striking 4-ft. copper ore, also carrying gold and silver.

WISCONSIN

Zinc-Lead District

M'KINLEY EXTENSION (Dodgeville)—Levi Pollard and others opened property, adjoining McKinley mine, at Dodgeville. Plan to erect concentrating mill, contingent upon ore-market conditions.

MINERAL POINT ZINC CO. (Galena)—Opened new zinc carbonate property on Eberle farm adjoining Clark mines, at Highland. New strike in shallow ground, easily mined.

KISTLER & STEPHENS (Platteville)—Recent churn-drill borings indicate rediscovery of ore range on Alderson tract, abandoned by this company two years ago.

CANADA

British Columbia

FLORENCE SILVER MINING CO. (Ainsworth)—The retiring board of directors reëlected at the company's annual meeting of stockholders at Ainsworth May 11. R. F. Wolfe, Spokane, president and manager; A. F. Kelly, vice-president; D. E. Sanders, secretary-treasurer; and J. A. Lavender and A. M. Frost, constitute board.

Ontario

KING EDWARD (Cobalt) — Leased to National Mining Co.; being dewatered.

BERRY CLAIMS (Kirkland Lake)—Optioned to interests closely identified with McIntyre.

MONTREAL KIRKLAND (Kirkland Lake)—Shaft down 150 ft. Mining plant being installed.

TECK HUGHES (Kirkland Lake)—April prodution, $27,216, from treatment of 2602 tons.

DAVIDSON (Porcupine) — Orebody at 600-ft. level drifted on for 75 ft., average grade of ore remaining high. Mill heads during May average $20 per ton. Winze being put down from 500-ft. level to 800 feet.

GOLD REEF (Porcupine) — Diamond drilling will soon be undertaken.

SOVEREIGN (Porcupine)—Surface veins being tested at depth by extensive diamond drilling.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver		June	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
29	4.6325	108⅛	52[illegible]	2	4.6300	109⅜	53⅛
30	......	....	52[illegible]	3	4.6125	109	53⅜
31	4.6300	109⅛	53	4	4.6138	109⅝	53¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May June	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
29	16.35	†72½	5.15 @5.25	4.90	6.12½ @6.15
30	.....	....	....	....	....
31	.....	....	....	....	....
2	16.35	†72½	5.15 @5.25	4.90 @5.00	6⅛
3	16.35 @16.45	†72½	5.15 @5.25	4.90 @5.00	6.10 @6⅛
4	16.60	†72½	5.15 @5.25	4.90 @5.00	6.10

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

May June	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
29	79⅛	79¼	82	233½	229¼	22¾	23	36
30	78¼	79	82	232½	229	22¾	23	35¼
31		....	...		..		....	....
2	79¾	80	82	235	231	22¾	23	35½
3	79¼	79½	81½	235	231½	22¾	23	35½
4	78¾	79	81	234	231	22⅝	23	35½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—June 4, 1919

The metal markets were very quiet during the early part of this week, but at the close there was a substantial renewal in the demand for copper, which was sufficient to lead producers to advance their price. Lead was very dull. Zinc was dull and soft.

Memorial Day coming on Friday, Saturday was generally observed as a holiday also, practically all offices being closed.

Transatlantic freights are easier. Though the liners are still demanding $30 to France, contracts with outsiders can easily be made at $20 for future shipments, and freight on the spot may be taken as low as $15 if something is needed to complete the cargo of ship. The rate to British ports continues at $20, with possibility of shipping goods on the spot as low as $18. From Pacific ports the rate to Hong Kong and Kobe continues at $14.

Copper—On Thursday the market continued very dull, but the big producers booked small business for June and July on the basis of 16.35c., cash., New York. A round lot for June-September delivery was booked by one concern on the same terms. On June 2, a moderate business, including one round lot for export, was done on the same basis. On June 3 there was a decided renewal of demand by domestic manufacturers. The bulk of the business was taken by one producer at 16½c., delivered, equivalent to 16.35c., cash, New York, which producer had not previously sold enough to satisfy itself. However, before the end of the day another seller succeeded in booking some substantial business on the basis of 16.45c., cash, New York, and several producers were asking the equivalent of 16.60c. (16¾c., delivered.) On Wednesday the market became firmly established on the higher basis, some further round lots being placed.

The full figures of the sales in May proved to be larger than any previous estimate, and were actually in excess of the production for the month.

Some of the refineries in the vicinity of New York are now working at only half rate, but others are producing more nearly at their full capacity in order to use up stocks of blister copper. Labor conditions are generally easier, but no reductions in wages have been made, the men being employed only part of the time.

British advices report a sentiment over there to the effect that arrangements should be made for the purchase of copper from Australia, where many of the mines have had to be closed, rather than to buy copper from America. However, the probability is that Great Britain has had enough of subsidies, etc., and will buy copper where it can be obtained most cheaply, but will first use up the stocks already in hand.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 18¾c.

Tin—Under date of June 2, Mr. Armsby issued the following statistics:

	Gross tons
Total quantity allocated to United States	10,169
Sales to Apr. 30, 1919, inclusive	6,863
Balance unsold May 1, 1919	3,306
Sales between May 1 and May 22, 1919, inclusive	1,107
Balance unsold May 23, 1919	2,199
Sales May 23 to May 31, 1919 inclusive	584
Balance unsold June 1, 1919	1,615

The above figures indicate that the Inter-Allied tin will be used up sooner than expected, possibly as early as July 1. This does not necessarily imply that the tin market will then become free from restrictions.

Lead—This market is very dull, the business of the week, aside from what was done on average-price contracts, being light. The most important producers find themselves in comfortable positions, and therefore express considerable indifference respecting the temporary relaxation in buying. Other concerns that might do something in the market are inclined to stand aloof and observe things for a while. In the interior, the market was a little stronger, reflecting a good deal of carload buying. In New York, lead continued to be offered at low figures by second hands.

Considerable export business in Mexican lead was done during the week.

Zinc—This market continued to exhibit dullness, for which lately it has been conspicuous. There was a noticeable softness, and during the latter part of the week a large producer was seller at low figures.

A fair business in high-grade zinc was done at about 6⅞c., New York, with some carload business reported done at 7c.

Zinc dust could be bought at about 9c., f.o.b, works.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 33c. per pound. Unchanged.

Antimony—The market was steady at 8⅜@8½c., the closing quotation of last week, and a fair business was reported done. As to future shipments, no Chinese antimony was offered, but Japanese for June shipment was quoted at 8½c., New York.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—The market remained firm at $92. San Francisco telegraphed $87, steady.

Silver and Platinum

Silver—The market has shown a rising tendency for the last week, but is rather quieter today at 53¼d. The steadiness has been maintained in part by some buying on China account. Exports of bar silver for week ended May 31st, 376,300 ounces.

Mexican dollars at New York, May 29, 83½; May 30, 83½; May 31, 81; June 2, 84½; June 3, 84½; June 4, 84.

Platinum—Refined ingot was firm at $105.

Palladium—Unchanged at $120.

Zinc and Lead Ore Markets

Joplin, Mo., May 31—Blende, per ton, high, $44.35; basis 60% zinc, premium, $42; Prime Western, $41@40; sludge, $37.50; flotation, $35; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $37.14; calamine, $23.21; all zinc ores, $36.68.

Lead, high, $63.80; basis 80% lead, $60@57.50; average settling prices, $57.40 per ton.

Shipments the week: Blende, 11,193; calamine, 389; lead, 1252 tons. Value, all ores the week, $496,690.

Shipments five months: Blende, 233,158; calamine, 6231; lead, 33,091 tons. Value, all ores five months, $11,382,360.

The large producing Bertha A mine, at Webb City, has closed down. The American Z., L. & S. Co. is running its mill, with its mining ground leased for working in the upper levels. This leaves practically only one large mill in the older camps in operation, the Mutual, at Oronogo. In all of Jasper County, Mo., less than a half dozen mills are regularly in operation, outside of the new Waco field.

Platteville, Wis., May 31—Blende, basis 60% zinc, $44 base for premium grade and $42.50 base for high-lead grade.

Lead ore, basis 80% lead, $56 per ton.

Shipments reported for the week are 2015 tons blende, 189 tons galena, and 568 tons sulphur ore.

For the year to date the totals are 41,798 tons blende, 2088 tons galena, and 5532 tons sulphur ore. During the week 3026 tons blende was shipped to separating plants.

Other Ores

Molybdenum Ore—No business reported.

Tungsten Ore—A fair business was done, mainly in Chinese ore, which was sold at $7 per unit for ore on the spot and at slightly higher figures for futures. It is now reported that China will not sell any more at less than $8 per unit. High-grade ore is quoted at $9@10, with $11@12 asked for some of exceptional quality.

Pyrites—Spanish pyrites is quoted at 20c. per unit for furnace ore and 18c. for unbroken ore, c.i.f., New York or other Atlantic port. Unchanged.

Iron Trade Review

PITTSBURGH—June 3.

The last week has witnessed additional though slow progress in the improvement in steel demand that characterized the fortnight preceding. In practically all descriptions of finished-steel products the buying is heavier. There is, however, little broadening in the scope of demand, buying being confined largely to the same quarters as formerly, so that buying against large construction projects is still conspicuous by its smallness, if not by a complete absence. There are reports, however, that matters are improving in that direction, and in some quarters the belief is entertained that within a few months there will be a marked increase in construction work. It is considered remarkable that there is as much demand for steel as is apparent, when so little is going into large construction undertakings. Much work of this description is in prospect—work that has been definitely planned and estimated on, according to the testimony of building firms and steel fabricating shops.

As to buying of railroad material, there are no favorable prospects for the current year. Possibilities of railroad expansion and improvement are almost limitless. The governing factor will be the conditions Congress is about to decree as to railroad operation in future.

Formal reduction or general decline in the steel market in the near future is now regarded as improbable in practically all quarters. Predictions made by many observers late in March and in April that there would be "another reduction in June" are universally admitted to have proved incorrect.

Pig Iron—Production of merchant pig iron seems to be adjusted at last to consumption, if, indeed, current consumption is not in excess of production. Furnaces have light stocks, and many consumers who had large stocks two or three months ago have reduced them. Sales are somewhat greater, but are still confined to small individual lots, for early delivery. Now and then there is an exception, as in the case of a large malleable foundry interest on the lake front, which recently bought 2000 tons of malleable from four furnaces, deliveries over a period of several months. Though there is some shading, the market in general is quotable at Mar. 21 prices, at furnace: Bessemer, \$27.95; basic, \$25.75; malleable, \$26.25 to \$27.25; foundry, \$26.75; forge, \$25.75, freight from Valleys to Pittsburgh being \$1.40, but one furnace with only \$1.10 freight to Pittsburgh also quotes these prices. W. P. Snyder & Co. report averages prices for May, based on actual sales, at \$27.95 for bessemer and \$25.75 for basic, at Valley furnaces. On foundry iron the average quotation in May was \$26.75, Valley.

Steel—There is no improvement in billets, which are sluggish, but sheet bars show more activity. One or two sheet-bar contracts have been made for delivery over about three months, but in general the buying is for delivery as soon as it can be made, generally within a week or two. There is a report that some mills are considering the making of an advance in billets, from the present \$38.50 to \$41, in recognition of recent criticism of finished-steel prices, that they were too much above billets. Sheet bars remain quotable at \$42, slabs at \$41, and rods at \$52.

Ferromanganese—It is somewhat more difficult to pick up resale 80% ferromanganese, indicating that there is little chance of shading the prices recently quoted, \$110 @115, delivered. Furnaces continue to quote \$150, but of course this quotation is nominal. Though imported is not closely quotable, it could be had at less than this price at any rate. Spiegeleisen remains nominal at about \$33@35, delivered, for resale 18 per cent.

Coke—The tone of the Connellsville coke market is materially improved. It is more difficult than formerly to shade \$1 on spot or prompt furnace coke, and producers on second-half contracts are talking prices all the way from \$4.25 to \$5. Furnaces would hardly pay such price, and buying may be done simply from month to month. Foundry coke is stronger, fewer brands being obtainable at \$4.50 for prompt, though there is much business in favored brands at \$5 and occasionally higher. Some negotiations have started for twelve-month contracts to date from July 1, but nothing is definite. Production in the Connellsville and Lower Connellsville region is running at about 100,000 tons a week, about half by merchant ovens and half by furnace ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan.	75 630	88 702	101.125	36 682	44 356	48 438
Feb	77.585	85.716	101.125	37.742	42.792	48.027
Mar	73 861	88 082	101.125	36 410	43 620	48 171
April	73.875	95 346	101 125	36.963	47 215	48 886
May	74 745	99 505	107.135	37 940	48 980	52.104
June	76.971	99 500	.	39.065	48 875	..
July	79.010	99 625	.	40.110	48 813	.. ..
Aug.	85.407	100.292		43.418	49 077	. .
Sept	100.740	101.125	.	50.920	49 500	.. ..
Oct	87.332	101 125		44 324	49.500	. .
Nov.	85.891	101 125	.	43.584	48 969	.. ...
Dec	85.960	101 125		43 052	48 492	.
Year	81.417	96 772		40 851	47 516	

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan.	23 500	(a)	110.000	92 238	125.000	106 619
Feb.	23 500	16.763	110.000	78 700	125.000	95 700
Mar.	23.500	14.858	110.000	76 821	125.000	82 071
April	23.500	15.216	110.000	77 300	125.000	82 200
May.	23.500	15.864	110.000	77.767	125.000	81.227
June	23 500	.	110.000	..	125.000	. . .
July	25 904		119.913	. ...	134.913	.....
Aug.	26.000	.....	122.000	.. ..	137.000	....
Sept.	26 000	.....	122.000	....	137.000	.....
Oct.	26 000	.....	122.000	....	137.000	.....
Nov.	26 000	.....	122.000	....	137.000	.....
Dec.	(a)	.....	118.447	. ...	133.167	.....
Year	24 628	...	115 530		130 507	

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85 500	67 702	293.227	248 657
February	92.000	66 801	311.525	223 983
March	(a)	67 934	318.875	236 843
April	(a)	72 500	329.905	225 275
May	(a)	72 500	364.217	234.398
June	(a)	.	331.925	. . .
July	(a)	... .	360.347	....
August	(a)	.....	380.900	....
September	(a)	.....	343 905	....
October	(a)	. ...	335.543	....
November	(a)	. . .	323.550	....
December	(a)		267 736	. . ..
Av. year	(a)	. . .	330.138	.....

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	5.432	6 684	5.316	29 00	37 227
February	6.973	5.057	6 899	4 784	29 00	28 676
March	7 201	5.226	7 091	4 992	29 00	27 952
April	6 772	4 982	6 701	4 722	29 00	24 888
May	6 818	5.018	6 704	4 773	29 00	23.852
June	7 611		7.611	..	29.00	..
July	8 033	..	7 750		29 00	. ..
August	8.050	...	7 750		29 00	....
September	8 050	....	7.750	...	29.00	......
October	8.050	. ....	7.750	.	29 00	......
November	8.050	. .	7 750	.	31 20	......
December	8.564	.	6.324	.	40 00	.....
Year	7 413	. .	7 222		30.10	

Spelter	New York 1918	New York 1919	St Louis 1918	St Louis 1919	London 1918	London 1919
January	7 836	7 272	7 661	7 922	54 000	66 045
February	7 814	6 623	7 639	6 273	54 000	46 150
March	7 461	6 500	7 286	6 150	54 000	38 500
April	6 890	6 465	6 715	6 114	54 000	36 118
May	7 314	6.429	7 114	6.079	54 000	35.477
June	8 021		7 791		54 000	
July	8 688		8 338		54 000	.
August	8 985		8 63[illegible]		54 000	
September	9 442		9 092		54 000	
October	8 801		8 451	..	54 000	
November	8 491		8 141	..	54.100	.
December	8 163		7 813		50.050	
Year	8 159		7 890		54 180	

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton.

Pig Iron, Pgh	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	\$37 25	\$33 60	\$33 95	\$31 40	\$33 95	\$32 40
February	37 25	33 60	33 95	31 40	33 95	32 40
March	37 25	32 54	33 95	31 40	33 95	29 12
April	36 15	29 35	32 95	27 15	33 95	28 16
May	36 20	29.36	33 00	27 15	34 00	28.15
June	36 36		33 16	.	34 16	
July	36 60		33 40	..	34 40	
August	36 60	....	33 40	. .	34 40	.
September	36 60	..	33 40	.. ..	34 40	
October	36 60		34 40	..	35 40	
November	36 60		34 40		35 40	
December	36 60		34 40	. ..	36 40	
Year	\$36 67		\$33 70		\$34 45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	June 3
Alaska Gold M	3½
Alaska Juneau	2½
Am.Sm.&Ref.,com.	80
Am.Sm. & Ref., pf.	106½
Am.Sm.Sec., pf., A	93½
Am. Zinc	16¾
Am. Zinc, pf.	52
Anaconda	69½
Batopilas Min	1¾
Bethlehem Steel	83¾
Butte & Superior	28
Butte Cop. & Zinc	13
Cerro de Pasco	43
Chile Cop.	24½
Chino	39¾
Colo. Fuel & Iron	49
Crucible Steel	90½
Crucible Steel, pf.	100½
Dome Mines	14½
Federal M. & S.	14½
Federal M. & S., pf	42½
Great Nor., ore ctf.	45½
Greene Cananea	42½
Gulf States Steel	75½
Homestake	‡85
Inspiration Con	56½
International Nickel	27½
Kennecott	36
Lackawanna Steel	84½
Mexican Petrol	189½
Miami Copper	27½
Nat'l Lead, com.	79½
National Lead, pf	‡109
Nev. Consol.	17½
Ontario Min	8½
Ray Con	22½
Republic I.&S.,com.	87½
Republic I.&S., pf.	‡104
St. Joseph Lead	14½
Sloss-Sheffield	63¾
Tennessee C. & C.	14½
U. S. Steel, com.	107½
U. S. Steel, pf.	116¾
Utah Copper	80
Va. Iron C. & C.	‡67
Worthington Pump	69½

BOSTON CURB*	June 3
Boston Ely	2
Boston & Mont.	.75
Butte & Lon'n Dev.	.15
Calaveras	1¾
Chief Con	3¾
Contact	.05
Cortez	.12
Crown Reserve	.40
Crystal Cop.	.12
Eagle & Blue Bell	2⅛
First Nat. Cop.	2
Gadsden Cop	3¾
Houghton Copper	.75
Intermountain	‡.05
Iron Blossom	.38
Iron Cap	10
Majestic	.21
Mexican Metals	.20
Mines of America	‡.05
Mojave Tungsten	.15
Nat. Zinc & Lead	.10
Nevada-Douglas	.16
New Baltic	1½
Oneco	1
Pacific Mines	‡.25
Rex Cons	14
Yukon Gold	80

SAN FRAN.*	June 3
Alta	‡.08
Andes	‡.30
Best & Belcher	‡.20
Caledonia	‡.24
Challenge Con.	‡.03
Confidence	‡.25
Con. Virginia	‡1 95
Gould & Curry	‡.10
Hale & Norcross	‡.25
Jacket-Cr. Pt.	‡.20
Mexican	‡.52
Occidental	‡.40
Ophir	‡1 55
Overman	‡.10
Savage	‡.20
Sierra Nevada	‡.15
Union Con.	‡.35
Utah Con	‡.04
Belmont	3 50
Jim Butler	36
MacNamara	1 00
Midway	37
Mont.-Tonopah	‡ 20
North Star	.10
Rescue Eula	17
West End Con.	2 10
Atlanta	04
Booth	09
Comb. Frac.	04
Florence	43
Jumbo Extension	12
Kewanas	03
Nevada Hills	.05
Nevada Packard	20
Round Mountain	.19
Silver Pick	07
White Caps	10

COLO. SPRINGS*	June 3
Cresson Con	4 31½
Doctor Jack Pot	03¾
Elkton Con	05
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	1 67
Granite	14
Isabella	04½
Mary McKinney	07½
Portland	98½
United Gold M	15½
Vindicator	32

BOSTON EXCH.†	June 3
Adventure	1½
Ahmeek	76
Algomah	‡.60
Allouez	40
Ariz. Com.	14
Arnold	‡.20
Bingham Mines	9½
Bonanza	‡.20
Butte-Balaklava	.60
Calumet & Ariz.	65½
Calumet & Hecla	440
Carson Hill	13½
Centennial	15
Copper Range	48
Daly West	2¾
Davis-Daly	6½
East Butte	13
Franklin	4½
Granby	‡66½
Hancock	6½
Hedley	‡12
Helvetia	4½
Indiana	1
Isle Royale	31½
Keweenaw	2
Lake	6½
La Salle	4¾
Mason Valley	3½
Mass	6½
Mayflower	10
Michigan	6¾
Mohawk	64¾
New Arcadian	3½
New Cornelia	19½
New Idria	10
Nipissing	11½
North Butte	14
North Lake	90
Ojibway	3
Old Dominion	37½
Osceola	56
Quincy	68
St. Mary's M. L.	59
Santa Fe	‡.25
Seneca	24½
Shannon	3½
Shattuck-Ariz.	11½
So. Lake	2½
So. Utah	.25
Superior	9
Superior & Bost.	3½
Trinity	4½
Tuolumne	1½
U. S. Smelting	67½
U. S. Smelting, pf.	49¾
Utah Apex	3¾
Utah Con	10¾
Utah Metal	2¾
Victoria	4
Winona	1½
Wolverine	21¾

N. Y. CURB†	June 3
Am. Tin & Tung	¾
Big Ledge	¾
Butte & N. Y.	¾
Butte Detroit	‡.03
Caledonia	40
Calumet & Jerome	1⅛
Can. Cop. Corpn	1⅝
Carlisle	‡2
Cashboy	09½
Con. Ariz. Sm.	1¾
Con Coppermines	5
El Salvador	4½
Goldfield Con.	21
Goldfield Merger	‡.05
Hecla Min	5½
Howe Sound	4½
Jerome Verde	¾
Louisiana	¾
Magma	‡31
Marsh	‡.08
McKinley-Dar-Sa	63
Milford	‡.75
Mother Lode	44
Nixon Nevada	33
Ohio Cop.	‡.60
Rawley	‡2¾
Ray Hercules	2¾
Richmond	‡.50
Rochester Mines	.22
Standard S. L.	⅞
Stewart	30
Success	‡.05
Tonopah	2½
Tonopah Divide	9
Tonopah Ex	2¹⁵⁄₁₆
Tribullion	‡.25
Troy Arizona	‡.10
United Eastern	4½
United Verde Ext	39
United Zinc	‡.75
Utica Mines	‡.08

TORONTO*	May 27
Adanac	21
Bailey	04
Beaver Con	45
Chambers Ferland	‡ 10
Coniagas	2 60
Hargraves	04
Kerr Lake	5 75
La Rose	25
Lake Shore	1 00
Min Corp of Can	2 00
Peterson Lake	07
Teck Hughes	15
Temiskaming	40
Wettlaufer-Lor.	03
Davidson	‡.68
Dome Exten.	.30
Dome Lake	20
Hollinger	6 75
McIntyre	1 75
Newray	.12½
Porcu. Crown	.30
Vipond	20
West Dome	13

*Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

June 14, 1919

Volume 107 *Number* 24

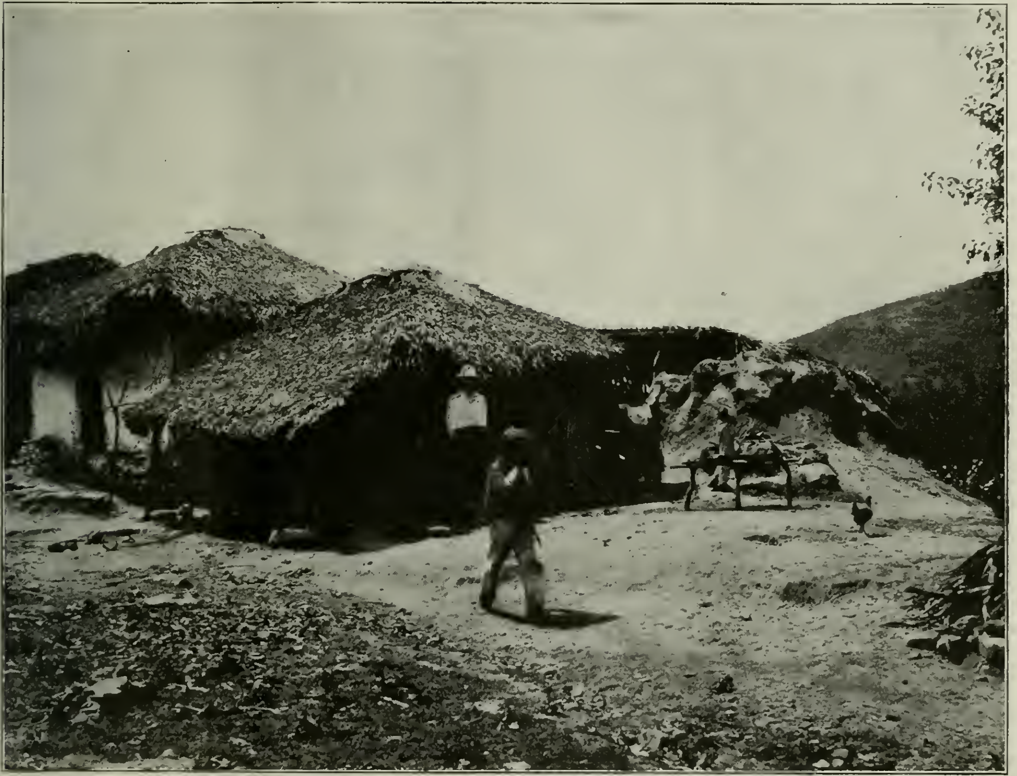


FIG. 1. PALMA RANCHO AT SAN AUGUSTIN, WITH "SALTPETER WORKS" IN REAR

Saltpeter in Guatemala

BY HOYT S. GALE

The making of saltpeter, or nitrate of potassium, termed "salitre" in Spanish, is an old industry among the natives in various parts of Guatemala. It is not known when or how this industry started, but the suggestion has been advanced that, as the use of gunpowder made from saltpeter is so closely identified with religious ceremonies among the Guatemalans and similar native races, the technique of its manufacture may have been brought by the early churchmen from the Old World. Saltpeter is made in Guatemala from the leachings of soils about the native villages, the work of separating and refining this salt being performed mostly by women. The amount of saltpeter vroduced in this way is small.

CRUDE fireworks made from the old-fashioned black powder are employed almost universally among the Central and South American native races as an accompaniment to the celebration of festivities and ceremonials of all kinds, and the opportunity for their use is frequent. The popping and banging of *cohetillas*, which are a kind of firecracker; *bombas*, and *quetas*, which are bombs or rocket-like affairs made of bamboo canes in the shape of an ordinary skyrocket, may be heard almost daily in many of the larger towns or cities.

Most of the powder employed in the manufacture of these fireworks is made from saltpeter produced locally, combined with native sulphur and ordinary charcoal. The quantities of such powder made locally must be considerable, judging from its almost constant use. but no statistics showing the amount are available.

The handling and use of explosives, including the manufacture of black powder and of saltpeter, are under strict governmental control in Guatemala. The making of saltpeter is commonly referred to as a government monopoly, as each operator in this industry is required by law or regulation to obtain a license. The cost of such license was said, in July, 1917, to be 5 pesos (about 12½c. U. S. money) a month. Another requirement was that all the saltpeter made must be delivered to the Administrador de Rentas in each department or province, by whom a price fixed by the government is paid. Only one grade is recognized officially, namely the best grade of refined saltpeter made locally, but the purity of the native product varies greatly. In 1917 the price paid by the government was stated to be 3 pesos (about 7½c. U. S. money) per lb., for the refined saltpeter crystal.

Reports of the making of saltpeter have come from various parts of Guatemala. Special attention has, however, been directed of late to the production at the little town of San Augustin, in the Department of Progreso, and at other places near by in the valley of the Motagua River. This includes a small production apparently made intermittently in the towns of El Rancho and Zacapa, and possibly in other neighboring settlements. Production has also been reported in other parts of the country, at Antigua, Occidente, and in the neighborhood of Totonicapan, which is 15 or 20 miles northeast of Quezaltenango. Less definite reports state that saltpeter is also made "somewhere beyond Tacana, down on the Pacific Coast."

SALTPETER MANUFACTURED DURING DRY SEASON

The procedure followed in the manufacture of saltpeter at San Augustin is essentially the same as that at other places in the country. Its manufacture is carried on principally in the dry season, which usually extends from November to May. My visits to San Augustin were made in the latter part of July, 1917, and were thus in the rainy season. Heavy showers occurred frequently, usually every afternoon or night, although occasionally it did not rain for two or more consecutive days. As these rains are usually torrential, and drench the soil, they wash away most of the soluble salts from the surface; but as soon as the ground begins to dry again there are many places in which an efflorescence of salts may be found. The crops of such salts are undoubtedly much more abundant in the dry season than during the rains.

The most surprising point developed by the inquiry into the Guatemalan saltpeter industry is the detail and exactness with which the different steps of the process are carried out. Knowledge of the details apparently has been handed down from generation to generation as a family inheritance, and with most of its possessors this knowledge is guarded jealously as a family secret. In almost every case the operators are the women of the family.

The view given in Fig. 1 shows a typical native hut in San Augustin, with the "saltpeter works" in the rear. The leaching and boiling are done under the shelter of a thatched roof, and the pile of soil is that thrown out after former leachings. The earth was obtained from the yard at the side of the hut, according to the method that is described as follows:

The raw material with which the manufacture of saltpeter is started is the soil from the yards and roads in the vicinity of the native dwellings. This is gathered by sweeping from the surface the loose soil particles and saline efflorescence that appears most conspicuously during the dry season. The ground is sometimes scratched to shallow depth with the large knives called *machetes*, and the soil thus loosened is included in the sweepings. Earth that has been leached and thrown aside becomes recharged with nitrate salts and can be reworked in the same way as the first gatherings, that is, by sweeping up the loose surface layers. Material can be preserved from the leaching of the rainy season under cover of a tight roof, and so may be worked at any season. That from the earth floors inside the huts, especially about the fireplaces, is used in this way.

WOOD ASHES USED IN LEACHING

A charge of sweepings, gathered as described above, is poured out on the floor of the small inclosure where most of the work is carried on. The first step in the procedure is the addition of wood ashes. These are mixed dry in a proportion of about two measures of earth to one of wood ashes. The charge is then packed into the leaching pots. These are large earthenware pans, about 2 ft. in diameter and 8 in. deep. They are of ordinary red burned clay, unglazed, and are of local manufacture, being the same as the larger pots used for household cooking. The leaching pots are perforated in the bottom with a half dozen or more round holes, so that the liquor may drain out. Before the soil is put into the pots, these holes are covered with a piece of palm matting that acts as a coarse filter to prevent the soil from washing through. The leaching pots are arranged on a low pole bench directly over similar pots with solid bottoms, placed to catch the solution as it drips through.

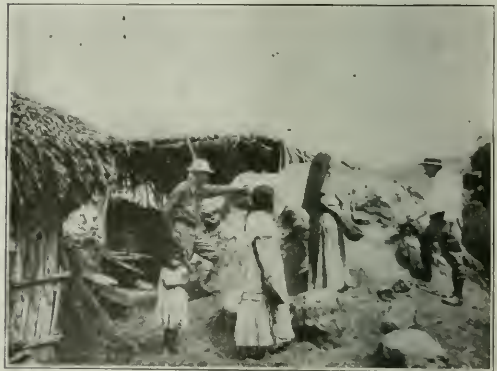


FIG. 2. NATIVE SALTPETER MAKERS AT SAN AUGUSTIN

Fig. 2 is a nearer view of the same saltpeter works shown in the first photograph, including some of the native saltpeter makers, who are showing the visitors where the saltpeter has again become rich in earth that has previously been worked. Some of the earthenware pots used in saltpeter making may be seen at the left and the bundles of twigs used to sweep the earth stand at the corner of the hut. The gourd cups held by the women are the dippers used in transferring or dipping the solutions.

Crude System of Concentration Practiced by Evaporation of Solutions

The first step in the leaching process is to pour old liquor, saved from previous crystallizations, over the dry earth and ashes in the upper pot. The liquor is added gradually until it saturates the mixture and begins to drip through. After an hour or two, fresh water is added, and this gradually diminishes the density of the filtered solution. At this stage a fresh egg is placed in the solution that collects in the pan below, which serves as a sort of hydrometer, giving an indication from time to time of the relative density of the solution. At first the egg floats high, but it settles as the density of the liquor decreases with the addition of fresh water. When the egg hydrometer is almost submerged, no more fresh water is added, and after the drippings have practically stopped the liquor collected in the lower pot is withdrawn.

The liquor thus obtained is transferred to a pot capable of withstanding fire, and is concentrated by slow boiling. While boiling continues, several sprays of fresh green leaves are gathered in the yard near by and thrown into the solution. The leaves are said to assist in the formation of crystals. The plant used is called *mosote de citio,* although *piñon or cuanlote* are said to serve the same purpose. These are common native plants. When small crystals form on the back of the gourd used to stir and dip the solution, the desired stage in the evaporation is approaching, and final tests are made by dripping the hot solution from the gourd to the cold blade of a steel *machete* and observing the formation of the crystals. When it is found that these drops solidify quite rapidly with cooling, the cooking is stopped by drawing out the fire. The hot solution is filtered through cloth into a second pot, care being taken to save the drippings and rinsings, which are returned to the system. The liquor is then allowed to stand undisturbed over night, when it cools and deposits a crop of crystals.

First Stage of Process Results in Granular Mass of Impure Crystals

The crop obtained at this stage is a granular mass showing cubes of the chlorides of potassium and sodium and the elongated needle-like crystals of nitrate of potassium. This product contains a considerable amount of sulphates and other impurities, and is not ordinarily marketable. It must then be put through a second or refining process, which resembles in a general way the leaching operation just described.

The crystals derived from the first leachings are redissolved in the smallest amount of pure water that will take them up. For this operation pure water is sought, by preference rain water. The whites of several eggs are added to the pot filled with this solution, and the whole is placed over a fire and boiled. The coagulation of the egg albumen with cooking gathers the suspended impurities and, on settling, clarifies the solution. The boiling is continued until nitrate crystals form quickly in cooling test drops, when the solution is again set aside over night to deposit a crop of crystals. If successfully done, the step should yield pure nitrate of potassium in characteristic needle-shaped crystals, the best being perfectly white. The grade of the final product is usually judged from the color and the perfection of crystallization.

A byproduct frequently obtained from this process, and locally supposed to be common salt, is at times separated and sold for stock and even for table use, but its recovery is often neglected. Most of the salt thus recovered is yellowish and moist, suggesting impurities. Potassium salts are likely to be present in such a product, because of the wood ashes that are used in the process of recovery of the nitrate. The amount of this byproduct salt obtained, however, is so small that it is of little practical consequence.

Residues, rinsings, old liquor, and skimmings are all poured on the floor of the small inclosure in which the leaching and boiling are done, and are therefore saved to be reworked with later charges. The earth from which the salts have been extracted is thrown on the floor or piled over the edge of the walls surrounding the inclosure.

Small Production of Saltpeter

A small plant like the one represented in the illustrations is said to produce, when regularly worked, about 4 lb. of saltpeter a day, but operations are seldom conducted for more than five days in a week. A production at one of these plants of 100 lb. a month is reported. During the dry season from 20 to 25 women are engaged in the production of saltpeter about San Augustin, the estimated average production being about 20 lb. each a month. Most of the production is made during the dry season, from December to April, inclusive, probably at least five months in the year, although some saltpeter is made during other seasons. Thus the production from this town is perhaps not more than one ton of refined saltpeter a year, if it amounts to as large a quantity as this.

Samples of the earth from the yard about the saltpeter works described, from a small boring made in the yard, and from the materials used in various stages of the process, have yielded the analytical results shown in the accompanying table. The first was a thin scraping from the surface of soil in the open yard near one of the native huts in San Augustin. It being the rainy season, the soil was undoubtedly much leaner in soluble constituents than it would have been at other times.

ANALYSIS OF SAMPLE COLLECTED IN A YARD AT SAN AUGUSTIN
W. B. Hicks, Analyst

Field Sample No. 34 Moisture in sample as delivered at the laboratory 5.30 per cent (obtained by drying at 100-105° C.)

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations		Calculated Salts	
K	1.49	KNO_3	2.43
NO_3	1.49	KCl	1.05
Cl	1.51	NaCl	1.66
CO_3	.14	Na_2CO_3	.25
Undetermined	2.09	Undetermined (a)	1.33
Total soluble salts (dried at 180° C)	6.72	Sum	6.72

(a) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, calcium sulphate, and organic matter.

Predominance of Potassium Over Sodium

The predominance of potassium over sodium found in Sample 34 would be unusual in a natural deposit of mineral salts, and is thought to be due either to the effect of organic matter that had decomposed in this soil, or it may be the result of long-continued accumulation of wood ashes both from domestic fires and the use of ashes in the extraction of the saltpeter.

An auger boring put down in this yard yielded three more samples, as shown herewith. Fig. 3 shows the manner in which these were taken.

ANALYSES OF SAMPLES COLLECTED BY AUGER BORING IN A YARD AT SAN AUGUSTIN

W. B. Hicks, Analyst

Field Sample No.	Depth	Moisture per cent. of sample as delivered at the laboratory (obtained by drying at 100-105° C.)
22	1 to 6 in.	2.52
23	6 in. to 1 ft.	4.55
24	1 ft. to 1 ft. 9 in	3.84

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	22	23	24
K		0.53	0.43
NO_3	0.02	0.15	0.07
Cl	0.23	0.31	0.12
CO_3	0.21	0.18	0.22
Undetermined	0.96	0.57	0.35
Total soluble salts (dried at 180°C.)..	1.42	1.74	1.19

Calculated Salts	22	23	24
KNO_3.......	0.03	0.24	0.12
KCl........	....	0.65	0.25
K_2CO_3......	....	0.18	0.44
Na_2CO_3.....	....	0.18	0.05
Undetermined (a)		0.49	0.33
Sum.......	....	1.74	1.19

(a) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, silica and organic matter.

These samples contain only small amounts of soluble salts, and little nitrates, and are not representative of the material generally used in the saltpeter works. The supply of earth obtained for that purpose usually consists of sweepings or thin scrapings taken only from the surface of the ground. Analyses of these samples, however, furnish evidence that nitrates exist to a depth of nearly two feet, and throw some light on the distribution of salts in the soil. Thus, in summary, the surface materials (Sample No. 34) contain 6.72% soluble salts; the first 6 in. below the surface, 1.42%. Whether the decrease in soluble salts continued with depth is a matter of conjecture, as the boring was stopped by rock or a layer of hardpan which it was found impracticable to penetrate. Possibly the soluble portion of this soil is much lessened during the wet season because of percolating waters and the fact that surface efflorescences are repeatedly washed away. It seems likely, however, that the average salt content of this firmly compacted ground does not vary greatly from season to season, except at the immediate surface, and that the supply of soluble salts is continually being replenished as a result of decomposition of soil minerals and organic matter. During the dry season this store of soluble material is drawn to the surface in solution by capillarity, where, as a result of evaporation, it accumulates as a saline incrustation.

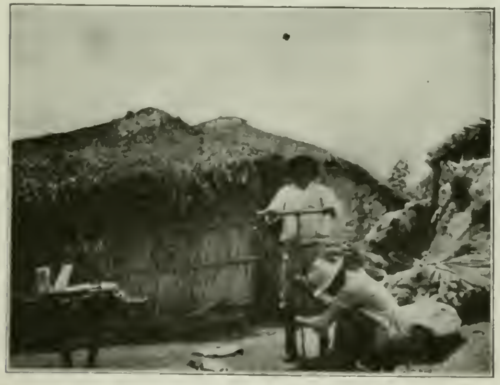


FIG. 3. SAMPLING SOIL IN THE YARD AT SAN AUGUSTIN BY MEANS OF A HAND AUGER

Sample 33 consists of thin scrapings from the surface of a pile of soil and ashes thrown out from former leachings from the saltpeter works as shown in Fig. 2 It is said to have regenerated nitrate or saltpeter and shows by analysis the following composition:

ANALYSIS OF SAMPLE COLLECTED FROM OLD SALTPETER WORKS, SAN AUGUSTINE

W. B. Hicks, Analyst

Field Sample No. 33 Moisture in sample as delivered at the laboratory, 5.30 per cent (obtained by drying at 100-105° C.)

Chemical Determinations	
K	1.57
NO_3	1.14
Cl	1.20
CO_3 ...	.11
Undetermined	2.98
Total soluble salts (dried at 180° C.)	7.00

Calculated Salts	
KNO_3	1.86
KCl	1.62
NaCl.	.71
Na_2CO_3	.19
Undetermined.	2.62
Sum...	7.00

These results show that the material that has been formerly leached contains roughly the same amount of soluble salts and a little less nitrate than do the thin scrapings from the yard; and in some measure they confirm the statement that the leached earth gradually becomes recharged with nitrates and ready to be worked again. In addition to the constituents determined, the sample contains a considerable amount of sodium, calcium, sulphates, and organic matter, and so the undetermined portion probably consists largely of sodium sulphate, calcium sulphate, and organic matter. A sample of the mixture of earth sweepings and wood ashes, exactly as this was prepared for a charge in the leaching pot at the beginning of a saltpeter run, was also taken, and gave the following results:

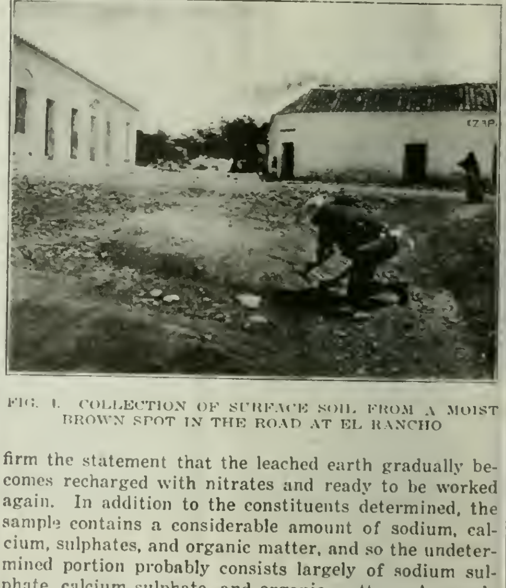


FIG. 4. COLLECTION OF SURFACE SOIL FROM A MOIST BROWN SPOT IN THE ROAD AT EL RANCHO

ANALYSIS OF SAMPLE COLLECTED AT A SALTPETER WORKS, SAN AUGUSTIN

W. B. Hicks, Analyst

Field Sample No. 32 Moisture in sample as delivered at the laboratory, 2.53 per cent. (obtained by drying at 100-105° C.)

ANALYSIS OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT OF DRIED SAMPLE

Chemical Determinations	
K	2.14
NO_3	.84
Cl	1.09
CO_3	.34
Undetermined (a).	2.06
Total soluble salts (dried at 180° C.)	6.47

Calculated Salts	
KNO_3	1.57
KCl	2.29
K_2CO_3	.72
Na_2CO_3	.05
Undetermined (a)	2.04
Sum	6.47

(a) Qualitative tests indicate that the undetermined portion consists largely of sulphates and organic matter

The results indicate that an unnecessarily large proportion of wood ashes was used in the charge, because potassium is present in considerable excess over that necessary to combine with the nitrate radical. It is possible that the procedure followed in the present instance, and out of the regular season of operation, did not have exactly the same effect that it would have had on materials collected from a more abundant crop of salts from the soil during the dry season.

The salts that began to crystallize in the cooling liquor obtained by leaching this mixture were chiefly cubes, suggesting potassium chloride or sodium chloride. Further cooling doubtless would have brought down the crop of potassium-nitrate needles.

A representative sample brought from these saltpeter works during the regular season of manufacture shows the general composition of the ordinary refined product.

ANALYSES OF REFINED SALTPETER FROM GUATEMALA
Stillwell & Gladding, New York, Analysts

Sample Number	Description	Per Cent of Sample as Delivered Moisture	Insoluble
1	"White" crystals	1.50	0.19
2	"Yellow" crystals	5.88	0.34

ANALYSIS OF WATER-SOLUBLE PORTION EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	1	2	Calculated Salts	1	2
K	38.67	38.33	KNO_3	99.11	90.66
NO_3	60.81	56.15	$NaNO_3$	0.05	0.77
Cl	0.25	3.68	KCl	0.53	7.74
SO_4	0.06	0.25	K_2SO_4	0.11	0.45
Undetermined	0.02	0.25			
			Sum	99.80	99.62
Total soluble (dried at 150° C.)	99.81	99.66			

These analyses have been recalculated from the original statement to conform with the tables given of other analyses.

The description of saltpeter making at San Augustin doubtless fairly represents the processes used at other places in Guatemala. The analytical data obtained at this place were not wholly satisfactory, owing to unfavorable weather conditions at the time the investigation was made. Some tests made at other localities serve to throw a little more light on the subject of the distribution and character of the salts in the soils about the native villages, and are briefly reviewed.

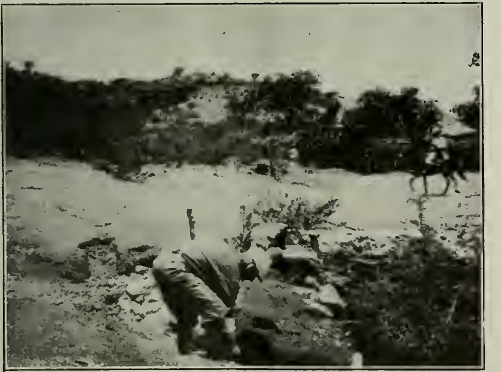


FIG. 5. THE COLLECTION OF SAMPLES 47 AND 48, FROM MOIST, DARK-BROWN EARTH FROM ROADSIDE IN EL RANCHO

Saltpeter is made in the town of El Rancho; and, in following an inquiry into the source and occurrence of the substance, various samples of nitrate-bearing earths were collected about this place. Field-nitrate tests made on the spot practically proved that the richest nitrate-bearing earth was confined to the moist, brown soil in the immediate neighborhood of houses, and thus the idea that the nitrate salts originate in the filth that accumulates about such places is more or less substantiated. These salts show more prominently in some towns than in others. Local variation of soil character may account for differences of this kind. In some places a loose, sandy soil and good drainage do not favor the retention of salts. In others, as at El Rancho, the soil in the streets is black and more or less gummy or sticky when wet, and the spots in the road that tend to remain always dark, moist, and slippery are reported to be richest in saltpeter. Sweepings from such spots as these are leached in the manufacture of saltpeter.

FIG. 6. VIEW SHOWING SITE AND COLLECTION OF SAMPLE NO. 42, AT MAGDALENA

A shop at the upper end of the main street leading up from the depot in El Rancho carries a sign over the door, *Se venden polbora* (powder is sold here), and at this place samples of yellowish saltpeter, said to have been leached from sweepings from the road, were exhibited. The view showing the collection of samples 45 and 46 represents one of the moist, salty spots, this being in front of the shop mentioned.

ANALYSES OF SAMPLES COLLECTED IN THE ROAD AT EL RANCHO
W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of samples as delivered at the laboratory (obtained by drying at 100-105° C.)
45	Surface scraping	2.88
46	6 to 8 inches	2.76

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLE

Chemical Determinations	45	46	Calculated Salts	45	46
K	0.12	....	KNO_3	0.31	...
NO_3	1.34	....	$NaNO_3$	1.58	
Cl	0.15	0.05	NaCl	0.25	
CO_3	0.05	0.10	Na_2CO_3	0.09	
Undetermined (a)	1.39	0.43	Undetermined (a)	0.82	
Total soluble salts (dried at 180° C)	3.05	0.58	Sum	3.05	

(a) A considerable amount of calcium is present, and a portion of the nitrate is in all probability represented as calcium nitrate. The undetermined portion probably consists largely of calcium sulphate and organic matter.

The sample from beneath the surface contained so little saline matter that complete analysis has not been made. Only a small amount of surface efflorescence appeared on the soil between the frequent torrential rains, and the content of saltpeter in the sample is probably much lower than it would have been if taken during the dryer seasons.

Two other samples, Nos. 47 and 48, were collected near the locality where Nos. 45 and 46 were taken.

These came from the side of the road, where recent cutting of the water along a drainage channel had exposed moist, dark-brown earth. The surface soil was sampled separately (No. 47) in order to compare its salt or nitrate content with that of soil at a depth of 6 in. to 1 ft. below the surface, although both samples, being moist, showed no evident saline efflorescence. The two samples were apparently similar, except that the material on top was very dark, almost black, and that from underneath of slightly lighter shade.

ANALYSES OF SAMPLES FROM ROADSIDE IN EL RANCHO

W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of sample as delivered at laboratory (obtained by drying at 100-105° C.)
47	Surface	10.24
48	6 in. 1 ft.	2.00

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLES

Chemical Determinations	47	48	Calculated Salts	47	48
K	0.13		KNO_3	0.34	.
NO_3	5.15		$NaNO_3$	6.78	.
Cl	0.66	0.03	NaCl	1.09	
CO_3	0.10	0.11	Na_2CO_3	0.18	
Undetermined (a)	2.61	0.30	Undetermined (a)	0.25	.
Total soluble salts (dried at 180° C.)	8.65	0.44	Sum	8.64	

(a) A considerable amount of calcium and magnesium are present and in all probability a portion of the nitrate is represented by calcium and magnesium nitrates. The undetermined portion probably consists largely of calcium sulphate and organic matter.

Sample 47 is notable in that it shows about 7% of readily soluble sodium, calcium, and magnesium nitrates, with only a small amount of potash, these salts constituting the greater part of the soluble constituents in the sample. The soil from a short distance below the surface at this place not only contained much less soluble salts than that from the surface, but showed only an insignificant amount of nitrate. These samples remained persistently moist, indicating the presence of deliquescent salts. As may be seen from the view given herewith, this place is situated well above the main settlement, and there is no apparent reason for an exceptional accumulation of filth. However, it is clear that such soil is heavily charged with organic refuse, and the warm, moist atmosphere had the pervading odor of filth so often characteristic of towns in the tropics. The samples from El Rancho differ from those obtained in the yard at San Augustin in carrying less potash.

Two samples were taken by boring in El Rancho at the upper side of the road in a moist, brown spot a little further from the settlement than the site from which Samples 47 and 48 were obtained. The soil here was of mealy consistence. A sample from the surface of the ground gave a good reaction for nitrate by the field test, whereas the field test made on a mixed sample of the soil in the lower part of the hole was so faint as to be essentially negative. When examined in the laboratory, these samples were found to contain so little nitrate or other soluble salts that analysis was not carried out completely. The determinations are as follows:

ANALYSES OF SAMPLES FROM BORING AT UPPER SIDE OF ROAD NEAR EL RANCHO

W. B. Hicks, Analyst

Field Sample Number	Depth	Moisture per cent. of sample as delivered at the laboratory (obtained by drying at 100-105° C.)
20	To 8 inches	4.70
21	From 8 in. to 3 ft	3.10

ANALYSES OF WATER-SOLUBLE PORTIONS EXPRESSED AS PER CENT. OF DRIED SAMPLES

Chemical Determinations	20	21	Calculated Salts	20	21
NO_3	0.12		$NaNO_3$	0.16	
Cl	0.08	0.05	NaCl	0.13	
CO_3	0.05	0.04	Na_2CO_3	0.09	
Undetermined (a)	0.80	0.66	Undetermined (a)	0.67	
Total soluble salts (dried at 180° C.)	1.05	0.75	Sum	1.05	

(a) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate with some calcium sulphate, and organic matter.

At a depth of 3 ft. a free seepage of water entered the bottom of the boring, thus furnishing an explanation for the moist spot on the surface.

Reference is frequently made by the natives to the occurrence of *salitre* in the town of Magdalena, which is on the north side of Motagua River, four or five miles east of El Rancho. No evidence of saltpeter manufacturing was seen at this place, but it was stated that earth gathered in Magdalena was carried to San Augustin, where the saltpeter was made. Magdalena stands on a terrace about 60 or 75 ft. above the level of the river at this place, and the river front is bordered by a bare bluff of sandy and clayey river deposits. The clayey layers in these bluffs effloresce with white salts when they are dry, and these efflorescences are locally called *salitre*. Such efflorescences are found at other places along the bluffs bordering Motagua River. They were tested for nitrate in many places, with negative results. The native use of the term *salitre* in Guatemala and in Mexico is not confined to the true saltpeter, but means also a saline efflorescence, not common salt, because salt is a designated *sal* where recognized as such. *Salitre* thus seems to include what is commonly referred to as alkali in our Western States.

Analysis of samples from these alkaline efflorescences showed them to be largely sodium carbonate and sulphate, with some chloride. A trace of nitrate was found in some of the samples at the surface, but none from freshly dug material from below the surface. Considerable effort was made to check these conclusions, as this occurrence seems to have been the source of much misconception about the distribution of the saltpeter-bearing earth in Guatemala.

Some of the soil gathered from the terrace surface near Magdalena was found to contain an appreciable amount of soluble potassium salts, in part as the ordinary carbonate and sulphate. Near some of the houses saline efflorescences similar to those in the river bluffs were tested and found to be rich in nitrates. Fig. 6 effectively illustrates the nature of these occurrences. This crust of salt formed in a single day, following one of torrential rains that had apparently dissolved and carried off all former accumulations of such surface salts. The composition of this sample is also of particular interest, the nitrates found in it showing, as they are believed to do, the influence of organic contamination.

ANALYSIS OF SURFACE EFFLORESCENCE FROM MAGDALENA

W. B. Hicks, Analyst

Field Sample No. 42 Moisture in sample as delivered at laboratory, 10.05 per cent. (obtained by drying at 100 to 105°)

ANALYSIS OF WATER-SOLUBLE PORTION EXPRESSED AS PER CENT. OF DRIED RESIDUE

Chemical Determinations		Calculated Salts	
K	2.20	KNO_3	5.69
NO_3	4.03	$NaNO_3$	0.74
Cl	2.50	NaCl	4.13
CO_3	0.08	Na_2CO_3	0.14
Undetermined (a)	6.04	Undetermined (a)	4.15
Total soluble salts (dried at 180° C.)	14.85	Sum	14.85

(a) Qualitative tests indicate that the undetermined portion consists largely of sodium sulphate, calcium sulphate and organic matter.

This sample is as rich in nitrates as are the soils used in the saltpeter works. The large percentage of soluble salts found in the sample (14.85%) is due to the fact that only a surface concentration was collected.

The foregoing is an abstract from a more detailed report of an investigation of the occurrence and manufacture of saltpeter in the Motagua Valley in Guatemala. Various rumors and one or two supposedly competent statements were received claiming the existence of extensive deposits in the country, which, as they were only being worked in the crudest way, were supposed to be worthy of development on a much larger scale. Such reports have been received especially during the war, not only from Guatemala, but from other parts of the tropics. No doubt they will recur from time to time as long as the interest in a possible new source of nitrate salts continues. For this reason, as well as for the general interest that a subject of this sort may have, it has seemed worth while to record in this paper, somewhat in detail, the basis of such rumors and reports.

Kennecott Copper Corporation

The report of the operations of the Kennecott Copper Corporation for the fiscal year ended Dec. 31, 1918, shows that a total of 660,228 tons of ore was mined and treated at the Kennecott and Latouche plants. The treatment of this material resulted in the production of 124,315 tons of concentrate for shipment to the smeltery, containing 32,457 tons of copper.

The concentrating mill at Kennecott operated throughout the year, but not to full capacity, owing to a shortage of labor at the mines, and, further, to decreased tonnage in May and June, due to the wrecking of the rope tramways by snowslides in the latter part of April. A total of 218,819 tons of ore, averaging 7.82% copper, was treated, with a resultant production of 27,174 tons of concentrates, assaying 53% copper. The extraction was 84.19 per cent.

The ore milled at the Latouche plant totaled 395,524 tons, this being an increase of 141,719 tons over the previous year. The average assay was 2% copper, and the extraction for the year was 80.7%, concentrate production totaling 49,915 tons, containing 12.8% copper.

The most important developments of the year were the discovery of an orebody on the 600-ft. level of the Bonanza mine, and of an orebody on the 900-ft. level of the Jumbo mine, about 400 ft. to the northwest of the main fissure. Rebuilding of the Bonanza rope tramway so as to increase its capacity to 600 tons per day was started and nearly completed. The construction of a rope tramway about 5000 ft. long to connect the Glacier mine with the Jumbo tramway was started.

Dividends paid during the year amounted to $5,574,089, and an equal amount was expended in capital distribution.

Storm in Texas Oil Fields

HOUSTON, TEXAS, CORRESPONDENCE

Much damage has followed a torrential storm in this section of the state on the morning of May 24, especially in the oil fields. The storm broke about 50 miles northwest of Houston. At Goose Creek, it is reported, only 27 derricks and a few houses are left standing in the whole oil field. One man was killed here, and the estimated damage was about $1,000,000. The Humble Oil Co. was the heaviest loser, only 5 out of 80 derricks being left standing. A 55,000-bbl. tank under construction was destroyed and four bunk houses were wrecked. The total loss to the company is probably $100,000. The Gulf Production Co. lost 100 derricks altogether, a loss estimated to amount to $40,000 by C. L. Jones, assistant manager. Simms interests have 3 derricks left out of 72. Other companies also lost heavily. At Spindletop, 25 derricks were blown down, and at Sour Lake, 11. Lightning at Hull struck a 55,000-bbl. steel tank belonging to Magnoleum Petroleum Co., setting fire to the contents. The Texas Co. also had some smaller fires here. The number of injured in the various fields is not yet known.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the U. S. Department of Commerce, for April, 1919, and the figures for April, 1918, as finally revised, are as follows:

IMPORTS, APRIL, 1918 AND 1919

(In pounds, unless otherwise stated)

	April, 1918	April, 1919
Metal and ore:		
Antimony ore, contents	264,857	46,616
Antimony matte, regulus or metal	1,734,790	924,848
Copper:		
Ore, contents	7,611,711	4,998,467
Concentrates, contents	2,793,200	2,374,639
Matte, regulus, etc., contents	3,642,542	2,400,549
Imported from (in part):		
Canada	2,215,712	1,731,661
Mexico	6,064,997	4,076,048
Cuba	2,399,040	3,650,176
Chile	2,564,125	6,643
Peru	422,602	309,127
Venezuela	176,227	*Nil*
Unrefined, black, blister, etc	31,294,232	22,781,489
Refined, in bars, plates, etc	2,192,706	556,303
Old, etc., for remanufacture	76,008	175,604
Composition metal, copper chief value	8,427	2,323
Lead:		
Ore, contents	3,859,129	2,731,279
Bullion, contents	9,529,400	7,527,446
Imported from (in part):		
Canada	3,210,714	1,791,152
Mexico	10,114,520	7,171,553
Pigs, bars and old	1,663,021	*Nil*
Manganese ore, long tons	58,039	59,47
Imported from (in part):		
Cuba, long tons	17,615	557
Brazil, long tons	33,084	57,590
Br. India, long tons	4,950	*Nil*
Pyrites, long tons	37,697	25,294
Imported from (in part):		
Spain, long tons	34,255	22,074
Canada, long tons	3,442	1,675
Tin ore, long tons	222	534
Tin bars, blocks, pigs, etc	13,035,803	504,903
Imported from (in part):		
Straits Settlements	7,550,189	504,903
Dutch East Indies	1,265,005	*Nil*
United Kingdom	1,131,248	*Nil*
Australia	858,962	*Nil*
Hong Kong	1,418,504	*Nil*
Tungsten ore, long tons	616	314
Zinc:		
Ore, contents	4,907,025	951,896
Imported from:		
Canada	612,000	83 607
Mexico	4,295,025	868,289
Blocks, or pigs, and old	10,463	23,040

EXPORTS OF COPPER, LEAD, AND ZINC

(In pounds)

	April, 1918	April, 1919
Copper:		
Ore, contents	350,186	*Nil*
Concentrates, contents	168,100	*Nil*
Unrefined, black, blister, etc	1,509,016	*Nil*
Refined, in ingots, bars, etc	49,854,754	17,841,731
Exported to (in part):		
France	12,906,783	1,120,000
Italy	8,911,644	*Nil*
United Kingdom	26,744,174	10,531,958
Canada	1,199,517	1,323,314
Composition metal, copper chief value	13,058	90,125
Old and scrap	157,450	118,084
Pipes and tubes	286,345	574,149
Plates and sheets	1,162,607	1,299,224
Wire, except insulated	811,722	3,310,788
Lead:		
Pigs, bars, etc., produced from domestic ore	12,512,185	1,066,919
Pigs, bars, etc., produced from foreign ore	1,882,788	4,252,408
Exported to (in part):		
Denmark	*Nil*	12,355
Canada	2,529,632	1,021,787
United Kingdom	10,303,271	3,345,985
Argentina	168,000	*Nil*
Japan	672,379	*Nil*
Brazil	239,826	*Nil*
Spelter:		
Produced from domestic ore	12,175,585	33,325,002
Produced from foreign ore	3,427,139	2,681,976
Exported to (in part):		
France	7,083,495	9,242,750
Italy	193,668	5,216,118
United Kingdom	5,509,354	18,990,919
Canada	2,190,381	902,574
Mexico	396,320	10,225
In sheets, strips, etc	2,842,090	2,156,184
Zinc:		
Dross	1,621,909	257,760

Economies in a Mine Power Plant*

BY J. A. CARRUTHERS†

Several improvements that it was found practicable to make in mine-power equipment already installed are detailed in the following article, and the suggestions contained therein may be applicable to other plants. Slight changes in grates and bridge walls resulted in higher furnace efficiency; old boiler tubes were rejuvenated, and a considerable saving was thus effected. The installation of dampers secured good fire control; exhaust steam was properly utilized for heating purposes, and other changes that resulted in improved conditions and increased efficiency were made.

THE power plant to be described consisted of 11 return-tubular boilers with a manufacturer's rating of 150 hp. each, and 104 hp. government rating. Considering the former rating and assuming that one boiler was to be closed down for washing, the total available energy was 1500 hp. The power house contained three air compressors and two generator engines, all of the compound-condensing type. The generator engines were operated alternately at 24-hour intervals. The total indicated horsepower of the four units under regular running conditions was from 1425 to 1475. In addition there were two service pumps and four jet condensers to operate. Besides the power plant were several engines used for fans, hoists, shops, coal crusher, car loaders, and like purposes, which totaled about 300 hp. This, added to the power-house load total, made an average of 1750 hp. The air compressor load would often increase 30 to 50% for days at a time, owing to the demand for air in the mines.

Several of the boilers leaked badly at the rear end of the tubes, and examination proved that they had been rolled to a finish. A hard scale inside the tubes extending about a foot from the head was one effect of the leakage. As these same boilers were badly scaled inside on the back head and a portion of the tubes, four of the worst ones were cut out and retubed.

SAVING MADE BY UTILIZING OLD BOILER TUBES

With tubes at war prices, new ones were put in the first boiler only. The old tubes in the meantime were cleaned by means of the home-made contrivance shown in Fig. 1 and then welded up for use in the next boiler cut out. In replacing the tubes, the new ends were put at the back end of the boiler. New tubes at that time cost about $11 each, and there were 70 to each boiler. The cost of welding up the old ones averaged about $3.20 for each tube.

These boilers, in common with most others of the same type, had the grates set scarcely two feet below the boiler shells, and this produced poor furnace conditions for the coal used, and these conditions were made worse by the fact that the bridgewall had been built to conform to the curvature of the boiler shell, and at a distance of from 10 to 12 inches from it. The result was that the gases were deflected against the relatively cool boiler surface before they had much chance to burn.

As a remedy for this poor furnace design, the grates were lowered considerably, as shown in Fig. 2, and the bridge walls were rebuilt flat on the top at a distance of 16 in. from the shell. The combination of the added furnace volume, and the free passageway afforded the burning gases to the back combustion chamber, resulted in a higher furnace efficiency. The increase in temperature was proved by the shorter life of the firebrick; also, the decrease in the amount of coal fired was soon noticeable.

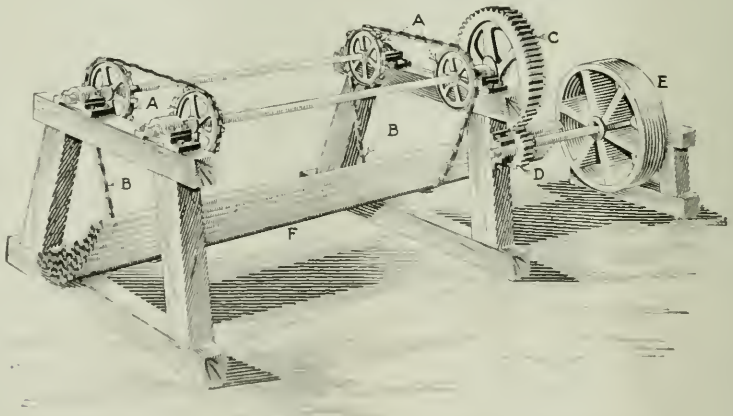


FIG. 1. RIG FOR REMOVING SCALE FROM BOILER TUBES

In lowering the grates, it was decided to replace the cast-iron fire-door arches and deadplates with firebrick. The cost of renewing these castings was between $70 and $80 every five or six months. This price refers to the cost of renewal of the castings per fire door.

The boilers had individual steel stacks, with no damp-

---

*Extracted from *Power*, May 13, 1919.

†Master mechanic Canadian Pacific Railway Mines, Lethbridge, Alberta, Canada.

ers fitted, so that the only draft regulation was by means of the ashpit doors. These were badly warped, and most of them would not close. Besides, this regulation was of no use when cleaning fires. As hand firing was practiced, at cleaning time the cold air rushed through the setting with full draft intensity, causing a considerable drop in temperature. To remedy this, as each boiler was cut out for washing a damper was fitted to the stack and the adjusting rope dropped within convenient reach of the firemen. After these were installed, the firemen were instructed to nearly close them when cleaning fires. The arrangement also gave some control over the fires if one of the large engines happened to shut down unexpectedly, and less coal went through the pop valves in the form of steam. The cost of making and installing the dampers was small.

Steam Header and Top of Boiler Properly Covered

Before the completion of changes in the boiler house a good quality of pipe covering, costing about $300, was put on the 16-in. steam header above the boilers in place of the original covering, which was of poor quality. The covering on top of the boilers was also overhauled and put in good condition by the use of some old plastic covering taken off an old, unused steam line. This class of covering will stand remixing and make a good job. The boiler settings were also gone over and all air holes and cracks in the brickwork were plugged.

One of the largest single losses around the plant was caused by the situation and design of the steam header serving the power-house engines and other equipment. This header included about 125 ft. of 16-in. outside diameter pipe, and 75 ft. of 12-in. pipe. There were also several 6-in. and 8-in. branch pipes leading to the various engines. All this piping was installed outside and directly under the drip from the roof. The large 16-in. flanges had never been covered, and the covering on the pipes was poor. Most of the flanges leaked at the threads, and the condensation, as shown by the leaks, was extremely high, as was to be expected in a place where the temperature is subject to big drops for days at a time. The header, as installed, required 60 to 70% more pipe than if it had been put up inside the power house.

Installation of New Header Facilitated Drainage

As it was impossible to make repairs to the header and at the same time keep the plant in operation, a new header was installed inside the power house. It was constructed of pipe on hand and a few of the fittings from the old installation. Instead of making the new header of 16-in. pipe, which was large enough for three or four power houses of the size served, pipes 12, 10, and 8 in. in diameter were used. This reduced size also facilitated drainage, owing to the increased velocity of the steam. Sufficient lagging to cover the new header was secured from some old unused boilers. This lagging came in slabs 6 x 36 in., but by splitting into 3-in. widths it made first-class pipe covering.

One of the two tandem-compound generator engines was in bad condition owing to the fact that the low-pressure piston and cylinder had worn enough to cause the piston rod to drop about one-eighth of an inch. The engines were of the horizontal type. This condition was remedied by fitting the low-pressure piston with two bronze wearing rings and all four packing boxes with bronze neck bushings. New piston rings were also put on, as the old ones had been passing steam badly. The low-pressure cylinder should have been bored out, to make a first-class job, but at the time the work was being done it was impossible to risk stripping the engine. While the low-pressure piston was being machined for the rings, the engine was run on the high-pressure end only, and carried the load all right. After over two and a half years' operation, the piston rod on this engine had dropped again only 0.008 inch.

The other generator engine had a bent piston rod and badly worn piston rings. These were renewed and the piston was given a one-quarter turn to bring the wear on a new section of the wearing rings.

Between 15,000 and 16,000 ft. of 1-in. pipe had been built into heating coils in the washhouse. The condensation from these coils had been allowed to blow to waste through a hand-regulated valve. Of course the valve was always left open enough to insure draining the coils "in case it happened to get a little colder." To get the benefit of this condensation for feed water, a good steam trap was connected to the outlet header of the coils. A bypass was also included, and in case the trap got out of order during the night, the watchman simply regulated the drainage in the same manner as before. The hot returns were discharged into a tank that fed by gravity into the open feed-water heater; some particulars of the connections to this tank are given subsequently.

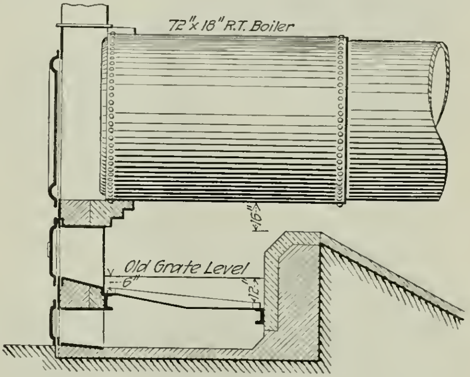


FIG. 2. BOILER SETTING SHOWING OLD AND NEW GRATE LEVEL

The trap used discharged about two gallons per dump, and I have often counted the number of discharges at twice a minute on the coldest days, down to once every four or five minutes on the average days.

With about 600 men washing daily, a large amount of hot water was required, and a considerable amount was wasted. This water had always been heated by live steam in an overhead tank. To make matters worse, the tank was usually permitted to overflow "to make sure that there was plenty of water." To eliminate this waste, the live steam was shut off and the exhaust from one of the boiler feed-water pumps turned in. As one pump was always in operation, there was no chance of the exhaust being shut off for long.

In making the change of piping to this hot-water tank, the queer ideas of some men with regard to simple questions in engineering were forcibly brought home. Someone in former years had put a large steam coil of 2-in. pipe inside the tank, with the drain of the coil piped outside to a trap on the ground below. The trap became frozen one night, and the coil broke at a return bend. After that the coil was allowed to drain into the tank through the break.

Utilization of Exhaust Steam for Heating

A cold machine shop is about the poorest place on earth in which to get any work done. The heating of the shops in this plant had been by means of stoves, but no one seemed to think that the heating really had been effective. To correct this condition, steam coils of old 2-in. pipe were put around the walls to a height of about three feet from the floor. A connection was then made for the exhaust steam from the shop engine to be used during working hours. When the engine was not running, by means of a reducing valve live steam at about 10-lb. pressure was utilized for heating purposes. To prevent any chance of the coils freezing, owing to drain valves being left closed, and also to eliminate any annoyance caused by adjusting the opening of these drains, a hole $\frac{3}{16}$ in. in diameter was drilled through the gate of each valve. In the morning the shop boy shut off the reduced steam, then opened the drain valves wide and turned the exhaust steam into the system. At night he reversed the procedure, and instead of having to set the drain valves to a required opening, he simply shut them. The small holes were sufficient to keep the coils drained with the pressure at 10 lb. Of course, there was a little steam wasted in this way, but simplicity and reliability were the most important factors to be considered.

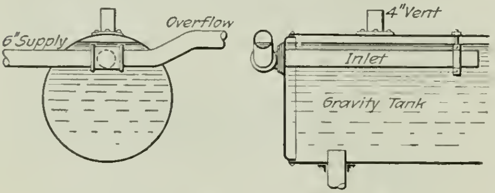


FIG. 3. PIPING TO GRAVITY TANK

Exhaust-steam heating was also put in two of the fan-engine rooms and locomotive sheds. As the fan engines ran 24 hours a day, practically every day in the year, conditions were ideal for exhaust heating. Before the heating coils were installed in the engine rooms, it was difficult to keep the oiling system in operation on cold days.

Change in Jacket-Water Piping Afforded Uniform Water Level to Feed-Water Heater

To provide a uniform head pressure to the water going to the feed-water heater, an overhead tank composed of an old boiler shell had been installed. This was good as far as it went, for every engineer knows how much better a heater float valve works with a uniform pressure than with a varying one. To supply the tank with water, the air-compressor jacket water had been piped to it, and entered at one end and overflowed at the other. As this system would waste the hot returns from the steam traps at the washhouse and the power house, the traps being piped to discharge into the tank, it was decided to change the jacket-water piping in such a way that the tank would not overflow and yet would keep a uniform water level.

It was first intended to use a float valve on a branch pipe from the jacket-water outlet header to supply the tank. However, after considering the natural troubles that accompany the use of most float valves, and trying one such valve, this method was discarded and the simple piping system shown in Fig. 3 was adopted. The solution was so extremely simple that it is surprising that it had not been thought of sooner. The idea may be of use to someone wishing to use all or a portion of the waste water.

Some of the outside steam pipes were leaking badly, and these were overhauled and thoroughly covered in preparation for below-zero weather. One old line about one-third of a mile long consisted of 8-, 6- and 4-in. pipes and apparently all the different fittings that could possibly be connected up. It was jogged up and down and sideways, and had several water pockets that furnished periodic slugs to the engines it served. Several hundred feet of the 4-in. size was laid on the ground alongside of the car track, and had been found very handy to thaw the snow shoveled from the track. This practice and rain had soon ruined the pipe covering.

The 4-in. section was relaid on trestles, properly covered, and given a 1% grade, and was also provided with a steam trap connected at the far end for proper drainage. The other part of the line, which had many fittings and jogs in it, was replaced by a new 6-in. line. Bends were used instead of the three or four slip expansion joints. These joints required frequent repacking, and the process had been the cause of several shut-downs of the fan engines. The water lying in the line seemed to make the life of the packing uncertain, and the result was either bad leaks or a shut-down at the first opportunity.

Quicksilver Ores*

Most quicksilver ores, according to F. L. Ransome, are of rather simple mineral composition. About 25 mercurial minerals are known, but most of these are rare and some of them contain quicksilver only as a minor constituent. Over 95% of the quicksilver produced in the United States comes from the bright cochineal-red sulphide of mercury, known in its natural form as the mineral cinnabar. Pure cinnabar contains 86.2% of quicksilver. Minor sources of quicksilver include metacinnabar, which has the same composition as cinnabar but is dark gray or black, and native quicksilver, which generally occurs in little globules but in some mines fills cavities of considerable size. The cinnabar in quicksilver ores is usually associated with pyrite or marcasite and less generally with the sulphide of antimony, stibnite. The commoner nonmetallic constituents of the ore are quartz, chalcedony, opal, calcite, mixed carbonates of calcium, magnesium, and iron, and barite. Many quicksilver ores contain also small quantities of an oily or asphaltic hydrocarbon, and some carry free sulphur.

No quicksilver ores that are mined on a large scale consist exclusively of pure cinnabar. The richest that are extensively worked are those at Almaden, Spain, where the average yield in 1917 was slightly less than 7%. Probably the lowest tenor in ores that are successfully mined is found on the Pacific Coast of the United States. The average yield of the California ores during the last two years was 0.38 per cent.

"Get what you can, and what you get hold," applies to W. S. S.

---

*An excerpt from *Bull* 666-FF, U. S. Geological Survey.

Placer Operations in Cariboo Area of British Columbia*

By B. R. MAC KAY

HYDRAULIC mining operations are being conducted on Lowhee Creek, Stouts Gulch, and Mosquito Creek in the Cariboo area of British Columbia. The great handicap is scarcity of water. Owing to the altitude of this part of the area, which is over 4000 ft. above sea level, no large drainage basins exist, and the necessary water must be collected from small catchment basins. For this purpose John Hopp has an elaborate system of ditches over 32 miles long, tapping the small drainage basins where possible and fringing the mountains, collecting the run-off water. Even in the most favorable seasons, however, there is not sufficient water available to keep hydraulic mining operations in progress throughout the working season. A number of years ago Mr. Hopp had a plan under way to overcome this obstacle by installing a large pumping station at the north end of Jack of Clubs Lake, the plant to be run by electric power generated by falls on Swamp River. By means of this, water from the lake was to be pumped to the Lowhee ditch for use in the Lowhee mine, and to a reservoir on Island Mountain for use in the mining of the Mosquito Creek deposit. In the Lowhee ditch scheme the water would be practically in a circulating system, being pumped into the ditch and, after being used in the hydraulic operations, returning to the lake. In the Mosquito Creek system the water, after being used in the hydraulicking of the deposit, would drain into Willow River. As the lake has a depth of over 200 ft. in places, sufficient water was available for the undertaking. As with other projects under way, however, with the outbreak of the Great War this scheme had to be abandoned.

LOWHEE CREEK

Lowhee Creek flows northward into Willow River, joining it just east of Jack of Clubs Lake. The pre-glacial channel of this creek has been uncovered for a distance of 4000 ft., along which distance it is narrow, averaging about 300 ft. in width and characterized by nterlocking spurs. The channel bed, having an average width of about 70 ft., is covered by pre-glacial gravels, boulder clay, and later gravels to a depth of 150 feet.

The transverse sections illustrated in the accompanying cut show the configuration of the pre-glacial valley and the approximate extension of the surface prior to hydraulic operations. Section 1 was taken at present workings, 4000 ft. above the lower end of the pit. Section 2 was taken near the company cook-house, 2000 eet above the lower end of the pit. The latter section hows, besides the deep channel, a still older channel bout 30 ft. in width and lying about 60 ft. above it. Remnants of this older channel occur as rock benches t several places along the valley.

Although the pay streaks were found principally in he gravels lying near or on bedrock of the deep chanel and the bench, considerable gold was evidently isseminated throughout the gravels, as old workings how the deposit to have been worked in a series of hree or more levels.

Hydraulic mining of this deposit has been carried on by Mr. Hopp for a number of years, and he has installed one of the most up-to-date plants in operation in the province. Water gathered from Lightning Creek, Jack of Clubs Creek, and several smaller streams is conveyed to the workings by means of 14 miles of ditches, Ella Lake, a depression lying in a tributary valley to that of Jack of Clubs Creek, four miles south of Jack of Clubs Lake, being used as the main storage reservoir. From a penstock on the west side of the channel a 250-ft. head of water is supplied to two monitors having 8-in. and 9-in. nozzles. The main sluice flume, 4 x 6 ft. cross-section, is 3750 ft. long, with a gradient of 4.35%. Throughout its length it is paved with wooden blocks 10 in. in height and 10 in. to 15 in. in diameter, the transverse rows being separated by strips of timber 1 in. in thickness. Along the upper part of the course the main flume is accompanied by a smaller flume 3 x 3 ft. cross-section, into which the water may be diverted and the gravels washed while the clean-up and repaving in the main flume are taking place. Better dumping facilities could not be desired. From the lower end of the sluice boxes to the level of Jack of Clubs Lake, about one mile distant, there is a drop of about 500 ft. in elevation, and the dumpage room is easily sufficient to take care of all the material of the deposit.

LARGE BOULDERS ENCOUNTERED NECESSITATE BLASTING

The great handicaps in the hydraulic mining of this deposit are the excessive length of flume, with its consequent heavy cost of upkeep in paving; the large boulders in the deposit, which require blasting before they can be run through the sluice boxes, and, as already mentioned, the scarcity of water. This latter difficulty has been somewhat overcome by diverting the water caught in the Ground Hog Lake reservoir and the Cariboo gold field ditch, which water is generally used in the hydraulic operations of Stouts Gulch deposits, into the Lowhee drain; but even with this extra supply there is not sufficient water available to keep mining operations continuously in progress throughout the working season.

Over 4000 ft. of the buried channel still remains to be mined, the greater part of which is virgin ground. As the hydraulic operations up to the present in ground previously drifted by the early miners have paid handsomely, and as the gravels exploited at the summit between Lowhee Creek and Stouts Gulch contained high mineral values, rich returns from the intervening unworked section are probable.

STOUTS GULCH

Stouts Gulch is a southward trending tributary valley of Williams Creek Valley, entering the latter a short distance above the town of Barkerville. Unlike Lowhee Gulch, the pre-glacial channel is shallow and much wider, being over 700 ft. in width. The great width of this channel with respect to the length of the gulch, which is a little more than a mile, is exceptional and indicates that the channel is part of some larger drainage system. The channel has been hydraulicked out for the greater part of its length, though untouched parts still remain along the sides. Section 3, taken at the workings about 2600 ft. from the mouth of the stream, shows the deep channel to be about 200 ft. in width and to have been covered by 85 ft. of overburden, of which the lower 30 ft. was gravel and the upper 55 ft. was boulder clay, and, later, gravels. Remnants of a bench about 300 ft. in width, lying 20 to 30 ft. above the deep channel, occur for a distance on the south side of the channel.

---

*Abstracted from Summary Report, 1918, Part B, issued by he Canadian Department of Mines.

GOLD FOUND PRINCIPALLY IN GRAVELS

As in the other deposits, the bulk of the gold was found in the gravels, both in the deep channel and on the bench, concentrated on bedrock, and in the crevices of the schist, which has weathered to a distance of several feet below the surface. Some gold was found, however, concentrated on a false bedding of boulder clay, evidently deposited there by later wash from a tributary valley on the south side.

At the upper end of the pit the bedrock surface slopes off toward Lowhee Creek, indicating that the divide between these two pre-glacial channels has been crossed. It is worthy of note that considerable amounts of gold were recovered from bedrock up over this summit, and down the other slope. The total gold yield from this gulch is estimated at $2,500,000.

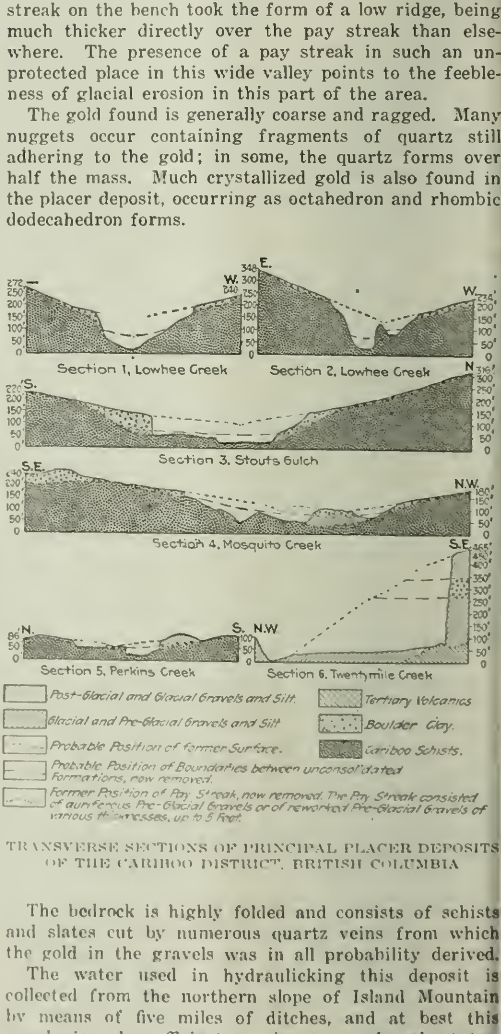
The water used in the hydraulic operations of this deposit is collected from the headwaters of Lightning and Jack of Clubs creeks and from the slopes of the mountains in the neighborhood of the deposit. Twelve miles of ditches are used for collecting and conveying the water to the workings. Ground Hog Lake, a cirque lake at the north base of Mount Agnes, has been converted into an excellent reservoir by the construction of a dam across its outlet. As this reservoir, and the ditch conveying the water to Stouts Gluch deposit, lie several hundred feet above Lowhee ditch, the former crossing Jack of Clubs Creek about 200 ft. higher in elevation than the latter, the water collected in the reservoir and the upper part of the ditch can be carried through the waste gate in the ditch, down Jack of Clubs Creek and into the Lowhee ditch. As already mentioned, during the dry season, when there is insufficient water to work both these deposits, hydraulic work on Stouts Gluch is discontinued and all the water available is used in the Lowhee operations.

MOSQUITO CREEK

Mosquito Creek, which is a little more than a mile in length, rises on the slope of Island Mountain and flows northeastwardly into Willow River. The stream occupies a wide, shallow valley, and throughout the greater part of its course runs on glacial drift. In the lower part of the stream course, where the pre-glacial channel has been exposed for a considerable distance by hydraulic operations, the overburden, consisting of gravel and boulder clay, was found to be from 40 to 100 ft. in thickness. The width of the channel here was about 800 ft. At the present workings (see Section 4) the main pre-glacial channel is joined by two tributary channels. No indication of the position of the main channel or the presence of these tributary channels was supplied by the post-glacial topography, the deposition of outwash gravels and boulder clay being so great as to obliterate entirely the pre-glacial drainage courses.

The gold, which has been largely obtained from the buried channels, occurs in rich patches. The deposits were first mined by drifting, but sufficient gold was left to enable the gravels to be reworked by the hydraulic method. Although the main pay streaks were found in the gravels along the troughs of the buried channels, rich material was obtained from a bench running for a distance of 700 ft. along the east side of the valley and varying in height from 100 to 150 ft. above the bed of the deep channel. The gravel along the pay streak on the bench took the form of a low ridge, being much thicker directly over the pay streak than elsewhere. The presence of a pay streak in such an unprotected place in this wide valley points to the feebleness of glacial erosion in this part of the area.

The gold found is generally coarse and ragged. Many nuggets occur containing fragments of quartz still adhering to the gold; in some, the quartz forms over half the mass. Much crystallized gold is also found in the placer deposit, occurring as octahedron and rhombic dodecahedron forms.


Section 1, Lowhee Creek
Section 2, Lowhee Creek
Section 3. Stouts Gulch
Section 4. Mosquito Creek
Section 5. Perkins Creek
Section 6. Twentymile Creek
E.
W.
N
S.
S.E.
N.W.
N.
S.
Post-Glacial and Glacial Gravels and Silt.
Glacial and Pre-Glacial Gravels and Silt
Probable Position of former Surface.
Probable Position of Boundaries between unconsolidated Formations, now removed.
Former Position of Pay Streak, now removed. The Pay Streak consisted of auriferous Pre-Glacial Gravels or of reworked Pre-Glacial Gravels of various thicknesses, up to 5 Feet.
Tertiary Volcanics
Boulder Clay.
Cariboo Schists.

TRANSVERSE SECTIONS OF PRINCIPAL PLACER DEPOSITS OF THE CARIBOO DISTRICT, BRITISH COLUMBIA

The bedrock is highly folded and consists of schists and slates cut by numerous quartz veins from which the gold in the gravels was in all probability derived.

The water used in hydraulicking this deposit is collected from the northern slope of Island Mountain by means of five miles of ditches, and at best this supply is only sufficient to give a run for about two months. During the dry seasons hydraulic operations are carried on only a few hours a day or abandoned altogether. The exceptional richness of the deposit, however, makes up for the handicap in mining. Over $3,500,000 is said to have been already derived from this deposit.

GROUSE CREEK

Grouse Creek, a stream four miles long, flows northeasterly into Pleasant Valley Creek, entering the latter near its junction with Antler Creek. For over thirty years the Waverley company worked the pre-glacial channel of this stream, having hydraulicked out a pit about 1200 ft. long, 200 ft. wide, and over 100 ft. deep. Recently a company represented by C. W. Moore and J. G. McLaren has taken over the property, and during last season had a number of men employed in Keystone drilling, erecting a sawmill, constructing reservoirs, and doing other preliminary work, with a view to beginning actual mining operations next summer. The intention is to work the untouched ground lying below and above the pit. At the head of the pit, where drilling operations were being conducted, the channel was about 100 ft. in width and lay about 90 ft. below the surface. The sluice flume used in the previous mining operations was found to be about 20 ft. above the bedrock of the main channel, and it is expected that the exploiting of these undisturbed gravels will yield rich returns.

JACK OF CLUBS AND SLOUGH CREEKS

Jack of Clubs Creek rises from the northern slope of Mount Agnes and flows westerly and northerly, emptying into the western end of Jack of Clubs Lake. At present, John McDougall and F. Dewitt Reed are engaged in sinking a 110-ft.-shaft, from the bottom of which they plan driving a 120-ft. tunnel to tap the buried channel.

Slough Creek rises near the western end of Jack of Clubs Lake and flows northwesterly into Willow River. The creek occupies a valley almost half a mile wide, which undoubtedly was the pre-glacial drainage course of Williams and Jack of Clubs creeks. Mining operations carried on a number of years ago under the management of John Hopp showed the pre-glacial channel to lie 285 ft. below the present surface and to be in places almost 600 ft. in width. The valley is filled in with gravel and clay, the clay stratum, which lies about 50 ft. above bedrock, being in places 180 ft. thick. Owing to the excessive flow of underground water, the attempt then made at exploiting these deep deposits proved unsuccessful, but Mr. Hopp is satisfied that the water difficulty will be overcome. No attempt is being made to mine this deep ground at present, the work that is being carried on along the creek being confined to the hydraulicking of bench deposits along the southwestern side of the valley. The banks being worked are almost 100 ft. in height, and a generalized section of the deposit as exposed in the different workings is, in descending order, as follows:

Glacial and post-glacial outwash—beds of sand and gravel dipping northwest, about 40 ft. thick.

Boulder clay and gravel.

Coarse gravels, auriferous.

Slate bedrock intruded in places by tongues of igneous rock.

The gold is largely derived from the lower gravels.

Of the three plants in operation, the Point mine, owned by Loo Gee Wing, Vancouver, and run under the management of Joseph Wendell, is much the largest. An up-to-date hydraulic plant is installed for the working of a bench deposit. A face 500 ft. in extent is being washed by a series of monitors, the material being run through a series of four sluice boxes converging into a single tailrace. In this way the excessive supply of water obtained in the spring through the melting of the snow can be handled, and the work of washing a part of the bank can proceed while the clean-up from another part is being made.

Dragon Creek, a small northeastward-flowing tributary of Willow River, enters the latter about two miles below the junction with the Slough Creek. During the season Leo Muller and Otto Muller were engaged in tunneling along the buried channel of the creek and obtained favorable results. Recently Leo Muller bought out his partner's interest in the claim and is now carrying on the work single handed. Mustang Creek, a small creek less than two miles long, flows eastward into Sugar Creek. John Bell and William Thompson are engaged in preliminary work with a view to beginning actual mining operations as soon as possible.

PERKINS GULCH

Perkins Gulch enters Lightning Creek on the north bank about one mile above Stanley. I. I. Felker and W. S. Sparkes, after several years spent in a systematic search along the lower part of this stream, have finally discovered a rich deposit a little over a half mile from its mouth. The deposit occurs in a pre-glacial channel, lying about 30 ft. above the present bed of Perkins Creek and entering it on the eastern side in a direction almost at right angles to the present course.

The buried channel is wide and flanked on the north side by a terrace over 100 ft. wide lying 30 ft. above it (Section 5.) The sections exposed in both the deep channel and on the bench are about the same, with the exception that no true boulder clay was to be seen on the latter, its place being taken by a thin bed of silt. The sections are as follows:

Character of Formation	Material	Bench	Deep Channel
Recent to Pleistocene deposits..	Silt and clay......	Feet 2	Feet 1775
	Fine gravel with sand lenses....	6	
	Coarse gravel...	8	
			Pay Streak
	Silt.....	2	.
Glacial boulder clay........	....	0	25
Glacial and pre-glacial gravels shingled up stream, auriferous....................	....	6	6
		Pay Streak	Pay Streak
Decomposed bedrock..........	....	1½	2
Fresh bedrock, Cariboo schists, strike north 45° west, dip 42° east.			

Pay streaks of both pre-glacial and post-glacial age occur. Coarse, rugged gold showing little evidence of wear occurs in the pre-glacial gravels, both on the rock bench and in the deep channel. In some places the gold was found to have worked down a distance of 2 ft. in the crevices of the decomposed schist. Another rich pay streak of finer, smoother gold is found in the coarse gravels immediately overlying the boulder clay of the deep channel. Whether this pay streak has been derived by the working over of the bench gravels which occupy the same horizon lying adjacent on the north, or whether it owes its orgin to the restoring of the deep channel deposits further up slope is not as yet fully determined, but the former opinion as to origin is favored.

Mining is being carried on by means of a small hydraulic plant, the necessary water for which is obtained from the drainage basin of Perkins Creek. With the small supply of water available, only a short season's run is possible. During much of the time the washing did not exceed a few hours a day, and this was made possible by collecting the drainage water in the reservoir during the remainder of the time. To overcome this difficulty Felker and Sparkes have procured water rights on Amador Creek and plan building a ditch to convey this water to the workings. As yet only a few hundred feet of the channel and bench have been cleared, but the returns from this have been phenomenally rich, over $5000 being recovered from a bedrock surface 100 by 150 ft. An attempt is being made to tap the old channel about 1100 ft. further up by a tunnel run through rock from the present channel of Perkins Creek, and in this way the time during which hydraulic washing cannot be carried on will be devoted to drift mining.

CHISHOLM CREEK

Chisholm Creek, a small southward-flowing tributary of Lightning Creek, enters the latter at the town of Stanley. Although only a little gold was recovered from the present stream bed, the fact that the neighboring creeks have yielded in varying degrees led the Cariboo-Chisholm Creek Mining Co., under the management of J. A. McPherson, to undertake considerable prospecting in the lower part of the creek in search of an old channel.

By means of Keystone drilling, a buried channel lying about 400 ft. west of the present stream and about 30 ft. higher than its bed was discovered, covered by 180 ft. glacial débris and gravel. The gold contained in the gravels induced the company to drive a tunnel 1300 ft. long from near the present stream channel, a gradient of 5 in. per 100 ft. being given the tunnel for drainage. On completing the tunnel it was found to be about 10 ft. below the bed of the buried channel, and in order to tap this it was necessary to run upraises. The water pressure in the channel, which was found to be great, was relieved gradually by working alternately on the faces of a series of three drifts run from a tunnel paralleling the channel. After draining the channel, a considerable amount of exploiting of the gravel deposit was done, but the excessive width of the stream bed, which at this place exceeded 100 ft., prevented great concentration of mineralization. The channel at this point bears westward at an angle of about 30° with the present course of Chisholm Creek. Owing to the scarcity of labor brought about by the war, development work was discontinued, but will probably be resumed as soon as normal conditions are restored.

COTTONWOOD CANYON

Cottonwood Canyon lies on Fraser River about twelve miles above the town of Quesnel. At the foot of the canyon, about two miles above the mouth of Cottonwood River, banks of gravel and silt rise to several hundred feet above the level of the water. Over a distance of several hundred feet the lower parts of the banks on both sides of the river consist of streaks of clay, sand, "chicken-feed" gravel, and fragments of wood intimately mixed with numerous boulders of foreign origin, the whole deposit being firmly cemented by percolating solutions. Some of the boulders are large and many show polished and striated surfaces, the result of glacial action. The deposit lies on bedrock, which on the east side of the river is about 25 ft. above water level and on the west side a little below the level of the water. As far as known to me, no definite pay streaks occur, but the lower 6 ft. of the deposit contains sufficient gold to attract capital.

For a number of years the deposit on the east side of the river was worked in a small way by D. Killam, the cemented material being allowed to slack on the dump during the winter, and run through the sluice boxes the following summer. Recently an attempt has been made by the Tertiary Mining Co., of Chicago, under the management of D. D. Fraser, to work the deposit on a much larger scale. The cemented gravel is blasted, loaded into cars of 1 cu.yd. capacity, run to the mouth of the mine, hoisted over a trestle to the top of the mill, and dumped into a large hopper leading into a revolving trommel screen, where it is disintegrated. The screen, which is made of $\frac{3}{8}$-in. steel, is perforated with holes 1 in. in diameter and revolves at a rate of 17 r.p.m. The coarse material passes down the revolving barrel and into a chute leading to the dump; the fine material, passing through the screen, is fed into a sluice box fitted with Hungarian riffles, where the gold is caught. The area so far stoped out measures about 100 by 150 by 6 ft.

GOVERNMENT CREEK

Government Creek, a stream about ten miles in length, flows southwesterly into Hixon Creek, a westerly flowing tributary of Frazer River entering about thirty-one miles north of Quesnel. For a number of years considerable prospecting has been carried on along the lower part of this creek by Dougal Cameron, and gravels estimated at about 4,000,000 cu.yd. are said to average 40c. per cu.yd. in gold and platinum.

QUESNEL MINING DIVISION

Although several dredges were operating on different parts of Quesnel River a few years ago, these attempts did not prove financially successful, owing to poor management, and since then no further effort has been made at mining the deposits. Recently, however, S. J. Marsh has procured a strip of dredging ground along the lower part of Marsh Creek, which flows northeastward into Quesnel River about twenty miles from its mouth, and along the main river for a distance of five miles downstream from the junction of this creek. Considerable prospecting by panning and sluicing has been carried on, and gold and platinum are said to have been obtained. Mr. Marsh is endeavoring to raise capital, with a view to installing a drag-line dredging plant to work the deposit.

Twenty-mile Creek, a small stream about seven miles in length, enters Quesnel River on the north side about twelve miles below Quesnel Forks. There the Quesnel Hydraulic Gold Mining and Development Co. is continuing operations under the management of K. C. Laylander.

The deposits being worked on Twentymile Creek consist of a 400-ft. bank on the east side of the stream about one mile above its mouth (Section 6). The upper 90-ft. stratum of this bank is of silt, sand, and gravel. This is underlaid by a 70-ft. bed of boulder clay composed mainly of small quartzite boulders firmly cemented in a brown, clayey matrix. Below this lies a 240-ft. bed of gravel of fluvioglacial origin. Volcanic bedrock, in places capped by a thin layer of yellow clay resulting from pre-glacial decomposition of the rock, is to be seen outcropping in the pit, but so far as observed there were no indications suggesting a confined channel.

The gold, which is mainly fine, is said to occur disseminated through the bank, the main proportion, however, being concentrated in the lower part of the deposit.

The plant of the Quesnel Hydraulic Gold Mining and Developing Co. is considered one of the most up-to-date hydraulic plants in the province of British Columbia.

The plant, including its nineteen miles of ditches, three large, inverted syphons, diverting dam on Swift River, and its many other unique features, is fully described in the annual report of the Minister of Mines, 1911.

An addition to the plant, however, has been made by Mr. Laylander in the installation of a mill for the saving of the black sand concentrate. An undercurrent placed in the lower part of the sluice boxes allows the concentrate to pass into a sump, from which it is raised by means of a hydraulic elevator, a distance of 20 ft. From this it passes over a grizzly, the gravels passing through the grizzly being fed into two Neill jigs, and the remaining coarser gravels passing off to the dump. The concentrate from the jigs is then passed over a 15-ft. by 4½-ft. Overstrom concentrating table, on which the sand is graded and the desired concentration obtained. In this way, about 1500 lb. of black sand concentrate is saved per day. As this concentrate is said to carry appreciable amounts of gold and platinum, this saving is a factor in the value of the deposit.

KEITHLEY CREEK

Keithley Creek, a stream ten miles long, heads on Cariboo Mountain and runs in a southeasterly direction into Cariboo Lake. Along most of its course it occupies a narrow, V-shaped valley, with banks of boulder clay and gravel rising steeply to a height of 200 to 300 ft. In places where the stream has cut through the drift and lowered its channel, either below the pre-glacial bed of the stream or into the rock shoulders which projected into the buried valley, the stream course is characterized by gorges and falls.

Remnants of at least two ancient channels buried beneath a blanket of glacial débris have been noted and traced for great distances along the present course. The drift covering was not sufficient, however, to fill the valley completely, and the stream in cutting out its present channel rarely lies more than 500 ft. distant from the buried channels.

Of these pre-glacial channels one occurs about 120 ft. above the stream, remnants of it being found on one side or the other of the valley. A later channel occurs near the level of the present stream bed, in some places being above the level of the stream and at other places below it. The gravels of this channel were found to be rich, and the stream where it has cut into or through them has been so enriched that certain parts have been worked six times.

At present the only mining carried on in this locality is a high channel deposit lying on the east side of the creek, 130 ft. above the present bed of the stream and one mile above its mouth. Here is situated the Kitchener mine, owned by R. W. Harrison and E. J. Worth. Harrison, assisted by three men, has driven a tunnel 100 ft. through the outer rim rock and has struck a very rich deposit of gravel. Two years ago Harrison and Worth worked another part of the same bench a short distance away, which yielded over $18,000 from 10,000 sq.ft. of bedrock surface; but the bench, averaging 40 ft. in width, on being traced, was found to have been cut away by later erosion, and a considerable sum was expended in determining its continuation.

The gold, which was largely coarse, was found to occur in two pay streaks—one, containing the coarser gold, occurred in gravel lying near bedrock, and in some places the gold was found wedged in the crevices of the quartzite schist to a depth of two feet; the other, a pay streak carrying somewhat finer gold, was found to be on a layer of silt occurring several feet above bedrock. Exceptional quantities were found beneath some of the large boulders lying on bedrock. Where pot holes occurred, gold was found around the rims and in small channels leading from them, but the pot holes themselves did not contain sufficient gold to make it worth while to clean them out.

There is little doubt that many other rich sections of these old channels still remain in this neighborhood undiscovered, so concealed by glacial drift that they were either overlooked altogether or the prospect tunnels run to locate them were too high or too low. If a road was constructed connecting this section with Barkerville or Quesnel Forks, so that a Keystone drill could be brought in, some of these likely areas could be prospected. At present prospecting has to be carried on by the slow, expensive, and unsatisfactory method of shaft sinking. Not only is it impossible to get in drilling machinery to carry on systematic prospecting, but, even where favorable indications are met, it is hard to interest capital in a deposit that is so difficult of access.

HARPERS CAMP

At Harpers Camp the International Dredging and Drainage Co., a Victoria syndicate, is operating on a flat of Horsefly River. The company holds three 250-ft. mining claims and one dredging lease extending for one mile along the river. Part of this ground was worked a number of years ago by R. T. Ward, and is said to have yielded rich returns.

The deposit consists of pre-glacial bench gravels lying on the northeast side of the present channel and buried beneath the covering of boulder clay and recent stream gravels. The gold ranges in size from flour gold to nuggets the size of birdshot. The fine gold occurs disseminated through the pre-glacial gravel bed, but the coarser gold was generally found concentrated either on bedrock or on a false bedding of clay lying about 14 ft. below the surface. Phenomenal quantities are said to have been derived from beneath a large boulder occurring on bedrock. Hydraulic elevators were used by Mr. Ward in mining these deposits, and four of these elevators may be seen almost completely buried in the old pits. The present company is operating a power scraper, which appears to be well suited to a deposit such as this, where the gravels to be worked are shallow, the floor is broad and with a gentle slope, and the bedrock is of soft shale.

The plant consists of a 45-hp. yarding donkey engine with 10 by 12-in. cylinders and a 3-drum hoist which operates a Stanley scraper of 2-yd. capacity. The scraper is 4 by 8 by 2 ft. and is bottomless, the base being supplied with eight 18-in. octagon teeth, 1¼ in. in diameter. The material excavated is held in place by the sides and back of the scraper. The scraper is said to work satisfactorily through a vertical distance of 100 ft. The gin poles, which guide the drag cables, are 30 ft. long and 16 in. in diameter and are generally placed about 600 ft. from the engine and about 300 ft. apart. Owing to the slight gradient of the stream, it was necessary to elevate the sluice boxes about 10 ft. to secure sufficient gradient for sluicing and dumpage room. The scraper is hauled up an incline and over a hopper feeding into the sluice box. The daily capacity of the plant is placed at 500 cu.yd. per eight-hour day. With a haul of 250 ft. or less, 1 cu.yd. per min. can be handled, the scraper making the forward haul in 1¼ min. and the return in three-quarters of a minute. A

DeVille gold-saving machine is used in connection with an undercurrent in the sluice boxes, to save the fine gold.

Owing to the large amount of tailing it was necessary to handle before getting into virgin ground, the returns so far have not been as satisfactory as had been anticipated. It is the intention in the near future to undertake systematic prospecting of this buried bench by Keystone drill, and it is reasonable to look for the discovery of rich deposits similar to the deposit already worked.

BLACK CREEK

Black Creek is a southward-flowing tributary of Horsefly River, joining the latter about fourteen miles east of Harpers Camp. It is a small stream about four miles long. Throughout its course it occupies a V-shaped valley, and descends rapidly through a series of gravel stretches and rock gorges to the main valley of the Horsefly.

The present stream valley through the greater distance lies within the pre-glacial valley, which during Pleistocene time was almost completely filled by sand, gravel, and boulder clay. The pre-glacial valley was narrow and characterized by interlocking rock spurs, indications of which may be seen in the rock shoulders outcropping from beneath the blanket of drift. The stream in cutting its channel through the drift was in places superimposed on these valley spurs, and along these parts of the course it is characterized by deep narrow canyons. Two such canyons occur within 900 ft. of one another in the lower part of the valley. Indications met along the valley suggest that seldom, if anywhere, has the present stream valley been cut below the bed of the pre-glacial channel. Attempts made so far to reach the bottom of the buried channel have proved unsuccessful, owing to the presence of underground water.

Considerable prospecting has been done along the lower part of this creek, with favorable results, the coarse gold recovered being derived from the rock slopes of the buried channel.

During the season of 1918, the Western Mines Exploration Syndicate, of Vancouver, was engaged in drilling operations on the lower part of the valleys, with the object of tracing the channel and testing the gravels. It is expected that further testing will be carried on next year, and if the results warrant an attempt will be made to work this deposit.

Sufficient water collects in the drainage basin of the stream to make hydraulic operations possible on a small scale. Several good dam sites occur about 1½ miles further upstream, where rock shoulders have been found projecting into the valley from the east bank. An excellent site for a dump for the disposal of tailings occurs below the lower gorge. As the gold is generally to be found concentrated on bedrock, it will be necessary to do considerable quarrying to lower the bed of the gorge to that of the pre-glacial valley. The use of this artificial outlet will probably be more satisfactory than locating the mouth of the buried valley and following up the old channel to this point.

CONCLUSIONS

Practically every foot of promising placer ground in the Barkerville area is staked, though, owing to the adverse conditions, no work is at present being done on the majority of the claims. Some of these areas are lying idle because high operating costs have compelled the plants on them to close down, though work will probably be resumed when normal conditions are restored and sufficient capital can be acquired. Owing to the scarcity of water, other claims cannot be worked until the water now being used in hydraulicking of neighboring deposits is available. Still others are temporarily idle, because attempts to exploit the deposit have proved unsuccessful. Many others, however, are being held purely from a speculative standpoint, the holders making no effort whatever to work them, but depending on the development work done on neighboring claims to prove them as to their value, when they will seek to sell at a profit.

As in comparison with the other mining methods employed, the great proportion of the yearly output of this field is derived from hydraulic mining, and as practically all the water in the Barkerville area is already taken, and is being used, the possibility of an increase in this phase of placer mining is slight and is confined largely to the less exploited areas in the vicinity of Cariboo Lake and Horsefly River. Although the former locality is at present practically deserted, an improvement in transportation facilities into the area would stimulate further prospecting along the creeks of this region, and there is reasonable ground to expect discoveries similar to that recently made on Keithly Creek, of other rich deposits that have been overlooked by early miners.

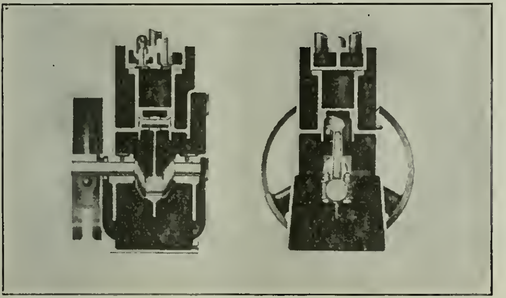
There is, however, a possibility of an increase of the mining of the deep ground along numerous creeks, including Williams Creek, Slough Creek, Big Valley Creek, Lightning Creek, Willow River, Jack of Clubs Creek, Snowshoe Creek, and many others. Considerable careful and systematic prospecting by Keystone drilling has already been undertaken along many of these creeks, and pay streaks have been shown to exist, but the excessive pressure of underground water has made the exploiting of the deposits by drift mining impossible as yet. However, with the improvement in pumping machinery, the operators familiar with the magnitude of the obstacle to be encountered are confident that they will finally master the situation. Much of the ground is suitable for dredging. So far, the main drawback to the employment of dredges is the distance the deposits are from railways and the consequent excessive cost in installing plants. With the completion of the Pacific Great Eastern Ry. to Quesnel, this obstacle will be greatly reduced, though not altogether removed.

If cheap power were available, much of the now idle ground would in all likelihood be worked. The amount of power thus demanded for the running of dredges and of pumps employed in connection with drift mining, and for hydraulic purposes, in addition to that which would be consumed by the present working properties using fuel for power, would be so large as in all probability to warrant the installation of an electric plant. Indeed, this question has already been considered in connection with the two falls on Swamp River, one fall a few miles below the outlet of Isaac Lake having a drop of 75 ft., and the other, short distance below the outlet of Sandy Lake, having a drop of 70 ft., from which good routes are obtainable for a transmission line to Barkerville and neighboring areas. M. Bailey, who has thoroughly examined these undeveloped waterpowers, estimated that the minimum capacity would be about 50,000 hp. Owing, however, to the present adverse conditions, the scarcity of labor, the high cost of supplies, and the distance from the railway, operators are reluctant to enter into any new project requiring a heavy outlay of capital.

Small Air Compressors

At the outbreak of the war a number of small air compressors were required for service where reliability was imperative. The Ingersoll-Rand Co. had just completed tests on the company's Imperial, Type 14 compressor, and had adopted it as the new standard small compressor, and its offer to produce these compressors for immediate use was accepted. The field performance of the machines has proved them to be efficient, reliable, and inexpensive to the operator, and they have now been placed on the general market.

There are four sizes, with capacities ranging from 3 to 45 cu.ft. per min. at pressures to 100 lb. per sq. in. The small compressors can, however, be used for pressure requirements up to 200 lb. per sq. in., the horsepower needed being, of course, slightly increased. They are single-acting machines, of the vertical type, built for belt drive. If driven from a line shaft, tight and loose pulleys are supplied, and if the use of an independent motor is planned the machines are ordinarily furnished as a complete unit, with motor, endless belt, and short-drive attachment, and a hardwood base plate is included with the standard equipment.



SINGLE-ACTING AIR COMPRESSOR

The machines are well balanced, and operate satisfactorily if bolted to any solid flooring, but if permanency of installation is desired the building of a concrete foundation is advocated. The smallest size is built with a ribbed cylinder for air cooling where the service is intermittent and with water-cooled cylinder of the reservoir type for continuous operation. Larger machines are water cooled only, employing the reservoir jacket system, although, in the case of the largest size, a closed jacket for connection to the pressure system is optional. In this particular it is worth noting that the reservoir cylinder design affords unusually ample water capacity and that both cylinder barrel and head are cooled. It is stated that a single filling of the water space is sufficient for a 10-hour run.

In the general design, the Imperial, Type 14 compressor resembles an automobile engine. There is the same drop-forged crankshaft and connecting rod, the die-cast renewable bearings, the automatic splash lubrication system, and general ruggedness and simplicity which have come to be recognized as guarantees of satisfactory service under variable operating conditions.

Breaking Up Concrete

Concrete structures, either plain or reinforced, are usually considered to be of a permanent nature. It is, however, sometimes necessary to remove or destroy such structures, which are often situated inside of buildings and adjacent to valuable machinery; or the mass to be removed may be in close proximity to or inside of buildings.

The customary method of removing old concrete so situated is to drill holes with jumper steel and sledges by hand and then break off the material bit by bit by means of wedges. This is a slow and expensive process. The best, quickest and cheapest method to remove old concrete, brick or masonry is by blasting with explosives. Concrete is easily broken by blasting, and experience has shown that the better the concrete the more easily it can be broken.

It is essential in this class of work that the holes are properly placed—which, however, is true of all blasting—and that light charges of explosives are used. It requires no particular caution or ability to blast old walls of concrete, brick and like material when the structure is in an open place where there is little likelihood of damage to surrounding property. But in instances where the structures to be removed are situated close to and often are a part of valuable property, machinery and buildings, care and judgment must be instructions for the selection of the most suitable explosive and the depth of drill hole are given:

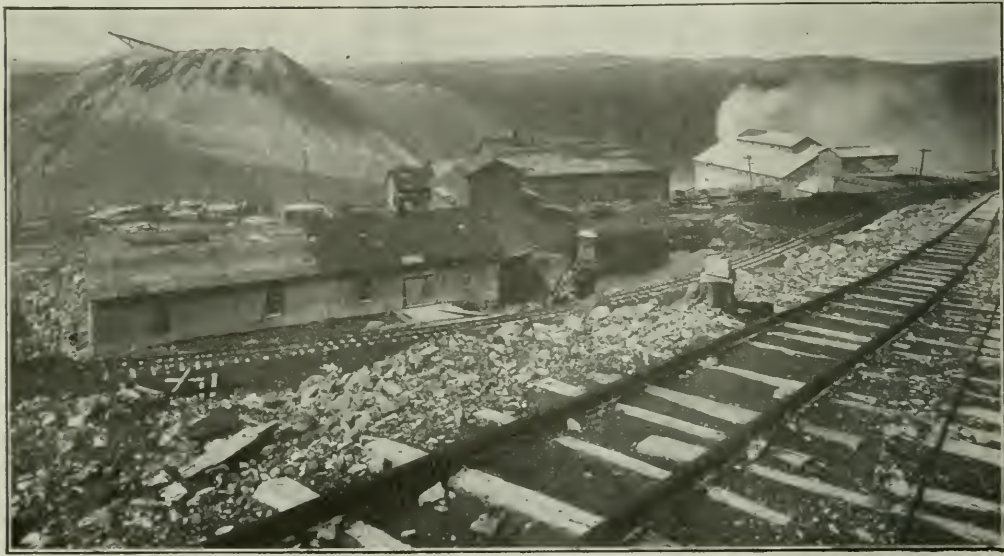
An explosive of relatively slow heaving action, like ammonia 30% to 40% strength, is best adapted for such operations, rather than a quick and shattering explosive. The drilling of holes is best accomplished by the use of self-rotating hammer drills, but when the size of the work does not warrant such equipment, holes can be drilled by hand, using jumper steel or hand drills and sledge. It is best to demolish the structure by gradual steps or benches, a little at a time, especially if situated inside or under a building. Holes are drilled, as a rule, from 1 to 1½ in. in diameter, and in depth depending on the thickness of the material, although 6-ft. holes are about as deep as should be shot in close quarters.

Franklin Mining Co.

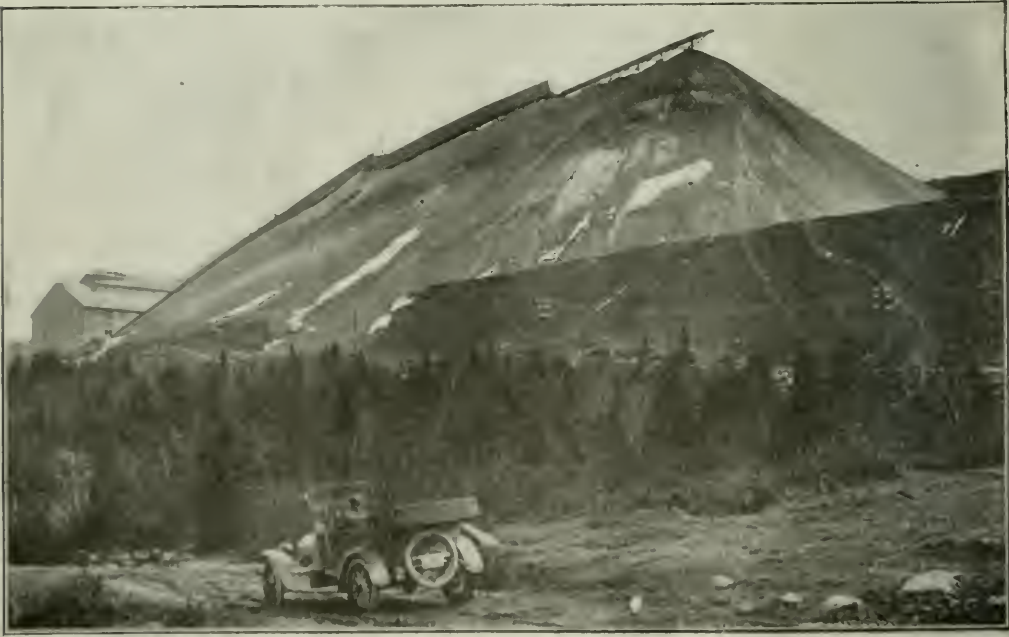
During 1918 the Franklin Mining Co. hoisted 296,182 tons of rock, of which 273,964 tons was stamped and produced 2,827,313 lb. of refined copper. The following development was done: Drifting, 1618 ft.; raising, 121 ft.; sinking 253 ft.; and crosscutting, 157 ft. An electrically driven coal conveyor, operating between the stockpile and the bins at No. 1 boiler house, was built at the mine shops and put into service during the year, and an experimental regrinding plant, consisting of one 8-ft. by 48-in. Hardinge mill, one 75-hp. motor, and six Wilfley tables, was set up in the mill, but this was not placed in operation until 1919.

A total of 2,711,008 lb. of copper was sold at 24.239c. per lb. Other income, including copper on hand, totaled $88,830.33, and these amounts, less $51,270.42 (inventory, Dec. 31, 1917), totaled $697,671.84. Expenses for the year, including mining, smelting, freight, taxes, insurance and miscellaneous, were $806,795.

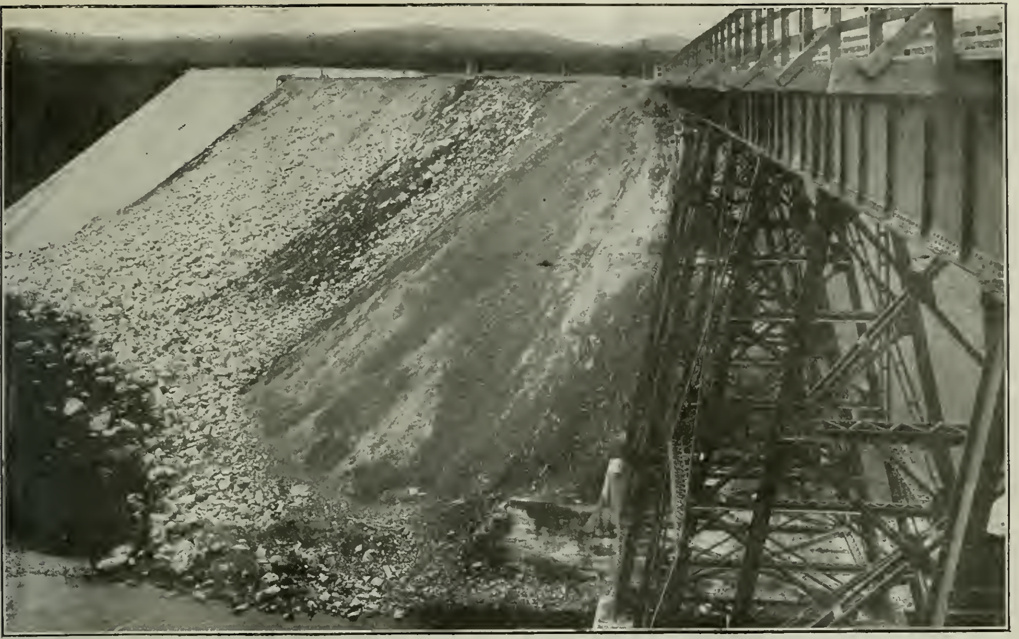
Asbestos Mills in Quebec



VIEW OF ASBESTOS MILL AND WASTE DUMP AT BLACK LAKE, QUEBEC



ASBESTOS DUMP AT BLACK LAKE, SHOWING DISPOSAL OF WASTE BY MEANS OF CONVEYOR BELT



OVERBURDEN AND WASTE DUMP AT THETFORD MINES. DISPOSAL BY CARS

MODERN ASBESTOS MILL AT THETFORD MINES, QUEBEC

The Flotation Decision

ON JUNE 2 the U. S. Supreme Court handed down its decision in the writ of certiorari proceedings instituted by Minerals Separation, Ltd., against the Butte & Superior Mining Co. The opinion of the court was delivered by Justice Clarke and is as follows:

This is a suit by the Minerals Separation, Limited, et al., plaintiffs below and petitioners in this court, against the Butte & Superior Mining Co., defendant below and respondent here, to recover for infringement of United States patent No. 835,120, applied for May 29, 1905, and issued Nov. 6, 1906, the validity of which was sustained by this court in *Minerals Separation, Limited, et al.*, vs. *Hyde*, 242 U. S. 261.

The patent has been so frequently described in court proceedings, that it will suffice to say of it here, in the terms of the specification, that it "relates to improvements in the concentration of ores, the object being to separate metalliferous material, graphite and the like, from gangue, by means of oils, fatty acids, or other substances, which have a preferential affinity for metalliferous matter over gangue."

The patent contains thirteen claims, which, for the purposes of this opinion, may be conveniently grouped, as follows:

(1) Numbers 1, 2, 3, 4 and 12, as "fraction of one per cent. claims," because they call for the use of that amount of oil on the ore; (2) Numbers 5, 6, 7, 8 and 13, as "oleic acid claims," because they are limited to the use of oleic acid in a small fraction of one per cent. on the ore—0.02-0.5 per cent.; (3) Numbers 9, 10 and 11, as "small quantity of oil claims," all three of which were held invalid by the former decision of this court. Only the five "fraction of one per cent. claims" are involved in this case.

The respondent denied the validity of the patent and the claim of infringement.

The lower courts followed the decision by this court and sustained the patent except as to the three "small quantity of oil claims."

The new evidence introduced on the validity issue is meager in amount, and of a character so unsatisfying that we see no reason for modifying our former conclusions.

The chief controversy in the case centers about the claim of infringement based upon the use of oil by the respondent in excess of one per cent. on (of the weight of), the ore, after the decision of the former case by this court.

The evidence shows, and counsel now admit, that prior to the decision by this court in December, 1916, the respondent used in its ore concentration operations, various oils in quantities less than one-half of one per cent. on the ore, but that from Jan. 9, 1917, to the time of trial, with the exception of two or three weeks, it used oils of a composition which we shall discuss later on, in quantities in excess of one per cent. on the ore. In other respects its methods were substantially those of the patent in suit.

On this showing, the District Court found the patent infringed by the respondent, when it used oil in quantities greater than, as well as when it used it in quantities less than, one per cent. on the ore.

The Circuit Court of Appeals held the patent infringed only when the respondent used oil in quantities equal to, or less than, one-half of one per cent. on the ore, and it therefore reversed both of the holdings of the District Court, but allowed recovery for the period when less than one-half of one per cent. of oil on the ore was used.

The Circuit Court of Appeals derived its authority to limit the claims to one-half of one per cent. on the ore from the construction which it placed upon the following clause of the opinion of this court in the former case, viz.:

"The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'"

The reasoning which carried two members of the court to their conclusion was that, as shown by the evidence of the patentees and the argument of their counsel, the amount of oil which is "critical," in the sense of marking the point of transition from the processes of the prior art to the process and discovery of the patent, is one-half of one per cent. of oil on the ore, and that therefore this court, by using the expression quoted, intended to limit the claims, not to a "fraction of one per cent." but to a "fraction of one-half of one per cent on the ore."

The specification of the patent points out that the proportion of mineral which floats in the form of froth varies with different ores and with different oily substances used and that simple preliminary tests are necessary to determine which oily substance will yield the best results with each ore. Of this feature of the patent this court said:

"Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. . . . The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law."

Thus was it plainly held proper for the patentees to claim a reasonable degree of variation—"within the terms of the claims"—in the amount of oil to be used in the application of their discovery in practice, and that the restricting of the amount to a fraction of one per cent. on the ore was reasonable and lawful.

The two expressions "critical proportions" and "amounting to a fraction of one per cent. on the ore" being used, the former derived from the evidence and the latter from the claims of the patent, obviously, to the extent that they differ—if they differ at all—the language of the claims must rule in determining the rights of the patentees.

While in the former case this court was not called upon, and in its opinion did not attempt, to define the scope of the claims, but was considering the patent only from the point of view of the invention and usefulness of the claimed discovery, nevertheless, the language quoted seems to indicate clearly enough that the opinion of the court then was, as it is declared now to be, that as to the claims here involved the patent extends to and covers the use in the process of oils of the patent, in amounts equal to any fraction of one per cent. on the ore. The oleic acid claims are in terms limited to 0.02-0.5 per cent. on the ore. The Circuit Court of Appeals fell into error in the interpretation which it placed upon our opinion and its judgment in this respect is reversed.

Since the case must be retried there remains to be considered the reversal by the Circuit Court of Appeals of the holding by the District Court that the use of oil by the respondent in excess of one per cent. on the ore constituted an infringement of the patent.

As we have said, prior to the former decision by this court, the respondent used in its ore concentration process less than one-half of one per cent. of oil on the ore, and as to such practice infringement is clear, but from Jan. 9, 1917, to the time of the trial, with slight exceptions, it used in excess of one per cent. on the ore, and it is necessary to consider only the operations during this latter period. The oil used during this period was a compound, varying in composition from time to time, but we agree with the District Court in selecting as typical a mixture made up of 18 per cent. pine oil, and the remainder of petroleum products or derivatives—12 per cent. of kerosene oil, and 70 per cent. of fuel oil. Of this compound there was used 30 pounds to the ton of ore, which would be 1.5 per cent. on the ore. As thus stated, without more, it is obvious that the use of such an amount of oil would not infringe the claims of the patent which limit the oil to be used to a fraction of one per cent. on the ore.

But the contention of the petitioners, approved by the District Court, was, and now is, that kerosene and fuel oil were inert and valueless, if not harmful, as used by the respondent in the process and rendered the recovery less than it would have been if the pine oil only had been used; that they were added solely to carry the content of oil beyond the prescribed fraction of one per cent. on the ore, in the hope of technically avoiding infringement; and that essentially in its operations the respondent used the process of the patent with .27 of one per cent. of pine oil on the ore, and therefore infringed it.

The respondent replied that it was not true that kerosene and fuel oil were inert and useless, and asserted that they were oils of the patent, "having a preferential affinity for metalliferous matter"; that the patentees by the claims of their patent had limited their exclusive right to the use, in the process, of any oil or oily substance having such an affinity, but in an amount not greater than a fraction of one per cent. on the ore, and that, therefore, the process of the respondent, in which more than one per cent. of oil on the ore was used, did not infringe the patent.

The entire evidence in the Hyde case was introduced on the trial of this case, and whether the petroleum products or derivatives used by the respondent were oils within the scope of the patent must be determined from the record now before us.

It is admitted that petroleum products are "oils having a preferential affinity for metalliferous matter."

In each of the four claims of the "Complete Specification" of the British patent, filed by the same persons who were patentees of the patent in suit, on June 3, 1905, "petrol" is given as an equivalent of oleic acid in the process. This appears in the statement, repeated in each claim, that the ore and acidified water shall be mixed or agitated with "a small proportion of an oily substance such as oleic acid or petrol, amounting to a fraction of one per cent. on the ore." "Petrol" is the name used in England for gasoline.

The claims of the patent in suit which we are considering call for the use in the process of an "oily liquid," "an oily substance," and in the twelfth claim simply of an "oil." These expressions are said by Professor Chandler, an expert for the petitioners, much relied on in the Hyde case and in this, to include petroleum products.

Higgins, one of the experimenters who discovered the process in suit, and who is much relied upon by the petitioners as an expert witness in both cases, testified as follows in the Hyde case:

Q. Have you since found it possible to use other oils than oleic acid with the result of producing a froth?

A. Yes.

Q. What other oils?

A. I have obtained satisfactory results by the use of petrol and certain proportions of distillate of crude petroleum, such as "Cosmos oil," and he said "Cosmos oil" is a "petroleum distillate."

Chapman, an engineer and a witness for the petitioners in the Hyde case, testified that he had obtained good recoveries in the laboratory and in commercial practice, from the ore of the Braden mine, in Chile, using three pounds of Texas fuel oil to one pound of American wood tar oil per ton of ore. Texas fuel oil is petroleum.

Graninger, an engineer employed by one of the petitioners in installing its flotation plants, testified in this case that in a mine in British Columbia he used a mixture of oil, 75 per cent. of which was derived from petroleum.

There is much more of the same character from witnesses for the petitioners and the evidence of the respondent is strongly to the effect that petroleum products are useful and efficient and have been widely used in the process in laboratory and commercial practice.

Without quoting more from the record before us, we must conclude that when the patent in suit was obtained, and even until the testimony in the Hyde case was closed in 1912, petroleum products were recognized by the petitioners, and that they are still used, as oils, efficient, and useful in the process of the patent in suit. Much of this evidence is especially impressive because the papers from which it is derived were written and the witnesses testified before the question as to petroleum, now made in this case, was raised or discussed.

While we thus conclude that petroleum and petroleum products are oils useful in this process of the patent, it is also clear that they are not as highly efficient as pine oil and several other oils and combinations of oils, which, in the nomenclature of the record are called "frothing oils," and also that better results would probably have been obtained by the use of less than one per cent. on the ore, of pine oil alone, than were obtained by the respondent with that oil in combination with the larger amounts of petroleum products. And this presents the further question necessary to a decision of the case, viz.:

Does the use of a more efficient, in combination with a less efficient, oil of the patent, constitute infringement, where the former is used in an amount within the limits of the claims but the combined amount is in excess of such limit, and when the amount of the more efficient oil used would probably produce better results from the process than are produced with the combination of oils?

To answer this question requires a consideration of the state of the prior art as it was when the discovery of the patent was made, and of the scope of the claims which we are considering.

It is always difficult to recover the realities of a situation long past, such as we have here, but it is especially difficult when the importance of the discovery has led, as in this case, to extensive improvements in mechanical appliances for utilizing the invention and to large additions to the knowledge of the adaptability to the process of various oils, singly and in combination.

We held in the former case that the patentees came late into the field of ore concentration investigation and that their discovery rests upon a prior art so fully developed that it was "clear from the record that approach was being made slowly but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905," and that their final step was not a long one.

Such a patent, in such a field of investigation, must be construed strictly, but candidly and fairly, to give to the patentees the full benefit, but not more, of the disclosure of their discovery which is to become a part of the public stock of knowledge upon the expiration of the patent period, and which was the consideration for the grant to them of a patent monopoly,

With the state of the prior art in mind, we come to consider the nature and extent of the disclosures of the patent in suit, but only with respect to the kinds and quantities of oil which may be used in the process.

The specification recites that the invention of the patent relates to an "improvement" upon prior processes employed in ore concentration "by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue."

Next come the specific disclosures required by the patent law (R. S. 4888), which are intended to describe the advance which the patentees claimed to have made from the prior art Cattermole agglomeration of metalliferous matter into granules, which separate from the gangue, and sink to the bottom of the pulp under treatment, to the discovery of the patent in suit, with its metal bearing froth, rising to the surface of the pulp. Here is the essence of the discovery and it is announced in these terms:

"We have found that if the proportion of oily substance be considerably reduced, say to a fraction of one per cent. on the ore, granulation ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

This is followed by the description of three "factors" on which "this tendency is dependent," viz.: slight acidification, heat, and fine pulverization of the ore, and then the disclosure concludes with the statement that the proportion of mineral which floats in the form of froth varies with different ores and with different oily substances, and that a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired.

The only additional statement contained in the specification, which is in the nature of a disclosure, is found in the description of the example of the application of the invention, in which it is stated that the "froth or scum" derives its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by agitation, such bubbles or air-films adhering only to the mineral particles which are coated with oleic acid.

There remain the claims of the patent, in which the Act of Congress requires that the patentee shall "particularly point out and distinctly claim" "the . . . improvement . . . which he claims as his invention or discovery." And of these this court has said in *Keystone Bridge Co.* vs. *Phoenix Iron Co.*, 95 U. S. 274, 278:

> "But the courts have no right to enlarge a patent beyond the scope of its claim as allowed by the Patent Office. . . . As patents are procured *ex parte*, the public is not bound by them, but the patentees are. And the latter cannot show that their invention is broader than the terms of their claim; or, if broader, they must be held to have surrendered the surplus to the public."

And in *White* vs. *Dunbar*, 119 U. S. 47, 52:

> "The claim is a statutory requirement, prescribed for the very purpose of making the patentee define precisely what his invention is; and it is unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms."

And see *Motion Picture Patents Co.* vs. *Universal Film Co.*, 243 U. S. 502, 510.

Since we are concerned only with the five "fraction of one per cent. claims," and since the question we are discussing relates only to the use of petroleum products, we need consider them only with respect to the amount and character of the oil prescribed, and, as they are substantially identical, we quote the first as typical:

> "The herein described process of concentrating ores which consists in mixing powdered ore with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth, and separating the froth from the remainder by flotation."

The first three claims declare that, so far as oil is concerned, the discovery resides or consists in "adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter, amounting to a fraction of one per cent. on the ore"; the fourth claim differs only in substituting the word "substance" for "liquid" in the first three; and the twelfth claim provides for carrying out the process with "oil in water containing a fraction of one per cent. of oil on the ore."

From this consideration of the terms of the patent as written, it is apparent that it makes no differentiation whatever, either in the claims or in the specification, among the oils having a preferential affinity for metalliferous matter, and that its disclosure, to which the petitioners must be limited, is, that when a fraction of one per cent. on the ore of any such oil is used in the manner prescribed, there will be produced a metal-bearing froth, the result of the process. No notice is given to the public, and it is nowhere "particularly pointed out" in the claims, that some oils or combination of oils, having a preferential affinity for metalliferous matter, are more useful than others in the process, or that some may be used successfully and some not, or that some are "frothing oils," a designation not appearing in the patent, and that some are not. That patentees discovered the described process for producing the result or effect, the metal-bearing froth, but they did not invent that result or froth,—their patent is on the process, it is not and cannot be on the result,—and the scope of their right is limited to the means they have devised and described as constituting the process. *Corning* vs. *Burden*, 15 How. 252, 268; *Le Roy* vs. *Tatham*, 14 How. 156, 175; *Fuller* vs. *Yentzer*, 94 U. S. 288; *Robinson on Patents*, Section 149.

The patent in suit was applied for in this country on May 29, 1905, within a few weeks after the discovery which it embodies was made, and whether, from haste or lack of investigation, from the necessity of meeting the exigencies imposed by the prior art or from a desire to make the claims as comprehensive as possible, this discussion of its terms makes it clear, that the only disclosure as to the kind and amount of oil which the patenteees made to the public as necessary to the practicing of their process is that it must be an oil or oily substance, or oily liquid having a "preferential affinity for metalliferous matter," and that it shall be limited in amount "to a fraction of one per cent. on the ore."

It is argued that the provision of the claims that the mixture prescribed, of oil, water and ore, shall be agitated until the oil-coated mineral matter forms into a froth, serves to differentiate the "frothing oils" from others having the required preferential affinity for metalliferous matter but which, when agitated in the mixtures, may not produce the characteristic froth, if any such there are, and that a proper construction of the patent limits it to such "frothing oils" and renders the use of them in a fraction of one per cent. on the ore an infringement when used with "non-frothing oils" having the required affinity in amounts sufficient to make the combination exceed the quantity limit of the patent.

To give such a construction to the patent would subordinate the clear description contained in it of what are oils of the process, to an implied and vague description and classification which would leave the whole subject again at large, to become a field for further experimentation, without definition in the patent of what oils or froths would satisfy it. So interpreted the patent could not reasonably be said to contain a disclosure of the discovered process in the "full, clear, concise and exact terms" required by law (R. S. 4888) and the claims might conceivably be said to fall short of "particularly pointing out and distinctly claiming" any discovery at all within the meaning of the act of Congress.

Thus when to our former conclusion that the respondent used an efficient oil of the patent, we add the further conclusion, derived from a study of its terms, that the patentees failed to differentiate among the oils described in the patent, we must conclude that it is impossible for the courts to distinguish among them, as more or less efficient in the process, without amending the claims of the patent, and this they are powerless to do.

We are confirmed in the conclusion thus arrived at by the evidence which the patentees in the Hyde case, petitioners in this, introduced to show that their discovered process could not be made operative when more than a fraction of one per cent. of oil on the ore was used, and that the use of a greater amount would not produce the typical froth which results from it,—this without differentiation among the oils described in the patent, save as to their varying adaptability to different ores.

Thus, Ballantyne, a metallurgist and the patent agent who prepared the patent specifications for the petitioners, when called by them as an expert witness, testifies to intimate relations with the patentees and with their investigations before and since the patented discovery was made and says:

> "I have never seen the agitation-froth process successfully carried out by the use of an amount of oil equal to practically one per cent. by weight on the ore, and in my opinion .9999 per cent. of oil would not be a proper quantity (that is to say a suitable and economical quantity), as contemplated by the patent, and would not, therefore, be a suitable fraction of one per cent., as contemplated by the patent."

Liebman, an expert much relied upon by the petitioners, testified:

> "Q. I understand from your answer . . . that you have never in your operations . . . obtained any floating mineral-bearing froth when using an amount of oil, or other selective agents, amounting to more than one per cent. of the weight on the ore. In order that there may be no misunderstanding, will you state whether I have understood you rightly?
>
> "A. That is my recollection."

John Ballot, one of the patentees, testified that he had never seen a froth of the character produced by the patent in suit using a pulp containing more than one per cent. of oil.

There is much more of similar import in the record. This, however, will suffice, adding only the record of a remarkable incident which occurred in this court during the argument of the Hyde case by Mr. Kenyon for the petitioners:

> "Mr. Justice McReynolds: I would like to ask you when in this process of reducing oil your invention came into existence?

"Mr. Kenyon: At about one-half of one per cent. of oil.

"Mr. Justice McReynolds: Before you got to the one-half of one per cent. did you have any invention?

"Mr. Kenyon: We were passing from the region of Cattermole, which was a distant——

"Mr. Justice McReynolds: I want to know when your invention came into existence?

"Mr. Kenyon: This invention was not reached, I should say, from those figures, until about .5, that is one-half of one per cent. of oil was reached.

"Mr. Justice McReynolds: At one per cent. you had no invention?

"Mr. Kenyon: No.

"Mr. Justice McReynolds: At one-half of one per cent. you did have invention?

"Mr. Kenyon: It began to come. Remote, but it began to come. At .3 of one per cent. the float vastly increased. At .1 of one per cent. the float again vastly increased.

"Mr. Justice McReynolds: When this float has more than one-half of one per cent. of oil it does not infringe?

"Mr. Kenyon: It does not infringe.

"Mr. Justice Pitney: What have you to say in answer to what Mr. Scott said the other day to the effect that 1.8 per cent., or perhaps more, of oil, would give the same result with increased agitation?

"Mr. Williams: Absolutely no.

"Mr. Kenyon: It would not."

While parties should not be held rigidly to statements made by their counsel in the stress of argument, even when replying to questions from members of the court, nevertheless these statements from leading counsel in charge of the Hyde case and of this case, are impressive and significant.

This and much more of like character in the record brings us unhesitatingly to the conclusion that the scope we have given to the patent, based upon an interpretation of the language of the claims, is justified also by the evidence in the case and that it is, in fact, that which the petitioners and their counsel, until very recently, placed upon it in full confidence, that the essence of the discovery lay to such an extent in the use of a small amount of oil, such as is described in the patent, that the result could not be obtained with more than a fraction of one per cent. on the ore.

It must be added that the evidence is far from satisfying that the results of the respondent's process was, in fact, that peculiarly superior quality of metal-bearing froth characteristic of the patented process when worked with a fraction of one per cent. on the ore. The evidence, otherwise doubtful on the point, is rendered especially so by the testimony introduced by the petitioners, and not contradicted, that a computation on the basis of the tonnage of ore treated by the respondent shows that if the process as practiced by it after Jan. 9, 1917, had been used through the year it would have involved a loss of over a million dollars in increased cost of oil and in diminished recoveries, as compared with what the results of operation would have been for the same time using the process of the patent as practiced by the petitioners. It is difficult to see how a process so wasteful and inefficient as that of the respondent is thus proved to be can be other than substantially different from that of the petitioners.

It is vaguely suggested in the testimony for the petitioners that there was some peculiarity in the composition of the ore of the respondent, or in the treatment of it, which resulted in the presence of "clayey gangue slimes" which absorbed an unusual quantity of oil and that this contributed to render it possible to produce the results of the patented process when more than the prescribed fraction of one per cent. of oil on the ore was used.

It is hard to see how this, if true, would be of value to the petitioners, but the evidence is quite too indefinite in character and meager in extent to be accepted as the basis for the judicial determination of such a claim.

The respondent contends that the disclaimer filed by the petitioners with respect to the three claims held invalid by the decision of this court in the former case, was so delayed and is so evasive in form that it is invalid and that, for this reason, the petitioners should not be permitted to further prosecute this suit, under the provisions of R. S. 4917, 4922.

The decision holding the three claims invalid was rendered on Dec. 11, 1916, and the disclaimer was recorded on the 28th day of March, 1917. Having regard to the fact that the owners of the patent in suit resided in a foreign country, and to the war-time conditions of communication then prevailing, the entry required by law was not "unreasonably neglected or delayed." While the wording of the disclaimer borders on finesse, we do not think it can be interpreted as giving any rights under the patent greater than may be legitimately obtained under the claims held valid, and we therefore deem it sufficient to meet the requirements of the statutes cited.

It results that the decree of the Circuit Court of Appeals that the respondent infringed the patent only when using one-half of one per cent. or less of oil on the ore must be reversed, but that its implied holding that the use made by respondent of petroleum products and pine oil in excess of one per cent. on the ore did not constitute infringement must be sustained. The cause is remanded to the District Court for further proceedings in conformity with this opinion.

Promotion of Friendly Relations With The New Nations of Europe

A Letter to Mine Managers and Superintendents

I am wondering whether we cannot enlist the assistance of many of our mine managers in informing the foreign-born Americans in their employ that Mr. Hoover, as Director-General of the American Relief Administration, has made it possible for individuals in this country to transmit funds to their relatives in Finland, Poland, Czecho-Slovakia, German-Austria, Jugo-Slavia (including Serbia), Rumania, and Turkey. In securing this exclusive privilege from the Federal Reserve Board, the Government has been chiefly interested in reëstablishing banking connections between the newly liberated countries and America. It is the first concrete move to put these people on their feet.

As I look upon the intervention of our Government in Europe, it can be divided into four distinct stages: First, armed intervention; second, suggestion of peace terms; third, supply of relief to the liberated countries; fourth, reëstablishing of commerce between the liberated nations and the outside world.

Each successive stage represents the natural advance beyond the preceding stage, and all constitute a logical sequence of overlapping steps. For instance, armed intervention against Germany, even if successful from a military point of view, would not of itself have attained our full purposes in entering the war. Having effected the isolation of Germany, we had to endeavor to secure a satisfactory arrangement as to geographical division of territory. With this in the way of accomplishment we could not abandon the new countries thus established without making some effort to supply them with food.

Having drawn upon our stocks of food in America and placed these supplies at the disposal of the liberated countries in order to meet their requirements until their own harvest became available, we shall not have fulfilled our full obligations unless we make some effort to reëstablish commerce. Commerce is fundamentally dependent upon definite financial relations between countries which hope to do business with each other.

The development of the fourth stage of American intervention, therefore, has its beginning in the scheme that has been worked out by Hoover by which the banks in America are offered immediate contact with the banks in the liberated countries through the medium of the American Relief Administration. Beginning on Apr. 22 this new arrangement afforded foreign-born Americans the opportunity to forward individual money gifts or payment of money to firms, individuals, institutions, or relatives at home. It was expanded in May so that drafts could be purchased on home banks and travelers could leave America with the satisfaction of knowing that their dollars here had a definite value in the currency of their own home country.

It is obvious that it would have been impossible, in the early stages after the armistice, to set up any such banking relations without the intervention of the Government, and this was made possible by the relief work of the American Relief Administration in Europe. But this is merely a stepping stone to permanent commercial arrangements, and the foreigners in America are asked to support this exchange system now, as it represents the definite beginning of financial connections between this country and the liberated nations. Though it is chiefly represented at the present moment in the transactions of food, it will gradually be transformed into transactions covering other commodities and lead to definite trade relations. The law forbids sending money by any other medium, and no one of foreign birth can justify using any other means for sending money to his relatives, as the support given by him to the American Relief Administration in this work is indirect support of his own government as well as that of the United States in its effort to complete the fourth and final step of its intervention in Europe.

The following rates are in effect beginning June 1 until further notice:

Finland, 9.65 finmarks per dollar.
Poland, 14¾ Polish marks per dollar.
Germany, 12.65 marks per dollar.
Austria, 24 kronen per dollar.
Czecho-Slovakia, 15½ kronen per dollar.
Jugo-Slavia, 23 kronen per dollar.
Rumania, 9.35 lei per dollar.

EDGAR RICKARD,
Joint Director.

American Relief Administration, 42 Broadway,
New York. June 5, 1919.

[In order to promote this commendable enterprise, the *Engineering and Mining Journal* has donated a page advertisement on this subject, which appears in this issue. This has been put in a form so that mining and metallurgical managers may cut it out and post it on their bulletin boards for the general information of their employees, and we urge them to do that. Also, we urge readers associated with companies employing foreigners to cut out the page from their copies of the paper and hand it to their managers, so that an ample supply of these notices may be available at each mine and works.—EDITOR.]

Relaxation of British Embargoes

The *Board of Trade Journal* of May 22, according to *Commerce Reports*, announces certain relaxations of the export restrictions, transferring the following articles to List C, which covers articles that may be exported freely to the United States and certain other countries: Copper and alloys of copper, copper ore, regulus, matte, concentrate, and precipitate, men's woolen gloves, iron pyrites, and barium sulphate. The following articles have also been placed in List C by reason of change of headings: Silver bullion, specie, and coin, other than British coin.

Canada Mining Corporation's Efforts To Secure New Properties

The annual report of the Mining Corporation of Canada, Ltd., states that efforts were continued in 1918 to secure a suitable property for exploitation, but, though many investigations were conducted, some of which disclosed distinct merit, only one prospect has been acquired.

Canada and United States—In these two countries, 160 proposals were considered by the corporation management, against 90 in 1917, and a large number of these were examined by the company's engineers. In the Cobalt district, four properties were examined, and extensive work was done on three of them. All were rejected, however, as no orebodies were proved. At North Cobalt a property is now being actively prospected, though nothing of value has as yet been found.

In the Casey district, the corporation, working under option, is developing the Nels Nelson and other claims, where, in 1914, a shaft was sunk on a vein to a depth of 40 ft., but has since lain idle. This shaft, known as No. 5, has been equipped with headframe, hoist, and pumps, and the necessary buildings. It is to be sunk to the Keewatin contact, which several diamond-drill holes have shown to lie, in this neighborhood, at an approximate depth of 350 ft. Crosscut will be driven from this shaft, both at the 220-ft. level and from a level near the contact, northeasterly and southerly, closely following the plan suggested in 1914, of which details were at that time issued to the shareholders of the Casey Cobalt Silver Mining Co. This shaft, at the close of 1918, had reached a depth of 280 feet.

Of the other prospects in northern Ontario, the Rickard property, on preliminary examination, showed rich gold ore near the surface, but after a campaign of drilling and underground work, occupying over six months, discouraging results forced its abandonment. Near Madoc, in eastern Ontario, a vein of fluorspar was examined and finally acquired. A separate company controlled by the corporation was formed for its exploitation. A plant has been installed and a power line built to the property by the Ontario Hydro-Electric Commission. Development work has reached a depth of 200 ft. and a body of ore of good quality has been partly exposed. Shipments of this ore have been made to several buyers under contract, and are expected to be resumed soon. Depending on the future market condition, and on the results of further development of the orebody, the venture seems promising.

In British Columbia, and at other places in western Canada, several properties, examined or considered, were all decided to be unsuitable for acquisition, and the options were relinquished.

During a visit to Alaska, to examine the Engineer gold mines, C. E. Watson and his assistant, Mr. Randolph, as well as one of the chief owners of the property, lost their lives under most distressing circumstances, in the sinking of the steamer "Princess Sophia." No report on the examination was received and no further action has, under the circumstances, been taken.

Russia—Since the delivery of practically the whole of Siberia from the hands of the Bolshevik element, and the establishment of comparative order under the new Omsk government, which is being supported and has received quasi-acknowledgment by the foreign powers, communication by post and telegraph has been reëstablished with the corporation's gold mine at Chebakee, in the Yenesei district, and the caretaker reports the property and buildings are undamaged. Acting on the advice of the British representative, the taxes were paid to the competent mining authorities, through the Bank at Tomsk, in October, and acknowledgment was received.

Examinations of Coal Properties

An examination of one of the largest coal fields in the Far East was made in the autumn of 1917 by Ross B. Hoffman, on behalf of the corporation. Mr. Hoffman was assisted by R. Smith, and, on advice of these two engineers, an application for a concession of the coal field was made to the Kerensky government, through the British consulate, and strongly supported by the chief Russian government officials of the Primorsk Province. Unfortunately, the fall of the government and the resulting disorganization of the country interfered with immediate progress of the negotiation, but a representative of the corporation was sent to the coal field in the autumn of 1917 and remained there, engaged in sampling, during the winter of 1918. The results of analyses of these samples, which were a representative series, indicated that the coals were of the high class reported, and in many instances better than any other in the Far Eastern market. This appears to be particularly the case with the coking varieties, of which a scarcity exists in Japan and China.

Negotiations have been continuously carried on since the establishment of the Omsk government, which has now declared itself anxious to assist the successful development of the fields by the corporation. In addition to the application for the government areas, private negotiation with owners of other portions of the coal field has resulted in the agreement of these parties to coöperate, and the discussion of terms is now in progress. In order to take advantage of the high local prices now obtaining, these owners are preparing to ship coal during the coming season, but on a comparatively small scale, as the full development of the field depends on the establishment of proper shipping facilities. This region in the past has produced, by petty efforts of small individual owners, without proper mining facilities, an amount estimated to be upward of 1,000,000 tons. Mr. Polevoi, a well-known Russian coal geologist, who has spent many years in mapping the field for the Russian government, estimates a quantity of marketable coal in excess of 500,000,000 tons, above the 700-ft. level.

On account of the quality of the coals, their position at tidewater and the presence of excellent and cheap Chinese labor, it is believed that a large and good market is assured, but the question of the method of development and the study of the best means of arranging for shipping facilities will require careful investigation, for which considerable time is necessary. In the event of proceeding with the development of this field, a large amount of capital will be required for development and exploitation.

Favorably situated on the coast, not far from the coal field, a lead-zinc-silver mine, formerly in control of Germans, has been working, without proper mining equipment, for ten years or more. At the outbreak of the Great War, it had an annual output of about 60,000 tons, but, because of the absence of a smeltery, it was under the necessity of shipping the ore, at heavy cost, to Europe, and, after the outbreak of the war, to Japan. This property is also under negotiation by the Mining Corporation. It has been examined by several well-known mining engineers, and, in a preliminary way, by Mr. Hoffman on behalf of the corporation, who recommended further work being undertaken. The ore developed is variously estimated at from 200,000 tons to 350,000 tons, but it is believed that a much larger tonnage of good quality exists below. Further work by drilling or adits is necessary to prove this, and, to operate economically, the installation of an up-to-date mining and smelting plant will be required. Until recently, causes somewhat similar to those already described have interfered with negotiations, but discussion of terms has now been resumed. Continued negotiations for options on both the coal and the lead-zinc-silver properties is recommended.

In northern Siberia, also on the Eastern coast, an interesting alluvial property was the subject of prolonged negotiation during the last year, but litigation in the early winter interfered with the consummation of business. It is hoped that satisfactory terms may be arranged later, when the settlement of the suit between the owners is concluded.

Properties in China and Mexico

China—A number of proposals were investigated in this country, and a large and interesting enterprise is recommended for consideration. At the beginning of 1918, a favorable option agreement was concluded in northern Manchuria for a large alluvial gold property, which had been examined in a preliminary manner by Mr. Hoffman, and reported to be worthy of a thorough investigation. A party was sent to the property last winter, and carried on intensive work by drilling and other methods, until September, 1918, when it was finally decided to relinquish the option. The abandonment of this property was a great disappointment, as its large area, the almost perfect physical conditions for successful dredging, and its favorable situation regarding transport would have made it a most suitable field for development by the corporation had the gold content been a little higher. Situated in more favorable regions, like the Sacramento Valley, with cheap power and a better climate, it would doubtless have been profitable to operate, but under the existing conditions it was decided to give up the option.

Mexico—Several properties have been presented in this country, but at present conditions there are such as to make it inadvisable to risk investment, unless the corporation is prepared to lock up capital for an indefinite period.

General—A large sum has been expended on the search for properties in many parts of the world, and of the many hundreds examined and considered, presuming that adequate terms for options can be arranged, a number are recommended for further examination.

In these days of keen competition for investment in mines by strong groups, it is the rarest chance that a property is acquired merely on a preliminary examination, and the expenditure of considerable sums is generally necessary for the purpose of definitely proving that the risk is warranted. It is suggested that instead of indefinitely continuing search, a choice be made from those recommended properties, and one or more selected for a thorough examination.

Investigation of Petroleum in Mexico

Official notice has been received from the Italian Secretary of Industry, Commerce, and Labor, according to Charles H. Cunningham, Vice-Consul of Mexico City, in *Commerce Reports*, that within a short time an official commission will arrive in Mexico from Italy to study the petroleum laws of Mexico. It is understood that other countries will also send delegates, and among the latter is Russia, whose government recently communicated its intentions in that particular through its consul. The Russian government is obtaining all the data possible relative to the production of petroleum in Mexico, as well as the government policy of exploiting same, with the object of improving the methods used in that country, which is considered to be one of the most important petroleum-producing countries in the world today.

The various European commissions were expected about June 1, reports having reached Mexico City that some of the specialists comprising them are already on their way to Mexico. It is understood that they will first come to Mexico City for consultation with certain high officials of the government, after which they will visit Tampico and the other oil-producing sections of the republic.

It is also officially reported that two American prospectors have solicited permission from the government to make explorations in the northern part of the State of Chihuahua, where they believe there are large deposits of petroleum. They base their belief on the grounds that important oil deposits lie immediately across the river Bravo in the State of Texas, from which a considerable yield has been obtained. These deposits are in the same geological zone. Permission to explore the federal districts of Casas Grandes, Guzman, Trinidad, and Santa Maria has been requested by these prospectors. The government has their petition under consideration.

Coördination of National Employment

At a conference on employment called by the Secretary of Labor and held at Washington, Apr. 23, 24, and 25, the delegates, representing the governors of states and the U. S. Employment Service of the Department of Labor, unanimously adopted the following expression of principles and purpose in regard to a bill to provide for a national employment system:

In the outline it is provided that the U. S. Employment Service shall be continued as a permanent bureau in the Department of Labor, for the purpose of promoting the establishment and maintenance of public employment offices for men, women, and juniors. Provisions are to be made for the management and business administration of this service. The bureau is to establish and maintain a system of employment offices where such service is not already in existence and is to coordinate various other employment offices. Expenses are to be met by regular appropriations, which, after the deduction of the general maintenance office expense, are to be allotted to the various states on the basis of their population. In the event that certain states have already provided appropriations for the maintenance of public employment service bureaus, these amounts will be supplemented by an equivalent appropriation from the Government up to a sum allotted in accordance with that paid on a population basis.

Civil Service Positions Open

The U. S. Civil Service Commission announces open competitive examinations for the following positions: At the Naval Ordnance Plant, Charleston, West Va., superintendent of heat treatment, July 1, $5000 a year: production engineer, July 1, $9.28 a day; assistant designing engineer, July 8, $9.20 a day. There are also the following vacancies in the Ordnance Office, and in the Ordnance Department at Large, War Department: Catalytical chemist, $3000 to $4000 a year; assistant catalytical chemist, $2000 to $3000 a year; junior catalytical chemist, $1600 to $2000 a year.

Competitors will not be required to report for examination, but will be rated on various subjects covering principally education, experience, and fitness. These examinations are open to all male citizens of the United States who meet the requirements.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the U. S. Civil Service Board, Custom House, Boston, Mass.; New York, N. Y.; New Orleans, La.; Honolulu, Hawaii; Post Office, Philadelphia, Penn.; Atlanta, Ga.; Cincinnati, Ohio; Chicago, Ill.; St. Paul, Minn.; Seattle, Wash.; San Francisco, Calif.; Old Custom House, St. Louis, Mo.; Administration Building, Balboa Heights, Canal Zone; or to the Chairman of the Porto Rican Civil Service Commission, San Juan, Porto Rico.

Chemical Warfare Service Men Desire Reëmployment

For more than six months the Chemical Warfare Service has been endeavoring to find situations for its chemists as they were discharged from the service, provided they had no places of their own to which to go, according to a communication from Maj. Frederick M. Crossett, C.W.S. Most of the men are college graduates or had partly completed their college course at the time of entering the service, and many of them had engineering and mining experience. They are now seeking reëmployment in those lines.

Employers can reach these men by addressing the Director of Chemical Warfare Service, Washington, D. C. This situation presents an opportunity to employers to make a selection from picked men, graduates of the best technical schools, who have had the benefit of military training and experience.

May Pig-Iron Production

Pig-iron production during May was 2,108,056 gross tons, or an average of 68,002 tons a day, as compared with 82,607 tons daily in April, 99,685 tons a day in March, and 111,175 tons a day in May, 1918, according to *Iron Age*. This is the lowest daily average since March, 1915, when 66,575 tons was made per day. There were only 195 furnaces in blast June 1, 29 having been blown out during May and 12 blown in. Six stacks operating on ferro-alloys produced 14,604 gross tons, of which 11,157 tons was ferromanganese. On June 1 the estimated capacity of the 195 active furnaces was 68,100 gross tons, as compared with 212 furnaces in blast on May 1, with an estimated capacity of 75,860 gross tons.

Ore Dressing and Metallurgy

Operators who have used sand beds for the purpose of clarifying water notice that, under certain conditions, a gradual blackening of the filter medium occurs. In the following note it is suggested that this is due to manganese and iron.

The charging of precipitate into a tilting furnace designed so that the flame or heated air causes currents around the top of the crucible results in dusting losses and other disadvantages. An ingenious modification of normal practice is described, by means of which a saving of time and fuel is effected and the life of the crucible is lengthened. A further advantage that accrued in the instance in question was that it became practicable to allow two bars of bullion to accumulate in the furnace.

Graphite is a substance which responds to "skin-flotation" practice. In such cases no oil is necessary. A description of a typical method follows and a flow sheet is given which indicates the various operating phases in the treatment of graphite ore.

Blackening of Sand in Filters*

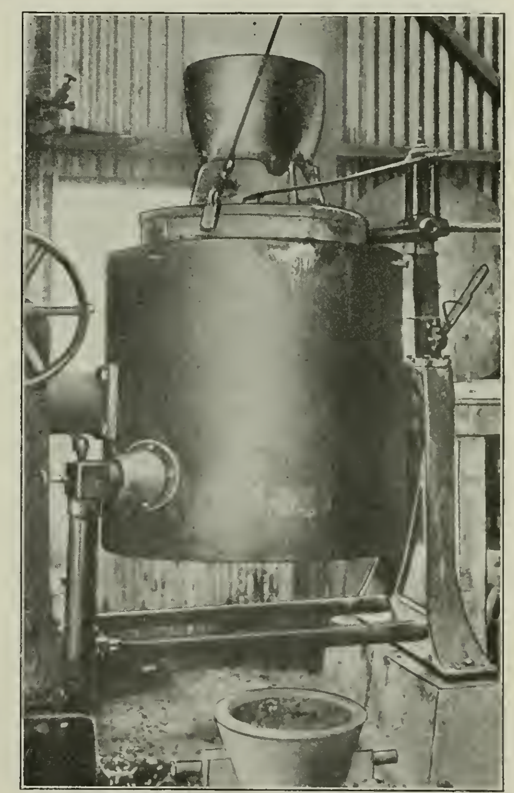
Filter-plant operators have often noted a gradual darkening of the sands in many of the plants. At first no thought was given to the phenomenon other than the fact that the beds were not clean at the time of observation, but it was found impossible to wash the sand back to its original color. Samples were submitted to the laboratory, and analyses made which showed that the dark color was due to manganese and iron. The darker the deposit, the higher the percentage of manganese.

At Osawatomie there was a striking change in the color of the sand. In a few weeks the color changed from a natural light yellow to coal black. Careful study of the basin and influent lines showed a growth of bryozoa or pipe moss. When these organisms died, the deposit of their sheaths showed a very high percentage of manganese. An analogy was drawn between this phenomenon and the fact that the muck lands of Florida, Hawaii, and other places carry an extremely high percentage of manganese, and it seemed plausible to assume that the same principles of decomposition and deposition would be maintained in a filter bed that was allowed to become foul.

Device for Charging Precipitate

At the beginning of the war nearly all the precipitate from the silver mills of Nevada was melted down in graphite crucibles in furnaces of the Faber du Faur, Steel-Harvey, or Case type. The cost of the No. 3 or No. 275 crucibles was about $12 each, f.o.b. factory; and with an output of 25,000 to 30,000 oz. of bullion per crucible, the expense for crucibles was merely nominal. Under war conditions the price of crucibles trebled, the quality decreased, and they were difficult to obtain. These adverse conditions hastened the installation of the more economical Rockwell furnaces, which used a mixture of water glass and carborundum as a lining of the reverberatory chamber.

On account of the cost of the Rockwell furnace and of the briqueting machine necessary to make it an economical installation, many of the small mills could not profitably make the change, and every effort was made to improve the practice with the old furnaces and to extend the life of the crucibles. To speed up melting, coke-fired Faber du Faurs were changed to oil-burning furnaces. To extend the life of the crucibles, the exteriors were painted with Johns-Manville "brickline"[1] to



TILTING FURNACE WITH CHARGING DEVICE

---

*Abstracted from a paper, by J. E. Welker and C. C. Young, read before the American Water Works Association and published in the *Canadian Engineer*.

[1] "Brickline" is a high-temperature cement mixed with water and applied with a brush.—EDITOR.

prevent the gradual oxidation of the graphite content of the crucible walls. Previously the discarded crucibles would show only a porous fire-clay exterior for a depth of ½ in. around the fire line. With the use of "brickline," the graphite remained intact, under the thin protecting skin. This gave ⅛ in. more life to the crucible around the slag line.

To retard the unavoidably faster corrosion of the crucible on the slag line on the No. 3 crucibles in the Faber du Faur furnaces, these crucibles were turned in the furnace with special tongs, after a few bars had been poured from one position of the crucible. In the furnaces using the No. 275 crucible, false lips were built on the opposite side to allow the crucible to be poured from an opposite side, to avoid a hole on the slag line. Patches over holes in the crucibles were made, but not with much success.

In the open-end type of crucible furnace, like the Steel-Harvey or Case, the oil flame plays around the top of the crucible, causing a draft with more or less chance of dusting. Charging the crucibles, even with all flame cut off, causes dusting, probably mostly from the sudden decomposition of the carbonate of soda on striking the hot slag. If a crucible is charged to the top with precipitate and flux, it is not sufficient to give an 1800-oz. bar and must be recharged. This gives a dusting loss and a sudden chilling of the furnace. A No. 275 crucible will easily hold two or more bars of bullion, but the charging space is correspondingly reduced. To overcome these difficulties and to speed up the melting, Frank Hobbins, superintendent of the Nevada Packard mill, devised the method of charging shown in the illustration.

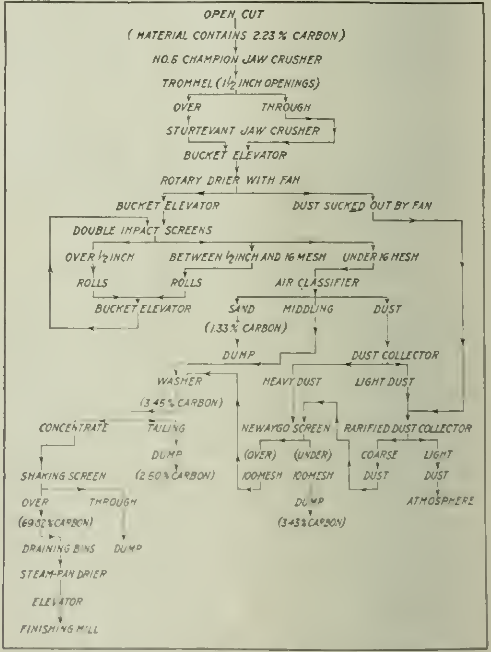
The furnace is a Case No. 275; the lid being of horizontal circular fireclay brick with a center charging hole. It is iron bound and connected to a post on the furnace with a lifting lever arrangement, allowing it to be raised and swung to one side for pouring. By cutting out the bottom of an old No. 3 crucible and sawing it off with a hack saw about 18 in. above the neck, Mr. Hobbins made a charging funnel and also a circular support for the new funnel. The charging hole in the lid was made larger by chipping it to fit the neck of the funnel. To provide for the additional weight, small cables were run from the lid, as shown in the illustration, over a sheave, to a proper counterbalance weight outside.

As soon as the original charge began to melt down, the funnel was filled with fluxed precipitate. The waste heat coming up around the funnel was sufficient to evaporate the moisture from the precipitate charge, and the heat at the mouth of the funnel was great enough to crust or fuse over the cone of precipitate extending from the funnel to the crucible charge. By this method, instead of damp precipitate being charged into the furnace, with dusting of precipitate and chilling of the furnace, a steady stream of precipitate slowly settled into the crucible, thoroughly dried and nearly at the fusion point of the fluxes.

Using this method of charging, it was advantageous to allow two bars of bullion to accumulate in the furnace before pouring. The result was a marked decrease in melting time, less heat and work for the melter, and a greatly reduced chance of dusting loss. Mr. Hobbins had data on the savings recorded with the idea of giving the information to his fellow engineers, but, his application for the officers' training camp being accepted, he entered with enthusiasm into the service of his country and later made the supreme sacrifice in the Argonne.

"Skin-Flotation" of Graphite Ores*

In the water "skin-flotation" system, a typical flow sheet of which is shown herewith, the ore is crushed dry to $\frac{1}{16}$ in. or $\frac{3}{32}$ in. It is then passed through a rotary drier, screened, and passed over an air separator, which classifies the material into three products—scalpings or tailings, which go to the waste dump; middlings, which form the washer feed; and fines, which are generally treated on a separate group of washers. The middlings plus the fines, which form 50 to 65% of the crude ore, go to a bin for fine ore, from which the material drops to surface-tension washers. In this machine, the graphite and some of the mica are floated off, on the surface film of water, while the gangue minerals are wetted by the water and sink to the hutch of the washer, which discharges to the tailings launder. The rough graphite concentrate is then dewatered on a trommel or shaking screen, which also removes both the graphite too fine to make No. 1 flake and the fine sand that has been carried over into the concentrates by the film formed by the graphite on the surface of the water. The dewatered concentrate, a dry sample of which analyzes 40 to 60% graphite carbon, is then dried in a rotary or steam-pan drier and sent to the finishing plant.



FLOW SHEET OF WATER "SKIN FLOTATION" SYSTEM

---

*Abstracted from Pamphlet No. 3, by George D. Dub, "Graphite for Crucible Making," War-Minerals Investigation Series.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Relief Claims Exceed $18,000,000

Claims in excess of $18,000,000 have been filed with the War-Minerals Relief Commission. Prior to midnight on June 2, when the act specifies that the docket close, in compliance with the law, 1287 claims had been received. So great was the number of claims received during the last week the docket was open that it has been impossible to calculate exactly the aggregate amount. The approximate total, however, exceeds $18,000,000.

Experience thus far shows that a large number of claims, when investigated carefully by the accountants of the War-Minerals Relief Commission, are subject to material reductions. It is regarded as possible that the reductions and rejections will be sufficient to permit payment of all claims allowed out of the $8,000,000 which will be available for that purpose.

On the night of June 2 a representative of the commission was stationed at the main postoffice, and to him was delivered each piece of mail matter arriving up to midnight. Claims are continuing to arrive, despite the expiration of the time limit, but they are not to receive any form of consideration. These claimants are being advised that their documents are being held subject to their instructions for their disposal.

The commission now is undertaking to gather additional evidence at hearings at different mining centers, for which three months will probably be required. Numerous difficult problems confront the members in administering the law. Important among them is the interpretation of the "request or demand" of a Government agency which induced the claimant to undertake his venture. The commission has promised not to make its interpretation of that feature of the law until after it has heard the oral arguments of the chrome producers. Many are of the opinion that a strict interpretation of the actual phraseology of the statute would bar out practically all, if not all, claims. It is thought that the commission will take into account the often-stated purport of the relief legislation, which is the discharge of a moral obligation on the part of the Government. If that view is taken it is believed that all claims will be admitted in the making of which it is shown that the claimant was responding to the general Government policy of stimulation. It is pointed out, however, that this policy of stimulation was not really begun until March, 1918, when the Shipping Board began its drastic restriction of imports of war minerals.

Another important question raised is that of the status of claims based on preparation of war minerals after their actual production. The most notable claim falling in this category is that of the Anaconda Copper Mining Co. That company has filed a claim for $561,346.62, and sets forth its case in substance as follows:

> In January and the early part of February, 1918, certain Government officials, and particularly B. M. Baruch, then chairman of the War Industries Board, discussed with officials of the Anaconda company, and particularly with C. F. Kelley, then vice-president and now president of the company, the proposition of installing and operating a plant at Great Falls, Mont., for producing ferromanganese from Montana ores.
>
> It was apparent to all that the construction and operation of such a plant at Great Falls would result in a distinct aid to the Government in at least three particulars—namely, the treatment of the ores produced at Butte and vicinity at Great Falls would render unnecessary the shipping of the lower-grade ores to Eastern steel plants, and thus largely economize railroad transportation; a lower grade of ore could be utilized, thus increasing the available supply of manganese; at Great Falls a large amount of hydroelectric power is generated which is used by the Anaconda company, so that less fuel would be consumed than at the Eastern furnaces and plants following ordinary methods of utilizing manganese.
>
> In his conversations with the officials of the Anaconda company, Mr. Baruch, as the chairman of the War Industries Board, repeatedly urged and requested that the company enter upon such an enterprise. It was clear to all that the operation of such a plant would be strictly a war business, and could be conducted only during the period of the war.
>
> The entire situation confronting the Anaconda company in connection with the installation of the plant is set forth in a letter to Mr. Baruch, which is attached to the claim. In his reply Mr. Baruch recognized the situation of the Anaconda company, but further expressed his desire that the construction of the plant be undertaken.
>
> Thereupon the company diligently proceeded with the installation of the plant. Every energy was devoted to its early completion, at a considerable sacrifice of other important operating requirements of the company, which had to be curtailed on account of the shortage of skilled labor.
>
> The plant was designed to include five electric furnaces with a capacity each of 15 tons per day of 80% ferromanganese. The first furnace was completed and started in September, 1918. At the time of the armistice, three plants were in operation. The other two were awaiting necessary apparatus. The early closing of the war, coming soon after the completion of the plant, resulted in the loss on which the claim is based.

Among the other large claims which came in at the eleventh hour is one for $609,429.31 by the Western Chemical Manufacturing Co., of Denver. The claim is based on a pyrites operation conducted in the Greenback mine, situated in Lake County, Colo. Edward E. Marshall, of Philadelphia, submitted a claim of $504,245.74, based largely on manganese mining activities in Cuba, Porto Rico, and Costa Rica. The United Chemical and Industrial Companies asks to be reimbursed for loss of $382,500, based on an effort to produce manganese near Crimora, Va. The Manganese Associates, a concern of Waynesboro, Va., which operated the Kennedy mine, in Augusta County, Va., has submitted a claim for $252,373.29. A. H. Jarman, of San Jose, Calif., makes claim for $138,929.51. His operation was known as the Steele Chrome Mine, in El Dorado County, Calif. The Arko Mining Co., of Minneapolis, is claimant for $100,000, as a result of manganese operations in Crow Wing County, Minnesota.

The schedule of the public hearings to be held by the commission, as announced, is as follows: St. Louis, Mo., Planters Hotel, until June 15; Little Rock, Ark., Marion Hotel, June 16-19; Tucson, Ariz., Pueblo Club, June 21-26; Los Angeles, Calif, Jonathan Club, June 27 (will remain a week or 10 days); and San Francisco.

Chronology of Mining, May, 1919

May 5—Calumet & Hecla reduces production by 50%, and 2000 employees are laid off.

May 6—Removal of restriction on export of silver.

May 7—Chiefs of the substations of the U. S. Bureau of Mines held meeting in Salt Lake City.

May 8—Spectacular rise in prices of silver to $1.03 occurred, with advances to $1.05¾ and $1.11 on following consecutive market days.

May 9—Announcement of suit between Balaklala Consolidated Copper Co. and Mammoth Copper Mining Co. for settlement on ores.

May 10—London silver price rose to 58d.

May 12—New Utah law regarding stock transactions became effective.—Silver price in New York rose to $1.19¾—Bureau of War Trade Intelligence merged into the Bureau of Enemy Trade.

May 13—All existing restrictions on the import of emery and emery ore removed.—Price of silver reacts to $1.14¾, with further decline on the following day.

May 15—Mammoth smelting works at Kennett closed down on account of labor troubles.

May 15—Fire at South Porcupine, many buildings being destroyed.

May 16—Price of copper advances to 16.10c.

May 19—Dolly Varden Mining Co., operating Dolly Varden mine, in Alice Arm district of British Columbia, and Temiskaming Mining Co. failed to liquidate claims of the Taylor Engineering Co. for construction of a railway from the coast to the mine on this date, set by the British Columbia Provincial Legislature.—Mining and Geological Exposition of the Department of the Interior opened at Washington, D. C.—Congress convened in extraordinary session—War Trade Board announced that nitrate of soda and nitrate of potash may be imported into the United States without restriction under a general import license when coming from countries with which general trade is authorized.

May 20—Operators in Coeur d'Alene district of Idaho advanced wages of miners 50c. per day to $4.75.

May 22—John Fritz Medal awarded to George W. Goethals.

May 27—Oil struck in England for the first time.

May 28—War Trade Board announced that applications would be considered for licenses to import tin ores and tin concentrates, subject to certain conditions.

May 29—Announcement that fine silver bars may be exported from Mexico during June without an export license and without the necessity of importing any percentage of gold in substitution.—Announcement by Cape Copper Co. of suspensions of mining operations of Cape Colony.

May 31—Bill introduced into Congress by Representative Raker, suspending all assessment work on mining claims during the war and for one year after peace is declared.

Gold and Silver in 1919

Washington Correspondence

No definite or even approximate figures are available of the production of gold and silver during the first four months of 1919, and the only comparative figures on output are based on the production in 1918 as estimated by the Bureau of the Mint and the U. S. Geological Survey, which estimate was published in the *Journal* of Jan. 11, 1919.

It is evident, however, the Geological Survey points out, that conditions prevailing in gold and silver mining during January, February, March, and April, 1919, were not such as would result in any large change in the output which was being made in the latter part of 1918. Labor conditions gradually improved in the gold-mining districts, both in the number of men employed and in their efficiency. There has been a reduction in the cost of powder, drill steel, and other necessary supplies and equipment, but neither wages nor purchase prices of materials have radically declined, so that the cost of mining remains much higher than in normal times.

Greatly increased activities have been noted in all the gold- and silver-producing districts. Many mines which were inactive or operated with reduced forces have resumed work. This increased activity has not yet resulted in great increase in output, for most of the work has been confined to repairs and development, the latter having been radically reduced during the war. In many mines which sent an increased quantity of ore to the mills there was a smaller recovery per ton, which was balanced by a lower cost of production.

It is probable that the rate of refinery output of gold and silver, as distinguished from that of mines, was about equal to that during the last part of 1918, for it was good policy to refine copper and lead containing gold and silver and store the base metals while marketing the silver.

There were no important discoveries of gold properties during the first quarter of 1919, though there has been more activity at old mines, which will probably result in an increased yield of gold from siliceous ores. This increase, however, will not be large and probably will be more than offset by a reduced output of gold from domestic copper, lead, and zinc ores, which amounts to about $10,000,000 a year. It is estimated that copper mines have been operating at about 65% of normal capacity, and lead and zinc mines, which produce some gold, at about 80%, so that there will probably be, in 1919, a decrease of $2,000,000 to $3,000,000 of gold from such sources.

There will be, during 1919, a slightly increased output of gold from deep mines in the Juneau district, Alaska, but this will probably be offset by a decrease in gold from gravels, owing to the shortage of labor and fuel at gravel properties. There will also be increases from the gold mines in Arizona, Colorado, and South Dakota, and probably other states. These increases, however, will not be great. A conservative opinion is that the production of gold in the United States in 1919 will not exceed by any large amount that of 1918, or about $69,000,000.

Owing to the increased value of silver, there has been a renewal of operation in many of the old silver-mining districts in Colorado, Nevada, Arizona, Utah, and Idaho, but the work has been largely that of development, which promises to increase the output of silver, but which so far has not resulted in increased yield. The new Divide district in Nevada is already shipping some high-grade ore, but it will be many months before the production will reach an amount comparable to that of former years from Tonopah and other districts. Even should the greater activity at the many silver mines now reported as being worked result in an increased output of several million ounces, there is every reason to assume that the output of silver for 1919 will be less than in 1918, owing to decreased ore shipments from copper, lead, and zinc mines.

Siliceous silver-gold and silver ores produce less than one-third of the production of silver in the United States. Copper ores yield slightly less than siliceous ores, and the remainder is derived from lead, zinc, and mixed ores, so that even with increased operations during the latter part of 1919 at copper mines in Alaska, California, Nevada, Utah, Montana, and Arizona, and at lead and zinc mines in Colorado, Idaho, Utah, and Montana, there will be a much smaller yield of silver from the refining of copper, lead, and zinc. These losses will be several times larger than any increase of silver from siliceous ores, and there is, therefore, no valid reason to believe that the production of silver in the United States in 1919 will exceed 65,000,000 oz., or about 3,000,000 oz. less than the production in 1918.

Southwestern Society of Engineers

The importance to the engineer of taking a larger part in civic affairs was emphasized at the convention of the Southwestern Society of Engineers held at the University Club in El Paso, Tex., on May 29, 30, and 31. It was the theme of the opening address delivered by the society's president, Dean G. M. Butler, of the University of Arizona, and was frequently stressed during the various sessions that followed.

The question of licensing of engineers was discussed by C. E. Drayer, secretary of the American Association of Engineers. A resolution approving the principles of licensing as advocated by the association was passed by the Southwestern Society, which also voted to affiliate itself with the association, the details of such affiliation to be decided upon later.

Other addresses included one upon "Oil Geology," by Dean Butler, of particular interest at this time, when new oil discoveries in the Southwest are attracting much attention. R. W. Goddard, of the New Mexico Agricultural and Mining College, had for his subject "Modern Wireless Telegraphy and Telephony."

C. E. Barglebaugh, secretary of the Southwestern Society of Engineers, who served as engineer with the Emergency Fleet Corporation during the war, discussed "The Concrete Ship."

Various resolutions were passed, one providing for the establishing of an organized employment service under the auspices of the society. On the second day of the convention the members were entertained at a luncheon given in their honor by the El Paso Mining Circle. Closer coöperation was urged between the two organizations in the interest of the development of the Southwest. Among the speakers was State Senator R. M. Dudley, who was recently active in securing the passage of a new mining law for Texas, which, however, was vetoed by the Governor.

The present officers of the Southwestern Society of Engineers were reëlected to serve until the fall session. They are as follows. G. M. Butler, Tucson, Ariz., president; S. H. Worrell, El Paso, Tex., and Gerald Sherman, Bisbee., Ariz., vice-presidents; R. W. Goddard, State College, N. M.; and C. E. Barglebaugh, El Paso, secretary. The directors are W. E. Robertson, El Paso; A. E. Barnes, State College, N. M.; James A. French, Sante Fe, N. M.; Ralph S. Moore, El Paso; D. B. Gillies, El Paso; and J. C. Ryan, Bisbee, Arizona.

Quincy-Hancock Consolidated Situation

Houghton Correspondence

The aspect of conditions respecting the Quincy-Hancock Consolidated would be considerably clarified if the Quincy absorbed the Hancock. This has been discussed among shareholders repeatedly, as it is understood it would be consistent from the standpoint of economical mining operations for both properties. However, the plan to have the Hancock shareholders authorize the sale of 125 acres of land to the Quincy is not preliminary to any such suggestion and would rather indicate that no consolidation scheme is under consideration. The territory in question could not be mined profitably by the Hancock for a long time and then only at great expense, whereas it can be handled easily by the Quincy. The price agreed upon is reported to be reasonable and gives Hancock funds enough to pay indebtedness and finance future opening operations, whenever conditions warrant.

British Import Restrictions

A concise statement of the British restrictions upon imports, with consolidated lists of prohibited imports and exceptions thereto, correct to May 1, 1919, has been prepared by the Division of Foreign Tariffs of the U. S. Bureau of Foreign and Domestic Commerce. The object is to make readily available for reference purposes accurate information regarding the conditions under which American goods are now admitted into the United Kingdom. The title of the publication is Tariff Series No. 39A (Supplement to British Control of Imports and Exports), and copies may be purchased from the Superintendent of Documents, Washington, D. C., at 5c. each.

Oil Companies Active in Arizona

Phœnix Correspondence

Every quarter of Arizona has its own oil boom, even though no oil has been developed up to date. Even 20 years ago, oil wells were drilled near Phoenix, at Riverside, in the Gila Valley, in the Verde Valley near Camp Verde, and on the plain north of Agua Caliente. During the last two years there has been similar activity prospecting in the Chino Valley, west of Jerome, where two wells were started, and in the Holbrook field, where two drills are now going down and where many more are promised. The Chino field is quiet. Its home company has transferred its machinery to a Texas lease. Two other promotions have been turned over to the Corporation Commission as employing stock-selling methods needing investigation.

The Holbrook field has many mining incorporations. A number of favorable geological reports have been made on the field. The oil fever has spread in the same locality. Winslow, to the west, has organized a mutual company for drilling. At Snowflake, on the south, and near St. Johns, to the southeast, great tracts of the state lands and of lands owned by cattle companies have been leased by oil speculators. Near the New Mexican line, seventeen townships have been leased by the Bankers' Oil and Refining Co., with stipulation that a well must be sunk on each township within a year. The Adamana Oil Co., of Holbrook, has just entered the

Ventura field, in California, having purchased 810 acres, adjoining the Modello property, with several shallow wells already in heavy oil.

Tucson is the center of another oil boom, with locations made on thousands of acres in the Cienega section, to the eastward; in the Rillito Valley, to the northward, and in the Santa Cruz Valley, southward. Oil indications are said to be good for many miles toward the Mexican line. One well-capitalized Tucson company, the Canoa, with lease on the land grant of that name, has decided that its first activities are to be in the western Texas fields, this decision following volunteer reports by university geologists considered unfavorable to local drilling, but strongly combated by others who are credited with knowledge of conditions under which oil may be found. Another Tucson company, the Tu-Tex, will drill in the Tampico field of Mexico, on a basis of $117,000 subscribed, and has the approval of the Arizona Corporation Commission of plans made.

Yuma is concentrating on a home company that is to drill in the Gila Valley, east of the city, where about all the acreage for 20 miles has been covered by leases. Locations have been made also on the California side of the river, near the Lower California line.

Near Buckeye a rig has been bought by the Palo Verde company, which has leased 12,000 acres of farm land.

In nearly every Arizona town small syndicates have been formed to send representatives to Texas for leases, and several large corporations have been capitalized within the state for development of Texas lands. Beyond these speculations, possibly a million dollars has been subscribed to Texas companies. Without doubt, oil speculation has served to slow down mining development within Arizona. It also has had the effect of absorbing the labor overplus temporarily existing at the end of the war.

Colorado Engineering Council

The Colorado Engineering Council, which was organized on Apr. 12, 1919, at the University Club, Denver, held its first regular business meeting recently, and elected the following officers: Arthur Ridgway, president; L. G. Carpenter, vice-president, and R. J. Grant, secretary-treasurer. The purpose of the council is to coördinate the work of various technical, scientific, and engineering organizations, to promote the welfare and professional standing of their members, and to foster a more general recognition of the engineer in civic matters. The council plans to hold regular monthly sessions and special sessions when advisable.

The charter members of the council, and the organizations which they represent, are as follows: L. G. Carpenter and Richard A. Parker, of the engineering section of the Denver Civic and Commercial Association; L. B. Skinner and Harry J. Wolf, of the Colorado Scientific Society; H. B. Lowden and L. B. Skinner, of the Teknik Club; F. H. Dreher and C. M. Lightburn, of the Colorado Society of Engineers; R. J. Grant and R. M. Keeney, of the Denver Section of the American Institute of Mining and Metallurgical Engineers; H. S. Sands and R. B. Bonney, of the Denver Section of the American Institute of Electrical Engineers; Thomas L. Wilkinson and Frank E. Shepard, of the American Society of Mechanical Engineers; and Arthur Ridgway and E. F. Vincent, of the American Society of Civil Engineers.

Mining in Venezuela

VENEZUELA CORRESPONDENCE

The returns just received from the Callao and Guiana gold districts of Venezuela show that during the last year over 3000 deaths occurred from malaria, pernicious fevers (probably yellow), dysentery, beri-beri, and other tropical diseases.

The foreign gold-mining companies that suspended operations during the last two years are now once more preparing to begin work, but scarcity of labor will prevent a resumption of activity on a scale corresponding to that of previous years. Prompt and vigorous action must immediately be taken to improve the sanitary conditions in the region, if the potentials of the gold belt are to reach that high degree of development that prospects indicate will be remunerative.

The bauxite deposits (Eocene) that are found between the boundary of British Guiana and the delta of the Rio Orinoco are attracting attention and cover great areas. The mineral is found in beds underlying the alluvial drifts and varies in thickness from a few inches to as much as 85 ft. At certain points it has been found that the material has acquired impurities Most of these are silica- and iron-forming concretions, at places covering many acres and rendering the material commercially worthless. Core drilling is absolutely necessary to prove the export value of the material. Many possibilities in the mineral industry in this country are retarded in development by the lack of ship bottoms.

Production of Soda Ash in 1918

Sodium carbonate in the form of soda ash is the foundation of the alkali industry, for it is used in the manufacture of glass, soap, and dyes, as well as caustic soda and most other sodium compounds. It is significant that the production of soda ash was well maintained in 1918, in spite of various difficulties incident to the war and of prices that were lower than those of 1917.

The sales in 1918 were 1,390,628 short tons, valued at $35,635,520, as compared with almost exactly the same quantity in 1917, valued at $38,028,000, according to R. C. Wells, of the U. S. Geological Survey. The sales in 1916 were about 1,200,000 tons, valued at $18,000,000. These figures do not include sodium carbonate reported in the form of monohydrate and sesquicarbonate, for the production of which exact figures are not available, nor the soda ash consumed by the manufacturers in their own plants in making caustic soda and other sodium compounds. The quantity of soda ash used for the latter purpose in 1918 is estimated at 664,000 short tons, against 482,000 short tons in 1917.

Most of the domestic soda ash is made from salt and limestone, but a small quantity is made in the West from natural sodium carbonate, chiefly that obtained from the water of Owens Lake, in southeastern California. The quantity made from this source in 1918 was 19,100 short tons, valued at $971,000, against 18,800 short tons, valued at $858,000, in 1917.

The exports of soda ash in 1918 were 119,218 short tons, valued at $7,805,550. This material went principally to Japan, Canada, Brazil, Australia, and Cuba, named in decreasing order of quantity exported.

Editorials

The Flotation Decision

AT THE time of going to press last week, we had only brief summaries giving the general conclusions of the Supreme Court in the Butte & Superior case, the complete opinion at that time not having been published. We have since received the full text of this opinion, which will be found upon another page.

It appears to be established that the effect of the decision of the court in the case is to confine the patent to the use of oily substances, having a preferential affinity for metal over gangue, in any quantity less than one per cent. on the ore, in a process in which air bubbles are introduced into the ore pulp by agitation.

In this case the Butte & Superior company denies the validity of the patent and the claim of infringement, but the Supreme Court considered the new evidence on the question of validity too meager and unsatisfying to justify any modification of its previous decision in the Hyde case in this respect, and determined, in the main, only the question of infringement.

The chief controversy in the case centered about the claim of infringement based on the use of oil by the Butte & Superior in excess of one per cent. This company had used oil prior to the Supreme Court decision in the Hyde case in quantities less than one-half of one per cent. on the ore, but after that decision, until the trial of this case, it increased the quantity of oil to in excess of one per cent., with the exception of a few weeks, when the oil used was in excess of one-half of one per cent. but less than one per cent. on the ore.

The District Court held Butte & Superior to be infringing during all of the three periods, on the theory that the practice of that company throughout involved the process of the patent—namely, the mechanical-agitation type of operation in connection with an efficient oil of the patent in the critical proportions.

Judge Bourquin, in the District Court, found that the use of a mixture of pine oil, kerosene oil, and fuel oil amounting to over 20 lb. to the ton of ore in which the pine oil was present in quantities of less than three-tenths of one per cent. of ore was an infringement, for the reason that the remainder of the mixture carrying the whole quantity over one per cent. was inert and useless, if not actually harmful.

The Circuit Court of Appeals reversed Judge Bourquin and construed the Supreme Court decision in the Hyde case as limiting the patent to the use of oil in quantities less than one-half of one per cent. on the ore. This opinion was based upon the language of the Supreme Court in the Hyde case, as follows: "The patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions,' 'amounting to a fraction of one per cent. on the ore.'" The Circuit Court of Appeals considered that this language was its authority to limit the claims to one-half of one per cent. on the ore, believing that the Supreme Court had found that the "critical proportions" "often described in the testimony" were proportions "amounting to a fraction of one per cent. on the ore" and that such "critical proportions" "often described in the testimony" were by the evidence and the admission of counsel for Minerals Separation, Ltd., confined to a fraction under one-half of one per cent.

The Supreme Court has found the Circuit Court of Appeals to be in error on this point. Justice Clarke in the opinion just handed down announces the opinion of the Supreme Court to have been in the Hyde case, and to still be, that the right of the patentees should be limited by the claims. In the claims the amount of oil is stated as "a fraction of one per cent. on the ore," and as the phrase "critical proportions" is nowhere to be found in the patent, but is derived only from the evidence, it must give way to the language of the claim when it conflicts therewith. He therefore decides that the "critical proportions" "often described in the testimony" must be held to be any fraction of one per cent. as set forth in the claims. This is the only point upon which the Supreme Court reverses the Circuit Court of Appeals.

In considering the question of the use of oil by Butte & Superior in excess of one per cent. on the ore, the Supreme Court found it necessary to define the scope of the claims with respect to the kinds and quantities of oils that may be used in the process. It will be remembered that Judge Bourquin, in the District Court, found kerosene and fuel oil to be of no use in the process when used in a mixture with pine oil—the pine oil being present in a quantity sufficient in itself to produce the result of the process. The Supreme Court, on an examination of the evidence in this case, found that kerosene and fuel oil were petroleum products having preferential affinity for metal over gangue, and that petroleum products had always been considered oils of the patent by the patentees and their agents until that question had been raised by Minerals Separation, Ltd. in this case. The Supreme Court in this connection says: "Much of this evidence is especially impressive because the papers from which it is derived were written and the witnesses testified before the question as to petroleum, now made in this case, was raised or discussed."

Justice Clarke finds no justification for limiting the oils of the patent to "frothing oils" as distinguished from "non-frothing oils." He says: "To give such a construction to the patent would subordinate the clear description contained in it of what are oils of the process, to an implied and vague description and classification which would leave the whole subject again at large, to become a field for further experimentation, without definition in the patent of what oils or froths would satisfy it." In this connection he further says: "It is apparent that it makes no differentiation whatever, either in the claims or in the specification, among the oils having a preferential affinity for metalliferous matter, and that its disclosure, to which the petitioners must be limited, is, that when a fraction of one per cent. on the ore of any such oil is used in the manner prescribed, there will be produced a metal-bearing froth, the result of the process. No notice is given to the public, and it is nowhere 'particularly pointed out' in the claims, that some oils or combination of oils, having a preferential affinity for metalliferous matter, are more useful than others in the process, or that some may be used successfully and some not, or that some are 'frothing oils,' a designation not appearing in the patent, and that some are not. The patentees discovered the described process for producing the result or effect, the metal-bearing froth, but they did not invent that result or froth—their patent is on the process; it is not and cannot be on the result—and the scope of their right is limited to the means they have devised and described as constituting the process." He concludes that the only disclosure as to the kind and amount of oil which the patentees made to the public as necessary to the practicing of their process is that it must be an oil or oily substance, or oily liquid having a "preferential affinity for metalliferous matter," and that it shall be limited in amount "to a fraction of one per cent. on the ore."

Though the Supreme Court considered the claims only with respect to the amount and character of the oil prescribed, it seems clear that the remainder of the process is that described in the decision of the Supreme Court in the Hyde case. As will be seen from the excerpt from the opinion above, "the patent is on the process—it is not and cannot be on the result—and the scope of their right is limited to the means they have devised and described as constituting the process."

In this connection it is interesting to note that Justice Clarke finds, after setting forth the disclosure of the patent with respect to the kinds and quantities of oils which may be used in the process, that: "The only additional statement contained in the specification, which is in the nature of a disclosure, is found in the description of the example of the application of the invention, in which it is stated that the 'froth or scum' derives its power of flotation mainly from the inclusion of air bubbles introduced into the mass by agitation, such bubbles or air films adhering only to the mineral particles which are coated with oleic acid." It can be concluded from this that "The inclusion of air bubbles introduced into the mass by agitation is part of the disclosure"; then it may be assumed that the patentees are limited to this means of "inclusion of air bubbles" as being "the means they have devised and described as constituting the process."

It is apparent from an examination of the typical claim quoted in the Supreme Court opinion that if one removes those words relating to the element of oil, the other elements of the process remaining are, first, "mixing the powdered ore with water," and, second, "agitating the mixture until the oil-coated mineral matter forms into a froth." In this view of the claims, it seems to us extremely doubtful that the Supreme Court would hold the pneumatic or bubble-column process to be covered by this patent. There is involved in such process the "mixing powdered ore with water" and "the adding of a small proportion of oily liquidation having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore)," but there is admittedly no "agitating the mixture until the oil-coated mineral matter forms into a froth." Such agitation as takes place is, according to the Circuit Court of Appeals in the Miami case, "not even approximately the agitation of the patent," and is the result of and not the cause of the introduction of air[1]. To say th least, this question is still an open one and leaves muc of interest in the Miami case.

The decision, however, so far as Butte & Superio is concerned, makes that company liable for an a counting for its profits, over and above what it coul have made [illegible] the process of the prior art, an amour which would be determined by the profits which it ha made as compared with a standard of comparison base upon the use of oil in excess of one percent.

The Latest Mine Holocaust In Pennsylvania

ON JUNE 5, in the Baltimore tunnel of the Del ware and Hudson Coal Co., 83 men were kille and 50 more burned and maimed. According to the a count, these men were miners going to their workin places two miles from the mouth of the tunnel. Th men were taking the trip in a train of 14 mine car drawn by an electric motor, two of the cars in the mi dle of the train containing powder, presumably for th day's operations. It is said that the accident resulte from a short circuit caused by the trolley wire comin into contact with one of the steel kegs containing th powder.

Such a holocaust may well cause mine managers an mining engineers intense regret that the obvious car lessness of handling large quantities of explosives an men in close proximity still persists. Similar accident have taken place in the metal-mining industry. We reca the accident at the collar of the Granite shaft, in Butt and one in the open pit of the Nevada Consolidated, i Nevada. In both relatively large quantities of expl sives were ignited accidentally when men were abou and a number of fatalities resulted.

It is a well-known rule in metal-mining practice t bring explosives into a mine at times when miners ar not present. The handling of both men and explosive on the same cage at the same time is prohibited. I adit workings, explosives are handled on separate train and only the trip riders are allowed to accompany th train.

The handling of relatively large quantities of expl sives, particularly in coal mining, cannot be avoide The inert character of black blasting powder—its co parative immunity to ignition through shock—undoub edly causes a certain amount of carelessness in its ha dling. The unexpected is always happening, and in th accident under review a greater number of fatalities r sulted than is usual. This is another expensive lesso that emphasizes the need for extreme care.

The transportation of workers and explosives in th same train should be absolutely prohibited. In th transportation of powder in separate trains, covere cars of such a type as to prevent all possibility of co tact of the live trolley wire and the load should be d signed and used. The time is opportune for a tho ough study of the conditions under which powder handled underground and for the drafting and enforc ment of rules which will reduce to a minimum the li bility of accident and prevent all possibility of the r currence of an accident of this magnitude.

---

[1] See *Eng. & Min. Jour.* Vol. 101, No. 22, Dec. 1, 1917, p. 956.

The recent Pan-American conference held in Washington was the second important meeting of the representatives of the republics of the Western Hemisphere having for its objectives the promotion of better understanding, coöperation, and the improvement of trade conditions. The mutuality of interests between the Latin Americans and the United States has received substantial recognition and will be stimulated by conferences of this kind. Some of the important subjects considered were the establishment of improved communications between the United States and the Latin-American republics; the securing of a common code of business methods among the republics; the working out of satisfactory financial arrangements; international agreements for the protection of patents, trademarks and copyrights; extension of trade; improvement of consular offices, standardization of consular invoices and fees, and annulling of local laws and tariffs detrimental to general trade expansion; improvement of banking facilities and the more complete interchange of publicity and news among the republics. The great variety of the questions involved indicates the international difficulties that must be thrashed out before a large volume of trade can be established among the countries of this hemisphere. A conference such as this has the advantage of giving the participants a bird's-eye view of the critical questions and may be expected to initiate action in the various countries toward the removal of trade obstacles.

Apparently a vigorous effort is being made by the New York District Attorney's Office to run down brokers and others who are selling to the public fake oil and other stocks of dubious value. According to latest accounts, the local Grand Jury has conducted an inquiry which may result in indictments of several promoters. From Washington comes news of the activities of the Federal Trade Commission, and it is said that scores of complaints have been drawn and that a number of oil companies are involved. This is commendable work, and we hope that it will bring results. Concerted action by the various authorities charged with ferreting out fraudulent enterprises will materially help the present situation. In the end it will greatly benefit legitimate enterprise in mining and in the petroleum industry. It will also tend to make the small investor more cautious. There is a good future for investments, but the success of many worthy ventures will inevitably be jeopardized if fictitious values are created by wilful misrepresentation.

BY THE WAY

The following is a bill of sale for a burro sold by one old prospector to another at a decadent mining camp "back in the hills": "Sold to R. H. Jones one lineal descendant of Christ's conveyance into Jerusalem for the sum of seventeen ($17.00) cash in hand. His age is unknown to the present generation, color twilight, guaranteed to be perfectly tame and docile, and easy to catch if hand-cuffed and chained to a mountain; otherwise it is easier to catch four aces. It is also guaranteed that he is the identical jackass selected by the Democratic party for its political emblem so that the country might have a true and correct index of its great vocal and oratorical powers and the high intelligence of its voters."

Pat Murphy had the name of being the biggest eater on the Comstock range, reminisced Dan De Quille in "The Big Bonanza." He was a very good sort, and tried his best not to make his appetite conspicuous, but it was a thing that could not be concealed. One morning a tall, gaunt, middle-aged man came edging into the restaurant, and meekly took a seat. The landlord rather liked the appearance of the new customer, and at once went to take his order. "Landlord," said the man, "let me have a porterhouse steak and onions, some liver and bacon on the side, six fried eggs, a bit of ham, a Jarman pancake, some fried pertaties, a cup of coffee, and a couple of doughnuts, and, if ye have them, a couple of waffles." It was Pat Murphy!

"So th'art complainin' baout tha 'igh cost o' livin', m'son," said Cap'n Dick. "Dam-me, do seem as 'ow a man never naws w'ere 'e's too, an' this 'ere business o' tryin' to satisfy tha 'ol worl' be a gert 'uge contrac'. Supposin' naow tha price o' food gaws daown, thee can depen' on ut, m'son, that daown will gaw the wages. Take tha case o' one o' these 'ere Finns workin' to Lucknow mine—w'y, dam me, 'e's over in 'ospital naow cursin' tha day 'e wuz 'it by one o' these 'ere drops in food stuffs. 'Pears as 'ow this 'ere chap wuz workin' at tha station 'o tha timber shaf', sawin' h'up bunch o' laggin' for 'is contrac'. 'Baout this time one o' these 'ere 'ogs belongin' to some h'Austrians 'o wuz squattin' near the mine 'appened 'long, as 'eart-free an' unmin'-ful as you please. Bloody little cared 'e w'ere 'e wuz gawin' till all o' a sudden down 'e gaws through shaf' —'ead, tail, two 'underd paoun' o' pork, right on top o' this 'ere poor Finn chap 'o wuz workin'. Dam-me, I don't see 'ow 'e pulled through, but do seem as 'ow some chaps can't be daowned. So, m'son, thee mus' see that some o' we better be bloody well satisfied that food stays on 'igh." D. E. A. C.

When an experienced mining engineer gets the habit of the tired business man, known as the "dictated-but-not-read" policy, the results are apt to be, to say the least, disconcerting, as may be judged by the following: An otherwise perfectly good report on a Mexican mining property was available for a short time, so the engineer dictated a few paragraphs to accompany other data with a proposition that he was in a hurry to submit to a well-known mining organization. The pretty little typist was willing and ingenious, but she was rather inexperienced when it came to geological nomenclature. The result ran like this: "Underlying all formations we find a rock that forms the coast frames. It is a costly crystalline rock, locally known as cranito. To the north is a dark green rock, at times showing perplyritic structure. Further south the predominating rocks are volcanic toughs and breeches ejected from vents, the andysitic breeches being most favorable for ore deposition. The mountain frame rises abruptly from the broad Maysie flats, which, though apparently on the level, have a nearly uniform 2 per cent. rate. They are drenched by the streams, whose diverting branches have cut broad and shallow vallies in the Basil mountain slopes and concentrate in drunk channels a hundred feet or less below the level of the plain."

Personals

Rudolf Gahl is in New York.

Marshall D. Draper, sails from New York on July 1, to be engaged in exploration work in the Orient.

William B. Franklin has been elected president of tho Nitrate Agencies Co., succeeding **J. L. Schaefer.**

Oscar G. Hershey, geologist for the Tom Reed Gold Mines Co., recently visited that company's property at Oatman.

A. Valjean, publicity manager, Arizona Chapter, American Mining Congress, is spending 30 days in the Ranger oil fields of Texas.

George Kingdon, general manager, United Verde Extension Mining Co., has returned to Jerome from a short business trip to Los Angeles.

L. C. Shattuck, manager Shattuck Arizona Copper Co., is visiting the Yuma section, where he has extensive land and cotton interests.

Robert E. Tally, assistant general manager, United Verde Copper Co., has returned to his headquarters at Jerome, from a trip to California.

Hywell Davies, U. S. Labor Administrator for Arizona, with headquarters at Phoenix, is making a tour of the mining camps of the state.

H. K. Masters, of tho ore department of W. R. Grace & Co., was recently elected a member of the board of managers of the New York Metal Exchange.

John E. Penberthy, superintendent of the Shannon Copper Co. interests at Gleeson, Ariz., has returned from a trip of mine examinations in New Mexico.

Victor C. Heikes, of the U. S. Geological Survey, has returned to his headquarters at Salt Lake City, after making a tour of all the mining camps of Arizona.

Scott Turner has been appointed consulting engineer of the Mining Corporation of Canada, Ltd., with offices at the Bank of Hamilton Building, Toronto, Canada.

James S. Douglas, president, United Verde Extension Mining Co., of Douglas, Ariz., has returned home from a trip of inspection of the Verde X mine and smelteries at Jerome.

A. G. Borrows and **Perry Hopkins,** of the Ontario Bureau of Mines, are making an examination of the Boston Creek gold district, a detailed map of which will be issued.

Walter Douglas, president Phelps Dodge Corporation, of New York, has completed a tour of inspection of the various Phelps Dodge properties in Arizona, New Mexico, and Sonora, Mexico.

D. E. A. Charlton, of the editorial staff of the "Journal," left New York on June 7 on a trip through the Michigan and Minnesota iron and copper ranges in the interests of the "Journal."

Arthur Notman and **W. B. Gohring,** superintendents respectively of the Copper Queen and Calumet & Arizona mines at Bisbee, recently combated for the tennis championship of Arizona.

J. A. Burgess, of Oatman, Ariz until recently superintendent of the United Eastern Mining Co., has been promoted to the position of general manager, with headquarters at the same place.

Rush T. Sill, of the firm of Sill & Sill, consulting mining engineers, Los Angeles, is leaving Seattle on June 11 for the Willow Creek district, Alaska, where he will be engaged in making mine examinations.

H. C. Henrie, chief clerk of the Copper Queen Branch of Phelps Dodge Corporation, accompanied by his wife and son, is spending a month in New York City and Pennsylvania.

Frank D. Adams, dean of the faculty of applied science at McGill University Montreal, has been appointed acting principal of the university during the absence of Sir Auckland Geddes, who has been given a year's leave

P. B. McDonald, who for two years has been head of the department of engineering English in the University of Colorado, has been appointed assistant professor of English in the school of engineering, New York University

A. H. Hubbell, news editor of the "Journal," returned to New York on June 6 having completed a nine-weeks' trip through the important mining districts of the United States and several in Canada in the news interests of the "Journal."

H. Kenyon Burch, consulting engineer, Phelps Dodge Corporation, has returned to Warren, Ariz., from a trip to California. Mr Burch has charge of the erection of the new concentrator plant near Warren, to treat the ores from Sacramento Hill.

C. H. Clapp, president of the State School of Mines in Montana, has been appointed director of the Montana State Bureau of Mines and Metallurgy, recently authorized at the last session of the State Legislature. **H. P. Pulsifer** is metallurgist and **A. E. Adami** is engineer in charge

Capt. E. G. Snedaker, 4th Engineers, detailed as adjutant to military commander, Coblenz, Germany, writes under date of May 20 that he expects to leave for the United States soon. He may be addressed care of M. M. Hamma, 425 First National Bank Bldg., Denver, Colorado.

L. D. Ricketts, of Warren, Ariz., who during the absence of **Col. John C. Greenway** in France has had charge of the management of the Calumet & Arizona properties in Arizona, is at present visiting the East. During the summer Dr Ricketts will spend a part of his time with his family at Santa Barbara, Calif., at the El Marisol Hotel.

Mark L. Requa, general director of the oil division of the U. S. Fuel Administration since the beginning of the war, has resigned from that post to become associated with the Sinclair petroleum interests. It is reported Mr. Requa will become vice-president of the Sinclair Consolidated Oil Corporation, which was until recently the Sholan Company

Maj. William H. Brophy, until recently manager of the Phelps Dodge Mercantile Co., who served with the Red Cross organization in France during the war, has resigned his position with the mining company, and will hereafter devote his entire time to his extensive mining, banking, and city-utility interests throughout Arizona, New Mexico, and Western Texas.

Charles M. Schwab was presented with a solid-gold medal, in recognition of his distinguished war services, by the citizens of Bethlehem, Penn., at a meeting on May 15. The face, in sunken cross panel, shows the manufacture of steel in the Bethlehem plant during the war. The obverse side has three panels, two of which illustrate the city. The cost of the medal is said to have been more than $1000.

R. D. Hall, who has been associate editor of "Coal Age," succeeds **Floyd W. Parsons,** resigned, as editor of that journal. Mr. Hall, associated with Mr. Parsons, has been with "Coal Age" since its inception, nearly eight years ago. As announced in last week's issue of the "Journal," Mr. Parsons has assumed an important editorial position on the staff of the "Saturday Evening Post," conducting a business and science department

J. W. Gray has assumed the editorship of "Iron and Steel of Canada," which until now had been jointly edited by **Dr. Alfred Stansfield** and **W. G. Dauncey** since its inception in February, 1918. Mr Gray was educated in England and is a member of the Institution of Mining Engineers. Until recently he was assistant to the general manager, Dominion Steel Corporation, and then assistant to the president, Nova Scotia Steel and Coal Co The editorial and printing offices have been removed to Ste. Anne de Bellevue, Canada

Lieut-Col. John C. Greenway, general manager of the Calumet & Arizona Mining Co. and New Cornelia Copper Co., at Ajo, who recently returned from France, has been granted an extended leave of absence by the directors of his companies, that he may regain his health It will be remembered that Colonel Greenway served with distinction in France, winning two rapid promotions and a citation for gallantry in action at the battle of Chateau-Thierry and later engagements, before falling a victim to German poison gas, from the effects of which he is slowly recovering

Obituary

Wilmot D. Matthews, of Toronto, president of the Consolidated Mining and Smelting Co of Canada, died on May 24 from an attack of pneumonia, in the 70th year of his age Mr Matthews was one of the leading financiers of Canada and was closely identified with a large number of industrial and commercial enterprises He was president of the Canada Foundry Co., of Toronto, of the Kingston & Pembroke Ry., and a director of the Canadian Pacific Ry the Steel Co. of Canada, and several other companies. Mr. Matthews took an active part in public affairs and had held office as president of the Toronto Board of Trade and Toronto Corn Exchange. He is survived by two sons and two daughters.

Maxwell Wanton Atwater, general manager of the Davis-Daly copper properties, died recently at the Mayo Brothers' Sanatorium, in Rochester, Minn. Mr. Atwater was born at Millville, N. J., in 1878, and attended the Colorado School of Mines from 1897 to 1901. He was connected with the Liberty Bell Gold Mining Co., Telluride, Colo., in 1901 to 1903; United Elkhorn Mines, Oregon, as superintendent, in 1904-5; Atwater, Linton & Atwater, mining engineers, Montana, as junior partner in 1905, and Butte & Superior Copper Co., Ltd., Butte, Mont., as general superintendent, 1909 to 1912. During 1913 he was engaged in general examination and exploration work. In 1914 Mr. Atwater became president and manager, Basin Salvage Co., and later president and manager, Alta-Montana Mining Co. In 1918, Mr. Atwater was appointed manager of the Butte & Plutus Mining Co., in the Philipsburg district of Montana.

Societies

American Institute of Chemical Engineers will hold the 11th semi-annual meeting in Boston, June 18 to 21. The program includes an unusally complete symposium on electric furnaces, which will consume practically all of the time on the opening day. The moving pictures of these furnaces will give a good conception of their operation. The smoker, in the evening at the A. D. Little Laboratories, is expected to be both entertaining and instructive. A trip in Boston Harbor has been planned for June 19, with visits to a number of important industries, followed by a sail to Marblehead and dinner at the Eastern Yacht Club. June 20 will be spent at the Boston "Tech." visiting the laboratories and listening to a program of papers, including an unusually complete description of the Providence gas plant, and a symposium on the registration of chemists. During the afternoon the Harvard laboratories will be visited, followed by an automobile trip through Boston, ending at the Brookline Country Club, where a dinner will be served and the evening spent. On June 21, the textile mills at Lawrence will be visited, followed by another auto trip.

The Chemists' Club announces through its scholarship committee that the Bloede and the Hoffmann scholarships will be awarded for the academic year 1919-1920. These scholarships were founded by Victor G. Bloede, of Baltimore, and William F. Hoffmann, of Newark, with the object of giving financial assistance to deserving young men, to obtain an education in the field of industrial chemistry or chemical engineering. These scholarships will be open to properly qualified applicants without restriction as to residence, and may be effective at any institution in the United States which may be designated or approved by the scholarships committee. Applicants must, as a minimum qualification, have completed a satisfactory high-school training involving substantial work in elementary chemistry, physics, and mathematics, and present a certificate showing that they have passed the entrance examination requirements of the college entrance examination board or its equivalent Preference will be given to young men who have supplemented these minimum qualifications with additional academic work, especially in subjects which will form a suitable groundwork for the more advanced study of applied chemistry and chemical engineering All inquiries should be addressed to the Scholarships Committee of the Chemists' Club, 52 East 41st St., New York City.

Industrial News

The Betson Plastic Fire Brick Co., Rome, N. Y., was recently incorporated. Frank J Jewell was elected president and secretary, and Nelson Adams, vice-president and treasurer The company's products are plastic fire brick for boiler furnace linings and baffle walls and "Hi-Heat" cement for use in the boiler room.

The Electric Furnace Co., Alliance, Ohio, has just shipped one of its standard nose-tilting type furnaces to the U. S. Navy

Yard at Washington, D. C., to be used in the Government brass foundry there. This furnace is provided with a motor-operated tilting mechanism and has a maximum hearth capacity of 2000 lb. The shell is 7 ft. in diameter, and the furnace is rated at 105 k.w. capacity.

Chicago Pneumatic Tool Co. announces that J. W. McCabe, who until recently has been district manager of sales for the company at Buffalo, N. Y., has been appointed special representative for the company's foreign trade department and will depart soon for an extended trip throughout the Orient, Philippine Islands, and Australia. W. H. White has been appointed acting district manager of sales at Buffalo, to take charge of that territory during Mr. McCabe's absence.

William B. Scaife & Sons Co., of Pittsburgh, announces the opening on July 1 of a Chicago sales and engineering office at 38 South Dearborn St., with Charles F. O'Hagan, formerly chief engineer of the company at Pittsburgh, as resident engineer and manager. The business of this company is the manufacture of black or galvanized, riveted, brazed or welded steel tanks for air, gas, and liquids, steel shipping drums, range boilers, and steel structures; also the We-Fu-Go and Scaife water softeners and filtering equipment.

The Metal & Thermit Corporation, New York, has recently successfully completed the largest marine weld ever recorded, on the cast-steel sternframe of the huge U. S. Army Transport "Northern Pacific." The section welded was entirely broken through as a result of the severe strain to which the frame was subjected when this transport, laden with homeward-bound troops, ran aground on Jan. 2, 1919, in a dense fog off Fire Island, New York. The sternframe was broken just above the upper rudder lug, in a position where the casting was hollow and measured almost 2 ft. in diameter. The walls of the casting at this point were about 3 in. thick. The weld, which required 1400 lb. of "thermit" for the chemical production of the necessary amount of molten steel, and which was made without removing the casting from the ship, obviated the delay and expense which would have been entailed by the only alternative of purchasing a new casting and installing it at a cost probably exceeding $5000.

Westinghouse Electric and Manufacturing Co.'s Works, East Pittsburgh, Penn., were visited recently by the French Commission, consisting of engineers, railway operators, and government officials, who arrived in Pittsburgh from Altoona, Penn., to familiarize themselves with the operation and manufacture of electric-railway equipments. The commission spent several days in Pittsburgh, inspecting electric locomotives being built for the New York. New Haven & Hartford R.R. Co., for operation on the New York Connecting Railway across the Hell Gate Bridge. They also inspected one of the 10 new passenger electric engines which are being built for the Chicago, Milwaukee & St. Paul R.R. These will be the most powerful locomotives running in passenger service, each of the 10 having a capacity sufficient to haul 950 tons (12 steel cars) over the entire mountain section at the same speed as called for by the present schedule. The commission were the guests of E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., during the members' stay in Pittsburgh.

Trade Catalogs

The Dorr Co., New York and Denver, has published Bulletin No. 13 describing the Dorrco pump. This is a 16-page bulletin containing tables of dimensions, weights, capacities and giving other pertinent information, part lists, instructions for operating and illustrations.

Heating, Ventilating, Drying, Blast Equipment. Massachusetts Blower Co., Watertown, Mass. Condensed bulletin; 9 x 11; 8 pp.; illustrated. Contains general data on fans, blowers, heaters, air washers for heating, ventilating, purifying, and cooling, air conditioning, forced and induced draft, commercial drying, and blast equipment.

Standard Apron Conveyors. The Jeffrey Manufacturing Co., Columbus, Ohio. Catalog 259; 75 pp.; illustrated. Descriptive of installations showing standard steel and wood apron conveyors in service in various industries, giving specifications, general dimensions and other important data of vital interest to the purchaser. The conveyors, both of steel and wood flights, are so arranged in this book that not only the engineer, but the layman can select a conveyor which will meet his requirements. On pages 4 to 9 are important notes to aid the purchaser in selecting a conveyor. The purpose is to save the time and expense heretofore required in making drawings and layouts for the purchaser's particular needs.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Air-Lift Pump. Levi T. Edwards, Philadelphia, Penn., assignor to Talbot Air Lift Co. (U. S. No. 1,302,780; May 6, 1919.)

Aluminum—Process of Soldering Aluminum. Armand Henri Alexandre, Levallois-Perret, France, assignor to Société E. H. Moll & Cie, Paris, France. (U. S. No. 1,301,633; Apr. 22, 1919.)

Aluminum Compounds, Process of Producing. Oystein Ravner and Victor Moritz Goldschmidt, Christiania, Norway, assignors to Det Norske Aktieselskab for Elektrokemist Industri, Norsk Industri-Hypotekbank, Christiania, Norway. (U. S. No. 1,302,852; May 6, 1919.)

Blast Furnace. Charles Henry Bingham, London, England. (U. S. No. 1,303,155; May 6, 1919.)

Blasting—Shot-Hole Scraper and Tamper. John H. Bitz, Mount Pleasant Township, Westmoreland County, Penn. U. S. No. 1,302,127; Apr. 29, 1919.)

Drilling—Well-Drilling Machine. William L. Dayton and John M. Scott, Fort Worth, Tex. (U. S. No. 1,301,915; Apr. 29, 1919.)

Drilling Apparatus. George H. Gilman Claremont, N. H., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,303,790; May 13, 1919.)

Drilling Apparatus. Mahlon E. Layne, Houston, Tex. (U. S. No. 1,302,058; Apr. 29, 1919.)

Drilling Appliance. Frank M. Dale, Sullivan, Ind. (U. S. No. 1,301,395; Apr. 22, 1919.)

Electric Furnace. Henry Arnold Greaves and Harry Etchells, Shelfield, England. (U. S. No. 1,301,932 and 1,302,788; Apr. 29, and May 6, 1919.)

Iron and Steel, Manufacture of. George Arthur Jarvis, Wellington, England. (U. S. No. 1,303,799; May 13, 1919.)

Lamp—Acetylene Lamp. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago. (U. S. No. 1,303,658; May 13, 1919.)

Lamp—Acetylene Lamp. John D. Luttrell, Benton Harbor, Mich. (U. S. No. 1,302,393; Apr. 29, 1919.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—June 3

Fire at the Argonaut Mine, in Amador County, is now under complete control, and milling operations have been resumed. The fire is confined to the areas between the 4350 and 4050 levels, and although all danger of the fire breaking out again is past, care must be exercised in watching bulkheads for escaping gas. The amount of caving in the burned area is not as great as expected. The ore for the present is being drawn from the 4500 level.

California Oil and Gas Supervisor will hereafter issue the annual report in monthly chapters, which will more promptly give the details of all work passed upon by the engineer staff of the State Mining Bureau. The purpose announced by Supervisor McLaughlin is to aid operators in more promptly correcting errors on part of the Bureau or the well owner. The monthly chapters will be mailed to assessment payers, agents of operating concerns, and others interested. The weekly press reports will be continued to newspapers interested.

DENVER, COLO.—June 7

Colorado School of Mines held its annual commencement at Golden on May 23, 1919. Thirteen men were graduated. A silver cup, presented by Prof. Ziegler for scholastic attainments, activity in athletics and leadership in the student body, was awarded to Guy E. Miller, of Cañon City. The Wolf medal for high scholastic attainment was won by Thomas B. Romine, of Walla Walla, Wash. The commencement address was delivered by Edwin S. Church, president Wellman-Seaver-Morgan Co., of Cleveland, Ohio. Mr. Church discussed foreign trade, labor conditions, and industrial organization, and gave the graduating class much good advice designed to be of service to young men about to enter professional and commercial life.

Railroad Administration seeks to legalize a Colorado order issued some months ago, setting aside the established ruling that shippers may release liabilities upon values exceeding $100, carrying insurance to meet losses. It is understood that the innocent-looking order asked for, apparently to cover only Colorado and district territory, is to be applied extensively over the West if finally authorized. In response to a petition from the American Mining Congress, Chairman Johnson, of the Western Freight Traffic Committee, has postponed hearings on the question of fixing new rates for ore between Western points until June 13, and arrangements have been made whereby the Colorado chapter of the American Mining Congress will be represented at the Chicago hearing, and individual and corporate representation have been invited. The outcome is considered of great importance to the mining industry, as under the proposed order the freight rates on many ores, concentrates, acids, and powders, now burdensome, would be greatly increased. The proposed increase is 1% of value exceeding $100 per ton, based on smelter or sales statements. In addition to the financial interests involved, it is feared that the proposed ruling would prevent the Railroad Administration from declaring a rate that might be necessary to keep industries and communities alive.

SALT LAKE CITY, UTAH—June 6

Opening the Uintah Basin, a section which can best be reached by the extension of the Moffatt road from Colorado, is a question which is again before the public. The plan is to form a union of Colorado and Utah capital for furthering the enterprise. Governor Bamberger, who has been in Denver informally consulting with business men in that city, is now on the way to the Uintah Basin, where, in company with other Utah men, he will make a study of the resources of that section, to determine whether they are sufficiently developed to warrant the construction of such a road. Iron deposits east of Park City, coal deposits at Red Creek, oil and oil-shales, in the eastern end of the district, gilsonite deposits, and others will be examined. With Governor Bamberger on the trip, which is to last about 10 days, are R. C. Gemmell, S. R. Inch, A. N. McKay, C. C. Richard, O. J. Stillwell, of Ogden, and T. W. Clyde. The proposed road, passing from Colorado into and through the Uintah Basin, will terminate in Salt Lake. Another way to open the Uintah Basin section, which has the approval of many Utah men, would be to extend a branch railroad northerly from some point in Utah on the main trunk line of the Denver and Rio Grande.

The Tintic Milling Co., a pioneer in seeking and finding the solution for the treatment of the siliceous ores of the Tintic district, has passed entirely into the hands of the Knight interests, whose mines have furnished the greater part of the tonnage treated. George H. Dern, manager of the company since the beginning of operations, about four years ago, and financially interested in the enterprise, has sold out his stock to the Knights, retiring from the company. He is succeeded as manager by John S. Smith, formerly manager of the Knight Woolen mills, at Provo. Theodore Holt, associated with Mr. Dern in the Mines Operating Co., which treated stope fillings from the Ontario Silver mine, at Park City, and later with the Tintic Milling, continues as superintendent in charge of the Silver City plant. The Tintic Milling is practically a consolidation of the Mines Operating Co. and the Knight-Christensen Metallurgical Co., and the present plant, situated near the site of the old Knight smeltery, was built at a cost of about $200,000. It is treating about 200 tons of ore daily by the Holt-Dern roasting process and producing an average of $60,000 worth of silver bullion monthly. The ore is coming from the Dragon, Iron Blossom, Colorado, Mammoth, and Empire mines, and some smaller properties. It is expected that improvements and additions will be made so as to permit of the treatment of a larger tonnage.

WALLACE, IDAHO—June 5

Non-assessable Mining Companies will be interested in a case recently decided in the district court of Shoshone County. The Sabina Mining and Milling Co. was incorporated in 1912 with 1,000,000 shares of non-assessable stock. The entire capitalization was turned over to the owners of the ground to be developed, the owners turning back 400,000 shares to the treasury as a working capital. One of the owners, John Melander, first refused to enter the deal, but finally consented to do so under a specific agreement that his stock should "forever remain fully paid up and non-assessable." The property was developed to a considerable extent through the sale of treasury stock. About a year ago, the company being unable to raise further funds in that manner, a meeting of the stockholders was called, and, by a vote representing more than two-thirds of the issued stock, the bylaws of the company were amended making the stock assessable. Melander held 156,000 shares and voted them against the change. An assessment of 3 mills per share was forthwith levied. Melander refused to pay his assessment and in due course his stock was sold in default of payment. Melander brought suit against the company to recover his stock and $7500 damages. On the showing that Melander had been specifically assured that his stock should be forever fully paid up and exempt from assessment, the court gave him the decision, ordering the company to reissue his stock and pay him nominal damages in the sum of $100.

Decision of the Supreme Court of Idaho in the case of the Independence Placer Mining Co. is of unusual interest to prospectors and others holding mining claims of which the boundaries are irregularly defined as viewed from a strict construction of the law. The Independence company has for many years held a group of placer claims near the old camp of Moose City, in Clearwater County. In 1916, Jack Moore and W. B. Simons, acting for themselves and others, located claims over the Independence ground, and the latter brought suit. The case was transferred to the district court of Kootenai County for trial, which resulted in a decision in favor of the Independence company. Appeal was taken to the state Supreme Court, which has now affirmed the decision of the lower court. Various contentions were made by the defendants in support of their right to relocate the ground, but the only claim discussed and passed upon by the Supreme Court was that the description of the Independence locations was not made with sufficient accuracy to identify their boundaries and that the complaint did not show that the ground was properly located as required by the laws of the United States and of the State of Idaho. Passing upon this point, and basing the decision upon it without discussing other evidence submitted, the court, in affirming the decision of the lower court, said: "Mineral deposits are frequently discovered in the wilderness, remote from a government survey. These discoveries are usually made by men who are not equipped with proper instruments, nor possessed of sufficient education, to enable them to correctly run lines, make measurements, and accurately describe the ground sought to be located. Some of these difficulties, at least, attended the location of respondent's claims. In such a case the law does not exact the impossible, but the rule has been thus stated: 'If, by any reasonable construction, in view of the surrounding circumstances, the language employed in the description will impart notice to subsequent locaters, it is sufficient.' Tested by this rule, respondent's notices are sufficient."

MARQUETTE, MICH.—June 4

Iron-Ore Shipments from this port show a marked falling off during May, and indicate that the season's tonnage will show a big decrease. This is made more probable by the fact that June opens in a manner no more lively than May and there is nothing in the situation at the moment to indicate that the shipments will increase greatly in volume. To date this year the Lake Superior and Ishpeming dock at Presque Isle has loaded 114,000 tons of ore. At a corresponding time last year the movement from the dock had been 380,000 tons, or well over three times as much. The falling off for the South Shore dock is in about the same proportion. In May last year at the L. S. & I. dock 56 steamers were dispatched, or an average of nearly two a day. The number loaded and cleared last month was only 17. Heavy quantities of ore in the furnace yards and a comparative lull in the iron market are given as the reasons for the marked falling off in the shipments from the upper Lake ports. Though conditions in Marquette may be slightly exaggerated as compared with some other ports, all are materially behind last year's shipments on Apr. 1, and though the amount of ore on the lower Lake docks was not materially greater than a year ago, the stocks in the furnace yards were reported heavy.

HOUGHTON, MICH.—June 6

Mohawk Will Show a Production of 1,230,000 lb. of refined copper for June and 1,100,000 for May, judging from careful estimates and assuming that the present status is maintained during June. In April, Mohawk sent down 48,913 tons of rock, securing therefrom 1,631,500 lb. of mill copper, showing 33.35 lb. per ton and 1,191,225 lb. refined copper, showing 24.35 lb. per ton. At present this average is maintained. Every underground facing is in rock, which is promising. June production, though it will show a slight increase, will be nothing sensational. More important to the future of the property is the fact that underground work is keeping openings further in advance than ever before. Mohawk is in position to increase output 10% when the market warrants such a step.

Copper Metal on Hand in the Lake Superior smelting plants at this writing does not aggregate 30,000,000 lb. Some of the Michigan copper mines have small amounts stored in New York warehouses, but practically none abroad. The total amount stored is just one month's output of the mines of this district, operating under normal conditions.

Calumet & Hecla and subsidiary mines have the greatest amount on hand, a total of 20,000,000 lb. This is the combined total showing at the Calumet & Hecla plant at Hubbell and the Lake Superior Smelting Co.'s plant at Dollar Bay, the subsidiary plant.

The Lake Superior plant was shut down 10 days ago, and all smelting hereafter will be done at Hubbell. A substantial amount of mass copper which was on hand at Dollar Bay was reshipped to Hubbell for treatment. Whether the Dollar Bay plant will be reopened when conditions improve again or not is a question which will be determined by the future product of the Calumet & Hecla mines. Since the opening of navigation, shipments of metal have been heavy and practically all of the copper has been sent out to fill urgent orders.

Shaft-Sinking at the Mayflower-Old Colony has reached 1250 ft., but progress is slow compared with the record for sinking at the Seneca property. However, conditions have been different, and there was not the same occasion for haste, although the progress at the Mayflower-Old Colony shaft has been economical and efficient. The general impression that this shaft will cut the Kearsarge amygdaloid lode is erroneous. The drill cross-section, as well as the geological history of the copper-containing lodes, indicates a "throw" of the upheaval east of the Kearsarge and nearer the sandstone. There is reason to believe that the copper lode under the Mayflower-Old Colony shaft presents a mining situation which is different from any other lode in the district. The angle of the dip is likely to be smaller than any other. The Pewabic lode in the bottom of one of the Quincy shafts today dips only 20 deg., but the Mayflower lode will be nearer the horizontal than that. The present operating company is a combination of two corporations and has 200,000 shares outstanding. The consolidation was made 18 months ago, principally due to the fact that drilling results warranted the sinking of a shaft and that one exploratory shaft would suffice for the two companies.

JEROME, ARIZ.—June 4

Slag Dump of United Verde's old smeltery, above Jerome, has become a menace to the railroad development passing below its 300-ft. face, a section of the slag face having collapsed, covering the grade of the Verde Tunnel and Smelter R.R. on the 300 level. A steam shovel and workmen were removed just in time to avoid being caught by the avalanche. Measures now are being taken to bench the slag face, to guard against further slides.

BISBEE, ARIZ.—June 4

Operation of "Safety-First" Rules is credited with the reduction of the percentage of permanent injuries per 1000 men among Copper Queen employees from 1.05 in 1915 to only .43 two years later. The men themselves have become interested in the maintenance of the safety rules, which now have become almost self-enforcing. It is recognized that carelessness on the part of a fellow employee may imperil the safety of an entire stoping crew.

Stripping Overburden on Sacramento Hill is about 40% completed, about 2,000,000 cu. yd. thus far having been handled by the steam shovels and trammed off to fill valleys near by, about 80 trainloads a day thus being disposed of. So much work remains to be done that the 5000-ton concentrator near Warren, though construction was stopped by the war, probably will be ready for work as soon as an ample ore supply for it has been developed and made ready for shoveling. Eventually, where the hill stands, a short distance below the main business section of the camp, there will be a great pit, embracing the whole width of historic Mule Pass, involving diverting elsewhere of the railroad and highway by which Bisbee is entered from the south.

Men are being added slowly to the operating forces of the Copper Queen and Calumet & Arizona properties, which now have about 3000 employees. A large proportion of the men taken on are returned soldiers. Only a few hundred men, mainly Mexicans, remain out of employment. Few of them are miners.

JOPLIN, MO.—June 6

Operation of the Picher Hospital has been undertaken by the mining operators of the Oklahoma section of the field. The companies are contributing $10 per month, and this, with the 25c. per man assessment against the miners, is expected to keep the institution going. The plan is similar to the one worked successfully in the case of the Jane Chinn Hospital, at Webb City, Mo., which has been operated by mining men for two years.

One Thousand Acres of Mineral Leases have been taken by W. L. D. Martin, of western Kansas, formerly a mine operator in this district, in the vicinity of Jay, Okla., about 40 miles south of Miami, Okla. He will start immediately prospecting for zinc, lead and copper. Mr. Martin has rich outcroppings of these minerals that he found about 40 years ago, but which he could not develop at that time because no mining leases on Indian lands were then being granted by the Government.

Continued Efforts to Increase the Uses of Zinc are being made by the business men and commercial clubs in this district. The Central Foundry is putting a sheet zinc roof on its new foundry building in Joplin. The business men of Miami are offering a prize to the first company or institution that will put on a zinc roof in that town. A new sanitary dinner pail has been invented by a Baxter man, which will be made of zinc and will have a ventilation apparatus calculated to keep the food in a more edible condition than is possible with the common types of dinner pail.

FORT WORTH, TEX.—May 31

Public Highways cannot be leased by Commissioners' Courts to any one intending to drill them for oil and gas. In the case of C. H. Clark et al. vs. T. R. Boone et al. (the former 99 taxpayers of Wichita County and the latter members of the

Commissioners' Court of Wichita County) the district court rendered decision in favor of the plaintiffs. The decision was affirmed by Justice Irby Dunklin, of the Court of Civil Appeals for the Second Supreme Judicial District, on May 31, at Fort Worth, making the injunction against erecting a derrick or drilling machinery perpetual. The case originated when members of the Commissioners' Court of Wichita County leased part of the public highway near Burkburnett to be drilled for oil and gas. C. H. Clark and 98 other citizen taxpayers of the county obtained an injunction, claiming this act to be against public policy, on the grounds that land donated by citizens of a county to be used as a public highway did not carry a fee simple deed to the property, and did not deed away the mineral rights, if they existed.

AUSTIN, TEX.—May 29.

Pipe-Line Companies operating in Texas were ordered by the Railroad Commission, under the act placing the pipe lines within the jurisdiction of the Railroad Commission, to file a written monthly report showing all expenditures for investments and operations, and operating revenues; also an annual report for the year ended Dec. 31, 1918, and each year thereafter.

BIRMINGHAM, ALA.—June 5

Figures for May Production and selling of iron are not yet released, but it is believed they will show a considerable gain over those for April. Particularly is this true for sales, the Woodward Iron Co. alone shipping between 10 and 20 cars a day, with promise of this being increased. The renewed activities of this company are particularly pleasing to this district, as the company employs a large part of the labor here, and the almost complete shutdown of its plants caused much concern. The company began work again during May and is rapidly renewing all operations. The third furnace at Woodward and one of the Vanderbilt furnaces near East Birmingham will be blown in soon. This will make four of the five furnaces of this company in operation, and, as a result, operations at ore mines, coke ovens, and limestone quarries will be increased to produce the raw material needed in the manufacture of iron. This in turn will provide employment for a considerable part of the labor in this district said to be surplus, though some companies are reporting no surplus.

It is expected a large tonnage of iron ore will be produced soon from the Woodward company's shaft mine, development of which is being pushed.

All six furnaces of the Tennessee Coal, Iron & R. R. Co. at Ensley, Ala., are now in blast and also two of the five at Bessemer, one on ferromanganese and the other producing basic iron.

In general the iron situation for Alabama at the close of May was far brighter than at any time during the present year. Many inquiries for pig iron are coming in and numerous small sales recorded.

ANYOX, B. C.—May 30

Another Advance in the Wages of employees of the Granby Consolidated Mining and Smelting Co. was announced recently at its smelting centre, Anyox. It amounts to 50c. a day to miners and 25c. a day to smelter men and others, approximately 1200 men being affected. This is in addition to a 25c. raise a day for every 2c. increase in the selling price of copper. Wages have been increased about $1 a day since Apr. 1, when the plant reopened after being suspended for about thirty days.

TORONTO, ONTARIO—June 7

Development of the West Shining Tree gold area, which is attracting much attention at present, will be considerably encouraged by the completion of the road which is being built to the camp by the Ontario government. It was begun some time ago, when the foundation for a good automobile road was laid. Work has been resumed, and it is expected that the road will be completed within two months, when the trip from the railroad can be accomplished in two hours.

Demands Presented to Mine Operators by the miners belonging to the Kirkland Lake branch of the International Mine, Mill and Smelter Workers' Union asking for a 44-hour week at the same wages as are paid for the present 48-hour week, recognition of the union and a minimum wage of $4.50 per day for all underground workers. The operators are asked for a reply within 10 days from May 27. The general feeling among the mine managers is that in view of the economic conditions affecting the gold-mining industry, the demands cannot be granted. Similar action has been taken by the miners at the Porcupine and Cobalt camps.

The Mining News

ARIZONA

Cochise County

DENN-ARIZONA — (Bisbee) — Further exploration of strike of copper ore cut for 35 ft. on 1700 level suspended until extraordinary flood of water which has filled workings to 1600 level can be controlled.

Gila County

AZTLAN—(Chilito)—New gold strike in southern point of county, north of Winkelman. Hiram Whitcomb, of Tucson, has control of group and has secured capital for development and building of 100-ton mill and cable tramway to Arizona Eastern R. R., on Gila River, five miles distant.

PORPHYRY CONSOLIDATED—(Globe)—Stockholders of Barney Copper Co. have approved consolidation with Porphyry, with nearly all stock represented at meeting in Globe. Winze to be sunk 200 ft. below 650 level, in expectation of passing into sulphides.

Mohave County

CATHERINE — (Kingman) — Development has fully defined fault in main vein, and funds are in treasury for large development work on three levels to 400 feet.

RURAL—(Kingman)—Preparing for installation of 100-ton mill, with electrical equipment. Bunkhouses for 50 men being built. Constructing new road for motor truck transporation. Rich wire silver taken from bottom of shaft. Situated at Mineral Park.

UNITED AMERICAN (Oatman)—Roadway completed to shaft, which is being equipped for sinking to 500 ft.

McCRACKEN — (Signal) — New mill given test run on silver-lead ores, with excellent results reported.

Pinal County

RAY-BROKEN HILL—(Ray) — Purchased from W. J. Graham controlling interest in Little Bobbie Co., securing nine claims into which development will be extended. Another adjoining group, the Tillman, also acquired. Consolidated property will be worked through long tunnel now being driven from creek level below Ray.

CALIFORNIA

Nevada County

WOOLSEY GROUP (Cherry Hill)—Extensive work planned on these gravel properties by V. Butters, F. C. Foote and W. T. Foote, of Long Beach.

BAKER (Graniteville)—Five-stamp mill to be in operation when work justifies.

ALLISON RANCH (Grass Valley)—Recently elected E. E. McMichael president, Scott Ennis vice-president, Henry H. Heilbron secretary, and C. H. Brockington superintendent. Upper levels being worked by lessees with good results.

SOUTH STAR COMPANY (Grass Valley)—George E. Freeborn, manager, reports finding of high-grade ore in vein of large dimensions, after long search.

ASBESTOS (Washington)—Preparing to ship products this season. Work can be prosecuted in summer only, because of necessity of keeping fiber dry.

Shasta County

GARFIELD MINING COMPANY (Old Diggings)—Acquired Garfield mine. Permitted to sell 20,100 shares at par, proceeds to be used in development and operation.

AFTERTHOUGHT COPPER (Redding)—Announced after inspection by principal owners that flotation plant and zinc plant will be put in operation. Ore carries gold, silver, copper and zinc.

Lassen County

GRAY MOUNTAIN (Westwood)—Development resulted in finding 6-ft. vein high-grade ore.

COLORADO

Clear Creek County

STANLEY — (Idaho Springs) — Being developed and operated under leasing system. All ground above Rood Adit level and south of Clear Creek leased to E. F. Viesselman, with exception of one block of ground on Stanley vein in Whale level, which is operated by John Symons. The Viesselman ground is being subleased. The Rood Adit level has been cleaned out to the breast, a distance of 3500 ft. Caved ground retimbered and new development work in progress. Body of commercial ore opened near Golden Link shaft, and regular shipments of high-grade silver-lead ore being made. Considerable milling ore shipped to local mills for concentration, and the concentrates sold to Idaho Springs sampler. Thomas & Co. operating lease on Hukill vein north of Clear Creek, and upper Hukill level being advanced northeasterly, with encouraging results.

San Miguel County

GOOD MINERS are in demand by most of the large mining companies operating in the vicinity of Telluride. Comfortable quarters and good wages are assured to about 200 miners.

DEWEY (Ophir Loop)—New raise being made on 4-ft. vein of commercial milling ore. W. S. Carhart, superintendent.

COLORADO VANADIUM CORPORATION (Sawpit)—Acquired Simmons mill and will remodel it for the treatment of vanadium ore. Construction of new mill on San Miguel River below Fall Creek under consideration. Frank G. Gardner, manager.

PRIMOS CHEMICAL CO. (Vanadium)—New mill is under construction. Part of structural steel work erected. During construction of new plant underground development continues.

IDAHO

Shoshone County

NABOB (Beeler)—Expect 150-ton concentrator to be completed and running in 30 days. Small force working in mine preparatory to supplying mill with ore. Large oreshoot proved in Denver claim and considerable ore available in Nabob. Controlled by Stewart Mining Company.

COPPER KING (Mullan)—Contracted for 1000 ft. prospecting work with diamond drill. Will determine extent of present orebody and prospect virgin ground to north.

NATIONAL (Mullan)—Shipped 15 carloads concentrates in May, averaging 15% copper and 40 oz. silver. Net value of shipments about $70 per ton. Started work on 800 and 600 levels, above main working tunnel, where shoot of higher-grade ore has been found.

SUCCESS (Wallace)—Lessees on upper workings shipped five carloads lead concentrates. Working on body of lead and zinc ore between 700 and 600 levels. Have 200 tons of 40% zinc concentrates. No profit in shipping them at present price, owing to excessive freight rates and smelter charges.

MICHIGAN

Gogebic Range

TILDEN (Bessemer)—Oliver Iron Co.'s diamond drilling completed. Begun in June, 1917, with two machines; later another machine added. Drilled 14 holes from 243 to 1587 ft. deep, average being 601 ft. Six holes drilled from 21st and 23rd levels of No. 10 shaft. Depth of holes from 248 to

670 ft., average 492 ft. Most of drilling done with "E" bit, and cased. Casing usually blasted down, reaming done where blasting failed. Vugs, being hard rock and soft dikes, caused much trouble. Drilling results of geologic interest, although little new ore found. Surface holes situated 800 ft. or more from foot wall. Previous exploration by underground workings confined to area near foot wall.

TOWNSITE (Ironwood)—Now working two shifts again.

MINNESOTA

Cuyuna Range

CHESTER (Chisholm)—Has completed shipment of entire winter stockpile, about 70,000 tons. One of the first to accomplish this.

HULL-RUST (Hibbing)—Shipping 60,000 tons high-grade ore per 24 hours. A record even for this largest pit.

BONNIE BELLE (Ironton)—Shipping 200 tons per day to Zenith Furnace Co., Duluth. Iron ore producer of Marcus L. Fay.

KINNEY (Kinney)—Operating churn drills along north side of present pit development. Republic Iron and Steel Co., operator.

PILOT (Mountain Iron)—Cleaning ore preparatory to shipping.

FERRO (Trommald) — Loaded from stockpile and shipped 5000 tons manganiferous ore sold to Algoma Steel Company.

MISSABE MOUNTAIN (Virginia)—Oliver Iron Mining Co. check-drilling considerable portion of property.

OMAHA IRON COMPANY (Woodrow)—Operating Wilcox mine. Issued $250,000 bonds, of which $150,000 have been sold to make necessary improvements, and for development and working capital. Balance of $100,000 will be sold if needed. Underground iron-ore producer, ore being dried before shipment. Has 10-year contract for ore at rate of 100,000 tons per year; other contracts pending.

MONTANA

Broadwater County

INDIAN CREEK PLACERS (Hassel)—Sluicing 50-ft. gravel bank with hydraulic and bedrock flume. Water at low stage.

IRON MASK (Hassel)—Driving 2000-ft. crosscut tunnel to ore vein. Air compressor driven by gasoline power.

JUMBO (Hassel)—New company takes over old silver-producing property at the headwaters of Indian Creek, and will reopen it.

Jefferson County

LEGAL TENDER (Clancey)—New owners in control. Shaft to be deepened below 500-ft. level and electric power to be installed. High-grade silver ore.

Lewis and Clark County

HELENA (Helena)—Prospecting vein at 400 level with north-south drifts. May sink to 500 level soon.

STEMWINDER (Helena)—New hoist and pump received. Ore carries high silver content.

WHITLATCH (Helena)—Lessees working on 400 level; drifting west on vein, with showing of ore in sight.

Silver Bow County

ANACONDA (Butte)—Drifts easterly and westerly on the 500 of the Anglo-Saxon fissure in Orphan Girl mine continue in milling ore, and shipments to the Washoe concentrator daily are more than 100 tons. Indicated tonnage thus far is heavy, vein being about 50 ft wide, with orebody about 35 ft in width. Drift on 500 of Orphan Girl fissure entering mineralized zone appears of considerable promise. Orphan Boy vein, on same level, and also in Orphan Girl mine, showing about 3 ft. silver-zinc ore of good grade.

Concreting Diamond shaft begun in accordance with shaft fireproofing plans for company's 50-odd air and working shafts in district. Scarcity of miners resulting in decision to suspend mining operations at this property, one of the larger copper producers, and embrace the opportunity for improvement work, which will require several months' time. Badger State, one of the largest mines, resumed operations recently after about a week's shutdown in consequence of engine trouble. Endeavoring to speed up on development work but difficulty in securing experienced miners hampering the effort. Production around 50%, but indications that this may be increased within a short time.

BUTTE & SUPERIOR (Butte)—Sinking No. 2 shaft will be under way soon, preparatory to carrying all workings to lower levels. Ore showing east in Four Johns on the 1800 in large tonnage with grade, 17% zinc, 6 oz. silver as general average of mill heads. Shoot showing 8 ft. ore going more than 50% zinc and 20 oz. silver east on 1900 is continuing. Quarterly report for period ending Mar. 31 shows deficit after taxes of $116,379, as compared with profits of $96,506 for preceding quarter and $327,981 for first quarter of 1918. May production 10,000,000 lb. of zinc in concentrates, and 210,000 oz. silver. Tonnage mined, 35,400, from which concentrate recovery was 9250 tons, with the mill saving 97%. Angus McLeod, superintendent.

SOUTH DAKOTA

Pennington County

NATIONAL TIN CORPORATION (Hill City)—Has purchased three carloads machinery to add to equipment, including one 550-ft. Norwalk compressor, air tank, and two dreadnaught drills; one 40-hp. boiler for prospecting on Mohawk shaft; eight Isbell vanners, seven Wilfley tables, and one 5 x 4 ft. ball mill, with three tons of balls. Cowboy shaft unwatered, and being widened to make it double compartment. Being deepened to follow the ore which parallels it, and will contract for additional 500 ft. Foundations for ball mill will be started in the coming week, and also for installation of concentrators. Intend to crush with present rolls and to use the jigs, after which sands will be reground and classified on Wilfley roughing tables, then to fine Wilfleys and vanners. Fine slimes from Wilfleys and vanners will go to canvas plant with 2000 sq. ft. surface. Concentrates will be smelted in present furnace, using carbon-monoxide method. Later, electric furnace may be installed if proves cheaper.

TEXAS

Bell County

BELL-LEON OIL CO. (Temple)—Recently organiz d; capitalization, $50,000. J. B. Dyess, of Belton, president. Has leases on 6000 acres near Summers; mill between Lampas and Saldado rivers. Eight other companies have holdings in this region. Financed by local capital.

NOLAN-BELL OIL CO. (Temple)—Contracted for building of derrick and will buy standard rig at once. Owns 1200 acres, five miles from Nolanville, west of Temple, on Santa Fe railroad.

Brazoria County

WEST COLUMBIA PRODUCTION for fourth week in May, 24,785 bbl. per day, as compared with 17,600 bbl. per day for previous week. Producing companies as follows: The Texas Co., 7400 bbl.; Gulf Production Co., 6400 bbl.; Crown Oil Co., 5000 bbl.; Humble Oil Co., 4950 bbl.; Sun Oil Co., 1000 bbl.; Hanicker Oil Co., 35 barrels.

FREEPORT SULPHUR CO. (Freeport)—Shipments of sulphur now being made to Galveston for export. Only ships of too great draft to enter channel at Freeport will be loaded at Galveston.

Crockett County

RYAN PETROLEUM CO., of Bartlesville, Okla., leased 20,000 acres near San Angelo. First test well will be sunk near Ozona.

Jefferson County

GULF PRODUCTION CO. (Beaumont)—McFadden No. 1 well came in flowing about 250 bbl. a day, even though not completed, oil pushing up past wash pipe left in well. Efforts to remove pipe abandoned temporarily, as wind carried oil in spray toward boiler. Main feature of interest is that well is producing from depth of 3000 ft., though pay oil first opened at Spindletop was 700 to 800 ft. deep. McFadden No. 2 well will be drilled 100 ft. south and 100 ft. east of No. 1 well.

THE TEXAS CO. (Beaumont)—Started drilling Fee No. 1 and Fee No. 2 at Spindletop.

Orange County

GUM OIL CO. (Orange)—All stock of company sold recently to New York men for $385,000. Consists of three leases in Vinton field, 10 miles east of Orange; five wells in operation.

Wichita County

TEXAS CHIEF OIL AND GAS CO. (Burkburnett)—Reported well brought in one and one-half miles north of Burk_waggoner extension, flowing 5000 bbl. high-gravity oil from depth of 1650 feet.

UTAH

Juab County

TINTIC SHIPMENTS week ended May 31 amounted to 137 cars and the total for the month—five weeks—to 704 cars, about 35,000 tons, of an estimated value of $1,100,000. This is compared with 597 cars in April and 584 in March. Production for first five months in 1919 was 3143 cars, estimated at 155,000 tons, of a value of about $4,050,000. There were 25 shippers.

CENTENNIAL-EUREKA — (Eureka) — Two drifts being run on 2000 level, 100 ft. below water level. Water taken care of by lifting to 1900 where lost in fissuring.

IRON KING — (Eureka) — Compressor on foundations and hoisting engine expected on ground soon. Power line being extended to shaft. Force working on iron ore underground.

OPHONGO — (Mammoth) — Reported work may be resumed here under lease to active Tintic interests.

COLORADO—(Silver City)—Promising fissure cut on 1900. Possible new source of ore.

Salt Lake County

SHIPPING SEASON, although beginning late owing to severe snowstorms in March and April, now in full force. Record of one day's shipment was 160 tons over the Little Cottonwood Transportation Co.'s narrow-gage line.

TAR BABY (Salt Lake)—New men in control. Directors, J. Martin Matsen, president; R. G. Savage, J. W. Brewer, A. P. Davidson, and W. N. Gundry.

Summit County

PARK CITY SHIPMENTS for May amounted to 2767 tons.

Tooele County

McKINLEY, DOOLEY-ST. CLAIR AND KELLEY GROUPS (Ophir)—Consolidation of above reported. Taken over by Nevada men. Part of ground adjoins Ophir Hill and part across canyon.

CANADA

Ontario

MILLER INDEPENDENCE — (Boston Creek)—Main vein cut by diamond drill at 103 ft. in hole about 150 ft. east from "D" shaft. Width of 16 ft. indicated, vein being highly mineralized.

McKINLEY-DARRAGH — (Cobalt) — Exploration program adopted for southeastern part of property, near where Nipissing has obtained satisfactory results.

OPHIR—(Cobalt)—Nipissing Mining Co. has dropped its option.

PETERSON LAKE—(Cobalt)—Annual shareholders' meeting took place in Toronto on June 2. Number of directors was increased from five to nine, the following being elected: W. A. Lamport, C. M. Nickel, D. E. Kennedy, C. R. Powell, M. G. McLean, and W. G. H. Browne, all of Toronto; J. E. Carter, Guelph; Irving L. Ernst and Max B. Borg, both of New York.

BALDWIN — (Eby Township) — Vein struck carrying free gold on 200-ft. level.

LEROY — (Gowganda) — Crew engaged on surface work; underground operations will be started soon.

KIRKLAND LAKE—(Kirkland Lake)—Accident in connection with electrical equipment temporarily interfered with milling. Considerable high-grade ore added to reserves.

TOUGH OAKES—(Kirkland Lake)—Ore reserves developed sufficient to keep mill running six to eight months. Management will concentrate on development, and mill will not be operated until late in summer.

FIDELITY — (Skead Township) — Vein opened on surface shows visible gold.

UNION NATURAL GAS CO — (West Dover)—No. 13 Trenton well struck gas and stated to be obtaining initial flow of 6,000,000 to 8,000,000 cu.ft. per day. No. 14 well reported producing about 5,000,000 cu. ft. These wells give promise of being large oil producers, but the provincial inspector has stopped further drilling, on account of the loss of gas that would result. Will probably be deepened into the oil-bearing stratum when the flow of gas decreases. Several other wells in area are producing oil and gas, the gas stratum being reached at a depth of from 2900 to 3100 ft. and oil at about 3,100 to 3,300 feet.

FOISEY CLAIMS—(West Shining Tree)—Optioned to E. J. Longyear Co., of Minneapolis, Minnesota.

The Market Report

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	June	Sterling Exchange	Silver New York, Cents	Silver London, Pence
5	4.6175	109⅛	53⅛	9	4.6350	109½	....
6	4.6213	109⅛	53⅛	10	4 6250	110⅜	53¾
7	4.6213	109⅛	53⅛	11	4.6200	111½	54⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
5	16.60 @16.70	†72½	5 15 @5.25	4.90 @5.00	6.125 @6.15
6	16.80 @17.10	†72½	5.25	4.90 @5.00	6.15 @6.20
7	17.10	†72½	5.25	4.95 @5.00	6.20 @6.30
9	17.15 @17.35	†72½	5.25 @5.35	4.95 @5.00	6.275 @6.375
10	17.35	†72½	5.30 @5.35	4.975 @5.025	6.40 @6.50
11	17.60	†72½	5.35 @5.40	5.05 @5.10	6.50

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

June	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
5	78⅞	79⅛	81½	233¼	229½	22¾	23	35½
6	79½	79¾	82	234	229¾	22¼	22	35½
7		....	...		..		.	...
9	....	....	...	....	....	...	....	....
10	80½	80¾	83	235⅛	230¾	22¼	22½	36
11	79½	80¼	83	236½	232¾	22¼	22½	36⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—June 11, 1919

Copper, lead, and zinc were excited this week, and each advanced sharply in price. In each metal there was large speculative buying.

The silver market has steadied itself at about $1.09. Our London advices are that the Indian government will not buy silver at any price for the present and does not propose to raise the embargo on imports of silver into India. The silver question is being carefully considered in London, and strong efforts to check any further advance in price will surely be made.

Transatlantic freights and transpacific freights remain unchanged from the quotations of last week.

It has come to our attention that there was an error in the price of standard spot copper and three-months lead in London on May 7, as published in the "Journal" of May 10. The correct figures are as follows: Standard spot copper, £76⅜; three-months lead, £24⅜.

Also, on account of indistinct printing, a number of the London metal prices during May did not show up clearly. In order that the record may be correct the prices for the entire month are reprinted herewith.

LONDON

May	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
1	76	76⅛	80½	226¾	226	24½	24	35¼
2	75¾	75¼	80½	226¼	225¾	24½	24	35¼
3	...	...	...	....	....	...	...	...
5	75¾	76	80	226¾	227	24½	24	35
6	76½	76½	80	227⅛	228	24	24¼	34½
7	76⅜	76½	80	228½	228¼	24⅛	24⅜	34¼
8	76½	76⅜	80	229½	228¼	24⅛	24⅜	34¾
9	76¾	77	80½	231½	229½	24	24¼	34¾
10	...	...	...	....	....	...	...	...
12	76¼	76¾	80½	236	233	24	24¼	34¾
13	76¾	77¼	80½	235	232¾	24⅛	24½	35¼
14	77¼	77¼	81	236	233½	24¼	24½	35
15	77½	77¾	81	237	234	24⅛	24⅛	35¼
16	78	78¼	81½	242	237½	24⅜	24⅜	35⅝
17	...	...	...	....	....	...	...	...
19	79¼	79½	82	246½	242½	24⅜	24⅜	36
20	79½	79¼	82	245	241½	24⅜	24½	36
21	79⅜	79½	82	239	237	23½	23¾	36
22	79¼	79¾	82½	236	232¼	23½	23¾	36¼
23	78½	78.85	82½	233¼	229	23½	23¾	36¼
24	...	...	...	....	....	...	...	...
26	78¾	79	82	236	230¾	23⅛	23½	36¼
27	79¼	79⅜	82	237	231	23	23⅛	35¼
28	79¼	79½	82	235	230	22⅜	23	36
29	79⅛	79¼	82	233½	229¼	22¾	23	36
30	78¼	79	82	232½	229	22¾	23	35⅝
31	...	...	...	....	....	...	...	...

In the "Journal" of June 7, the New York silver price of June 3 did not show clearly, owing to defective printing. The price on that day was $1.09½.

Copper—The market was excited right from the beginning of the week and advanced not only from day to day, but also from morning to afternoon. At the beginning of June 5, the market was on the basis of 16.60c., but by the end of the day it was firmly established at 16.70c. Considerable speculative buying began to be done, and England was reported reselling contracts, her price being lower than ours. On Tuesday the market became pretty steady on the basis of 17.35c., a rather large business being transacted, and before the end of the day 17.60c., or 17⅝c., delivered, was asked and received for some small quantities, but with June 11 the market could be called established on that basis.

The aggregate of business done during the week was fairly large, but in no way sensational. However, producers found it easy to advance their prices on relatively small business. Wire-drawers were buyers, but a considerable part of the business of the week was of purely speculative character.

It was supposed that the Japanese had finished their buying but some further inquiries from that quarter appeared in the market. According to comparatively recent mail advices from London, the Japanese have paid cash there to cancel c.i.f. contracts.

The labor situation in this country is becoming threatening and is playing a part in the copper market. On the one hand, strikes among copper manufacturers in New England and New York are causing them to ask for delay in deliveries. On the other hand, the general situation as to labor in the Western mining and metallurgical districts is becoming critical. No higher wages than at present can be paid but the present rates are insufficient to maintain the working forces.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 19½@19⅝c.

Tin—The balance of unsold stock on June 1, as reported by Mr. Armsby, was 1615 gross tons. From June 2 to June 7 sales were 544 tons, leaving 1971 as the balance on June 9.

Lead—The demand for lead in the middle West has been such that for some time the interior market has been out of joint with New York, where some liquidation of speculative lead was being made. Up to June 5 some cheap lead was still to be had in this market, but with June 6 all such offerings disappeared, and consumers who required some round lots had to pay the full price of 5.25c. Beginning with June 9 some large buying developed in the St. Louis market, while Western producers made sales for delivery at various places in the interior at prices considerably above the New York parity, following which some producers advanced their prices in New York. On June 11, 5.40c. was realized in the forenoon, and immediately afterward the American Smelting and Refining Co. advanced its price to 5.40c. This advance brought the New York market more nearly into line with St. Louis.

Zinc—The market advanced sharply from day to day on rather large business, which appeared to be mainly of a speculative character. The nature of the market was such that considerable irregularity was exhibited.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 33c. per lb. Unchanged.

Antimony—The market was steady at 8⅜@8½c. Futures were quoted at 8@8¼c., duty paid, New York, for June-July shipment from the Orient.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Strong at $92. San Francisco telegraphs $88, firm.

Silver and Platinum

Silver—During the last week the silver market has been steady, with a rise on June 10 and a still further rise on the 11th to 54⅛d. in London and $1.11½ in New York. There has been a constant demand from buyers outside the London market, principally from the China banks, combined with orders from Scandinavian and South American countries. Sterling exchange has strengthened somewhat from the low figure of last week, and, although it has reacted lately, it has not dropped again to the previous low level.

Mexican dollars at New York: June 5 84; June 6, 84; June 7, 84; June 9, 84½, June 10, 84⅝; June 11, 85½.

Platinum—Refined ingot was in good demand at $105.

Palladium—Strong at $120.

Zinc and Lead Ore Markets

Joplin, Mo., June 7—Blende, per ton, high, $43.90; basis 60% zinc, premium, $42; Prime Western, $42; sludge and flotation, $40@35; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $37.86; calamine, $22.72; all zinc ores, $37.54.

Lead, high, $64; basis 80% lead, $60@57.50; average settling prices, all grades of lead, $58.38 per ton.

Shipments the week: Blende, 9403; calamine, 195; lead, 1374 tons. Value, all ores the week, $440,620.

One smelting company, which has been a light buyer for several months, came into the market strong this week, contracting nearly 6000 tons on a $42 basis, just at a time when all other buyers had decided prices must decline, following spelter downward. Two of the large mills of the Waco district closed down last Saturday, but others to be closed tonight will wait a little longer, hoping for a steadier ore market.

Platteville, Wis., June 7—Blende, basis 60% zinc, $44 base for premium grade, and $42.50 base for high-lead grade. Lead ore, basis 80% lead, $56 per ton. Shipments reported for the week are 1979 tons blende, 82 tons galena, and 274 tons sulphur ore. For the year to date the totals are 43,777 tons blende, 2168 tons galena, and 5806 tons sulphur ore. During the week 2639 tons blende was shipped to separating plants.

Other Ores

Manganese Ore—Some business in odd lots reported done at 50c. per unit for metallurgical ore.

Molybdenum Ore—Some business was reported done at 65@75c. for ore of good grade.

Tungsten Ore—A fair business reported done at about the same prices as last week.

Other Minerals

Pyrites—Spanish pyrites is quoted at 20c. per unit for furnace ore and 18c. for unbroken ore, c.i.f., New York or other Atlantic port. Unchanged.

Nitrates—The present Government price of nitrate of soda, fixed at $4.07½, is expected to drop to about $3.10 on June 30, when Government control will be removed.

Iron Trade Review

PITTSBURGH—June 10

Not much further improvement in the volume of steel orders has been observable in the last week, but in some lines there has been at least a little improvement. The most marked change is in merchant steel pipe, which now shows a demand not far below normal. Demand for oil-country goods continues excellent, and some mills have fallen behind in deliveries of lap-weld sizes, although running practically at capacity in lap-weld departments. In sheets there is some improvement. Plate and shape demand continues light, and merchant steel bars show moderate and unchanged demand.

The Steel Corporation's unfilled obligations decreased during May by 518,375 tons, or about 100,000 tons less than the average decrease in the four months preceding. Shipments amounted to about 800,000 tons, so that fresh bookings amounted only to about 300,000 tons. The unfilled tonnage reported, however, includes contract obligations, and during the month there were increased specifications against contracts, which meant a larger total booked in actual shipping orders than in preceding months, even though the figures relating to contract obligations appeared unfavorable.

The Valley market is quotable at Mar. 21 prices, except as to basic, which can be shaded 75c., the Valley market being Bessemer, $27.95; basic, $25; foundry, $26.75; forge, $25.75, f.o.b. furnace, with $1.10 freight to Pittsburgh, but furnaces outside the Valleys would probably sell in Pittsburgh at delivered prices $1 to $1.60 less on basic iron and $1.50 to $2 less on foundry iron.

Steel—The billet market is almost absolutely dead, but there is a fair run of sheet-bar orders for nearby deliveries, at full prices in all or nearly all cases. The market remains quotable at Mar. 21 prices: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferromanganese—The uncertainty as to prices at which English producers would sell ferromanganese is now in line to be ended, as some agents have authority to sell 80% alloy at $125, delivered consuming points. For some time it had been thought they would sell at £25, c.i.f., but there were claims that £30 was the regular price. Domestic makers continue their nominal quotation of $150. Resale material still makes the market, but is somewhat harder to find at previous quotations, $110@115, delivered. Spiegeleisen remains nominally at $33@35, delivered, for resale, 18%.

Coke—The market has been quiet but each week coke producers have higher views as to what they want for second-half furnace coke. It is rumored that some Connellsville furnace coke can be had at $4 for second half, but operators insist they want much more, and are talking sliding scale contracts. Eastern furnaces state that if they had to pay $4 for Connellsville coke they would take byproduct instead, there being two good sources of supply, Bethlehem and the new Midvale operation, about completed. Spot furnace coke is now fairly firm at $4 per net ton at ovens, spot foundry being $4.50@5, depending on grade.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1917	New York 1918	New York 1919	London 1917	London 1918	London 1919
Jan	75.630	88.702	101.125	36.682	44.356	48.438
Feb	77.685	85.716	101.125	37.742	42.792	48.027
Mar	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	107.135	37.940	48.980	52.104
June	76.971	99.500		39.065	48.875	
July	79.010	99.625		40.110	48.813	
Aug.	85.407	100.292		43.418	49.077	
Sept	100.740	101.125		50.920	49.500	
Oct	87.332	101.125		44.324	49.500	
Nov	85.891	101.125		43.584	48.969	
Dec	85.960	101.125		43.052	48.492	
Year	81.417	96.772	...	40.851	47.516	

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper	New York Electrolytic 1918	New York Electrolytic 1919	London Standard 1918	London Standard 1919	London Electrolytic 1918	London Electrolytic 1919
Jan	23.500	(a)	110.000	92.238	125.000	106.619
Feb	23.500	16.763	110.000	78.700	125.000	95.700
Mar	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500	15.864	110.000	77.767	125.000	81.227
June	23.500		110.000		125.000	
July	25.904		119.913		134.913	
Aug.	26.000		122.000		137.000	
Sept.	26.000		122.000		137.000	
Oct	26.000		122.000		137.000	
Nov.	26.000		122.000		137.000	
Dec.	(a)		118.447		133.167	
Year	24.628		115.530		130.607	

(a) No Market.

Tin	New York 1918	New York 1919	London 1918	London 1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.600	329.905	225.275
May	(a)	72.500	364.217	234.398
June	(a)		331.925	
July	(a)		360.347	
August	(a)		380.900	
September	(a)		343.905	
October	(a)		335.543	
November	(a)		323.650	
December	(a)		267.736	
Av. year	(a)		330.138	

(a) No average computed.

Lead	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	6.782	6.432	6.684	6.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818	5.018	6.704	4.773	29.00	23.852
June	7.611		7.510		29.00	
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Spelter	New York 1918	New York 1919	St. Louis 1918	St. Louis 1919	London 1918	London 1919
January	7.836	7.272	7.661	7.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	48.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314	6.429	7.114	6.079	54.000	35.477
June	8.021		7.791		54.000	
July	8.698		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡ 1918	Bessemer‡ 1919	Basic‡ 1918	Basic‡ 1919	No. 2 Foundry 1918	No. 2 Foundry 1919
January	$37.75	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.75	32.54	33.95	31.40	33.95	29.12
April	36.15	29.35	32.95	27.15	33.95	28.15
May	36.20	29.35	33.00	27.15	34.00	28.15
June	36.36		33.16		34.16	
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	June 10
Alaska Gold M.	3¼
Alaska Juneau	2⅛
Am.Sm.&Ref.,com.	83¼
Am.Sm. & Ref., pf.	106
Am.Sm.Sec., pf., A.	93
Am. Zinc	24½
Am. Zinc, pf.	62
Anaconda	73
Batopilas Min.	1¾
Bethlehem Steel	88
Butte & Superior	29¼
Butte Cop. & Zinc	13⅛
Cerro de Pasco	51½
Chile Cop.	26⅛
Chino	46¼
Colo. Fuel & Iron	49
Crucible Steel	92¼
Crucible Steel, pf	99
Dome Mines	14½
Federal M. & S.	14¼
Federal M. & S., pf.	44
Great Nor., ore ctf.	46¼
Greene Cananea	44
Gulf States Steel	66⅛
Homestake	86
Inspiration Con.	59¼
International Nickel	28½
Kennecott	39¼
Lackawanna Steel	86
Mexican Petrol.	187⅝
Miami Copper	28¼
Nat'l Lead, com	82
National Lead, pf	108
Nev. Consol	19⅛
Ontario Min.	8⅛
Ray Con	24⅛
Republic I.&S.,com	89⅛
Republic I.&S., pf.	104⅛
St. Joseph Lead	14½
Sloss-Sheffield	65
Tennessee C. & C.	14
U. S. Steel, com.	108⅛
U. S. Steel, pf.	116⅛
Utah Copper	87½
Va. Iron C. & C.	68
Worthington Pump	80⅛

BOSTON CURB*	June 10
Boston Ely	2
Boston & Mont.	76
Butte & Lon'n Dev.	.17
Calaveras	1½
Chief Con.	3¼
Contact	05
Cortez	.20
Crown Reserve	.25
Crystal Cop.	.12
Eagle & Blue Bell	2 1/16
First Nat. Cop.	1 3/16
Gadsden Cop	3⅛
Houghton Copper	1
Intermountain	‡ 05
Iron Blossom	38
Iron Cap	10½
Majestic	30
Mexican Metals	22
Mines of America	‡ 05
Mojave Tungsten	12
Nat. Zinc & Lead	10
Nevada-Douglas	15
New Baltic	1½
Oneco	1
Pacific Mines	‡ 25
Rex Cons	14
Yukon Gold	75

SAN FRAN.*	June 3
Alta	‡ 08
Andes	‡ 30
Best & Belcher	‡ 20
Caledonia	‡ 24
Challenge Con.	‡ 03
Confidence	‡ 25
Con. Virginia	‡1 95
Gould & Curry	‡ 10
Hale & Norcross	‡ 25
Jacket-Cr. Pt	‡ 20
Mexican	‡ 52
Occidental	‡ 40
Ophir	‡1 55
Overman	‡ 10
Savage	‡ 20
Sierra Nevada	‡ 15
Union Con	‡ 35
Utah Con	‡ 04
Belmont	3 50
Jim Butler	36
MacNamara	‡ 00
Midway	37
Mont.-Tonopah	‡ 20
North Star	10
Rescue Eula	17
West End Con.	2 10
Atlanta	04
Booth	.09
Comb. Frac.	04
Florence	43
Jumbo Extension	.12
Kewanas	03
Nevada Hills	.05
Nevada Packard	.20
Round Mountain	.39
Silver Pick	.07
White Caps	.10

COLO. SPRINGS*	June 3
Cresson Con	4 31½
Doctor Jack Pot	03½
Elkton Con	05
El Paso	18
Gold Sovereign	‡ 02
Golden Cycle	1 07
Granite	14
Isabella	04½
Mary McKinney	07½
Portland	.98½
United Gold M.	16½
Vindicator	32

BOSTON EXCH.†	June 10
Adventure	1½
Ahmeek	79½
Algomah	.80
Allouez	44½
Ariz. Com.	15
Arnold	‡ 20
Bingham Mines	9½
Bonanza	‡ 20
Butte-Balaklava	.65
Calumet & Ariz.	69½
Calumet & Hecla	420
Carson Hill	15
Centennial	17½
Copper Range	52¼
Daly West	2⅛
Davis-Daly	7
East Butte	15¼
Franklin	4½
Granby	76½
Hancock	7
Hedley	‡12
Helvetia	6
Indiana	1½
Isle Royale	38
Keweenaw	2
Lake	6
La Salle	3½
Mason Valley	3¼
Mass	7½
Mayflower	10½
Michigan	6¼
Mohawk	68½
New Arcadian	4
New Cornelia	21½
New Idria	9¼
Nipissing	11½
North Butte	15
North Lake	1½
Ojibway	2½
Old Dominion	43
Osceola	58
Quincy	72
St. Mary's M. L.	63
Santa Fe	‡ 25
Seneca	23½
Shannon	4
Shattuck-Ariz	15½
So. Lake	3
So. Utah	25
Superior	9
Superior & Bost	4
Trinity	4
Tuolumne	1¼
U. S. Smelting	68¼
U. S. Smelting, pf	49½
Utah Apex	3¼
Utah Con	11¼
Utah Metal	2½
Victoria	4¼
Winona	1¼
Wolverine	23½

N. Y. CURB†	June 10
Am Tin & Tung	1¼
Big Ledge	1/16
Butte & N. Y.	1¼
Butte Detroit	‡ 03
Caledonia	40
Calumet & Jerome	1 1/16
Can. Cop. Corpn	1⅝
Carlisle	‡2
Cashboy	08½
Con. Ariz. Sm.	1¼
Con. Coppermines	6⅛
El Salvador	4½
Goldfield Con	18
Goldfield Merger	‡.04½
Hecla Min	5¼
Howe Sound	‡4¼
Jerome Verde	‡1 1/16
Louisiana	‡¼
Magma	37½
Marsh	.07
McKinley-Dar-Sa	.60
Milford	‡ 75
Mother Lode	42
Nixon Nevada	23
Ohio Con.	50
Rawley	‡2½
Ray Hercules	2¼
Richmond	‡ 50
Rochester Mines	.20
Standard S. L.	1
Stewart	.30
Success	‡ 04
Tonopah	3⅛
Tonopah Divide	8¼
Tonopah Ex	2¼
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	4 11/16
United Verde Ext	40½
United Zinc	‡ 25
Utica Mines	‡ 08

TORONTO*	June 10
Adanac	18
Bailey	01
Beaver Con	42
Coniagas	2 00
Hargraves	03
Kerr Lake	5 75
La Rose	25
Lake Shore	1 00
Min. Corp. of Can.	1 50
Peterson Lake	07
Teck-Hughes	20
Temiskaming	37
Trethewey	.40
Wettlaufer-Lor.	03
Davidson	‡ 68
Dome Exten	30
Dome Lake	17
Hollinger	6 50
McIntyre	1 62½
Newray	.17½
Porcu. Crown	.25
Vipond	18
West Dome	12

*Bid prices. † Closing prices. ‡ Last quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	3.55	4 64	4 57	5 80	4 57	5 45
No. 12	3 60	4 69	4 62	5 75	4 62	5 50
No. 14	3 65	4 74	4 67	5.90	4 67	5 55
Black						
Nos. 18 and 20	4 15	5.24	5.17	6 75	5 17	6 25
Nos. 22 and 24	4 20	5.29	5 22	6.80	5 22	6 30
No. 26	4 25	5.34	5 27	6.95	5 27	6 40
No. 28	4 35	5.44	5 37	7 05	5 37	6 45
Galvanized:						
No. 10	4 70	5 79	5.72		5.50	6 70
No. 12	4 80	5 89	5 82	7 30	5 55	6.80
No. 14	4 80	5 89	5 82	7 30	5 60	6.80
Nos. 18 and 20	5 10	6 19	6 12	7 60	5 90	7 10
Nos. 22 and 24	5 25	6 34	6 25	7 75	5 05	7 25
No. 26	5 40	6 49	6 42	7 90	5 20	7 40
No. 28	5 70	6 79	6 72	8 20	5 50	7.70

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$45 00	$65.00	$45 00	$65.00
Standard openhearth rails	47 00	67 00	47 00	67.00
Light rails, 8 to 10 lb.	2 58½*	3 36*	2 83½*	3.36½*
Light rails, 12 to 14 lb.	2 54*	3.09*	2 79*	3.09*
Light rails, 25 to 45 lb.	2 45*	3 00*	2.70*	3.00*

* Per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, 9/16-in. and larger	$3.35	$3.90	$4.27	$4.44	$5.65
Track bolts	4 35	4 90	5.17	Premium	6.65
Standard section angle bars	3 00	3 25	4 22	Premium	4.60

STRUCTURAL MATERIAL—The following are the base prices f. o. b mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago
Beams, 3 to 15 in.	$2 45	$3 47	$4 195	$3 54	$3 47
Channels, 3 to 15 in.	2 45	3 47	4 195	3 54	3 47
Angles, 3 to 6 in. ¼ in. thick	2 45	3 47	4.195	3 54	3 47
Tees, 3 in. and larger	2 45	3 52	4 195	3 54	3 47
Plates	2 66	3 67	4 445	3 54	3 67

STEEL SHEET PILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$2.55	$2.55	$4–5

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Mill Pittsburgh	Warehouse New York Current	Warehouse New York One Year Ago	Warehouse Chicago	Warehouse St. Louis	Warehouse San Francisco	Warehouse Dallas
¾-in. and larger	$4.20	$5 05	$6 095	$4.72	$4.79	$6.70	$6.75
CONE HEAD BOILER							
¾ in. and larger	4 30	5 15	6 195	4 82	4.89	6.80	6 75
⅝ and 11/16	4 45	5 30	6 345	4 97	5.04	6.95	6.90
½ and 9/16	4 70	5 55	6.695	5 32	5.29	7.30	7 15

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	+12½%
Galvanized cast steel rigging	7½%
Bright plow steel	35%
Bright cast steel	22½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.75	$7 50	$6 50	$6 25	$8 50	$7 35
Assorted	..	7.50	6.50	6 40	8.75	7 60

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars	2 35c.	Steel bars	2 35c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0.16½	$0.18	$0.19	$0.18½	$0.16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham	Denver
Solid	14c.	13c.	15c.	15c.
Hollow	21c.	14c.	.	20c.

STEEL AND IRON PIPE—The following discounts are for carload lots f. o. b. Pittsburgh, basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's for iron, both dated Mar. 21, 1919.

Inches	Steel Black Per Cent.	Galvanized Per Cent.	Inches	Iron Black Per Cent.	Galvanized Per Cent.
BUTT WELD					
¾ to 3	57½	44	¾ to 1½	39½	23½
LAP WELD					
2	50½	38	1¼	24½	9½
2½ to 6	53½	41	1½	31½	17½
7 to 12	50½	37	2	32½	18½
13 and 14	41		2½ to 6	34½	21½
15	38½		7 to 12	31½	18½
BUTT WELD, EXTRA STRONG PLAIN ENDS					
⅛, ¼ and ⅜	46½	29	⅛, ¼ and ⅜	28½	11½
½	51½	39	½	33½	20½
¾ to 1½	55½	43	¾ to 1½	39½	24½
2 to 3	56½	44			
LAP WELD, EXTRA STRONG PLAIN ENDS					
2	48½	37	1¼	25½	10½
2½ to 4	51½	40	1½	31½	17½
4½ to 6	50½	39	2	33½	20½
7 to 8	46½	33	2½ to 4	35½	23½
9 to 12	41½	28	4½ to 6	34½	22½
			7 to 8	26½	14½
			9 to 12	21½	9½

From warehouses at the places named the following discounts hold for steel pipe

	Black New York	Black Cleveland	Black Chicago
¾ to 3 in. butt welded	47%	46½%	57½%
3½ to 6 in. lap welded	42%	42½%	53½%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
¾ to 3 in. butt welded	31%	31%	44%
3½ to 6 in. lap welded	27%	27½%	41%

Malleable fittings, Class B and C, from New York stock sell at list plus 15%. Cast iron, standard sizes, 10%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$0 25	$1 00	$1 90	$1.40	$2 00	$1.05
Hot pressed hexagon	25	1.00	1.90	1.20	2.00	.85
Cold punched square	2 25	1.00	1.90	.75	1 30	1.50
Cold punched hexagon	2 25	1.00	1.90	.75	1.30	1.50

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50–10%	40%
Chicago	50%	50%
Cleveland	60–10–10%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	60%	50%	50–10%
Larger and longer up to 1 in. by 30 in.	50%	40%	40–10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York	$2 00	Cleveland	$3 00	Chicago	$2.25

For cast-iron washers the base price per 100 lb. is as follows:

New York	$6 00	Cleveland	$3 75	Chicago	$4.00

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f. o. b. New York and Chicago:

	Carload Lots N. Y.	Carload Lots Chicago	Less Than Carload Lots N. Y.	Less Than Carload Lots Chicago
Tar felt (14 lb. per square of 100 sq.ft.)	$52 00	$52 50	$53 00	$53.50
Tar pitch (in 400-lb. bbl.)	19.00	16 00	20.00	17.00
Asphalt pitch (in barrels)	36.00	36.00	41 50	41.50
Asphalt felt	67.50	67.50	72 00	72 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows in New York, St. Louis, Chicago and San Francisco:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.35	$1.60	$1 70	$1.95	$2.05	$2.30
No. 2 grade	1.20	1.45	1 50	1.75	1.80	2.05

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.00 per 100 lb.

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.80 per roll in carload lots and $2.05 for smaller quantities.

Shingles, red and green slate finish, cost $5.00 per square in carloads, $5.25 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	$0 056	$0 11	$0 162
Seattle	09	175	30
Los Angeles*	082	154	236
New Orleans	165	22	325

* F.o.b. factory, 4, 8 and 10 inch

LUMBER—Price per M in carload lots

	8 x 8-In. x 20 Ft. and Under P	Fir	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under P.	Fir
Boston	$46 50	$45.00	$45 00	$46 00	$52 00	$46.00
Kansas City	40 25	42.50	42 25	42.25	45 50	13 25
Seattle	20 50	20 50	20 50	20 50	20 50	20 25
New Orleans	35 50 (No. 1)				40.00 (No. 1)	
St. Paul	50.00	53 00	46 00	46 00	57 00	55 00
Denver	44 00	36 50	36 50		49 00	39 00
Atlanta	37 50	..	......	......	48 00	.. ..
Montreal	.. ..	65.50	....	38.00		38.00
Detroit	40.00	......	......	......	45.00	......

	1-In. Rough, 10 In. x 16 Ft. and Under P.	Fir	Hemlock	2-In. T and Gr. 10 In. x 16 Ft. P	Fir
Boston	$50 00	$45 00	$40 00	$45 00	$48 50
Kansas City	52 75	50 75	59 75	55 00	66 00
Seattle	20 50	20.50	20.50	20 50	20 50
New Orleans	40.00	......	......	38.00	......
St. Paul	51 50	47 00	40 00	51 00	46 00
Denver	45 00	35 50	35 50	38 00	32 00
Atlanta	33 00	....	....	33.00	. .
Los Angeles		36 00	35 00		
Montreal	60 00	......	45 00	60 00	......

* Los Angeles: Base price of fir is $32; of hemlock, $34; redwood, $35.

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3 25	$3.90	$4 75	$3 90	$3 90
Cut	4 45	6 00	.....	5 50	6 00

PORTLAND CEMENT—These prices are for barrels in carload lots, without bags.

	Current	One Month Ago	One Year Ago with Bags
New York	$2 30	$2 45	$2 5[illegible]
Jersey City	2 [illegible]7	2 62	2 50
Boston	2 57	2 57	2 87
Chicago	2 00	2 05	2 [illegible]6
Pittsburgh	2 05	2.15	2 71
Cleveland	2 22	2 32	2 84
Denver	2 67	2 67	3 20

Note—Charge for bags is generally 15c. each, 60c. per bbl.

LIME—Warehouse prices

	Hydrated per Ton Finished	Common	Lump per 300-Lb. Barrel Finished	Common
New York	$17 50	$14 50	$2 90	$2 65
Kansas City	21.00	..	.....	2 20*
Chicago	18 00	17 50	1 80*	1 10*
St. Louis	22 00	18 00		1 75*
Boston	22 50	18 25	3 65	3 30
Dallas	2 25	1 25*		
San Francisco	19 00			2 00
St. Paul	23 00	19 50	1 60*	1 40*
New Orleans	. ..		....	1.65*
Atlanta	..	18 50	.....	1 40*
Los Angeles			3 05†	2 80*
Denver		26 25		2 50*

* 200-lb. barrels. † Per 180-lb. bbl. ‡ Per ton

Note—Refund of 10c. per barrel

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Raw per barrel	$1 76	$1 55	$1 74	$1 65	$1 78	$1 65
5-gal. cans	1 89	1 65	1 90	1 80	1 98	1 75

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry and In Oil	White 1 Yr. Ago Dry and In Oil
100-lb. keg	13 00	14 50	11 25	11 00	13 00	10 50
25- and 50-lb. kegs	13 25	14 75	11 50	11 25	13 25	10 75
12½-lb. keg	13 50	15 00	11 75	11.50	13 50	11 00
5-lb. cans	15 00	16 50	13 25	13 00	15 00	13 00
1-lb. cans	16 00	17 50	13 25	13 00	16 00	13 00

MINING AND MILLING SUPPLIES

HOSE

Fire	50-Ft. Lengths
Underwriters' 2½-in.	70c. per ft.
Common, 2½-in.	40%

Air	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0 50	$0 35	$0 25

Steam—Discounts from List

First grade 30% Second grade 40% Third grade 40–10%

LEATHER BELTING—Present discounts from list in the following cities are as follows

	Medium Grade	Heavy Grade
New York	3[illegible]%	25%
St. Louis	4[illegible]	50%
Chicago	45	40%
Birmingham	35	3[illegible]
Denver	35-5%	10%

RAWHIDE LACING—30% off for cut, 62c. per sq. ft. for side lacing

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra, while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; 1-in., 6; 1¼-in., 4½; 1½-in., 3½; 1¾-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils

Boston	$0 25	Denver	$0 29
New York	27	Kansas City	28½
Cincinnati	29	New Orleans	27½
Chicago	26½	Seattle	[illegible]7
St. Paul	28	St. Louis	26½
San Francisco	[illegible]6	[illegible]nta	30

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0 95
Asbestos for high-pressure steam	1.60
Duck and rubber for piston packing	1 00
Flax, regular	1 20
Flax, waterproofed	1 60
Compressed asbestos sheet	1 00
Wire insertion asbestos sheet	1 20
Rubber sheet	60
Rubber sheet, wire insertion	80
Rubber sheet, duck insertion	50
Rubber sheet, cloth insertion	30
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1 20
Asbestos wick, ½- and 1-lb. balls	85

REFRACTORIES—Following prices are f. o. b. works, Pittsburgh:

Chrome brick	net ton	$120 00 at Chester, Penn.
Chrome cement	net ton	65 00 at Chester, Penn.
Clay brick, 1st quality fireclay	net ton	40–30 at Clearfield, Penn
Clay brick, 2nd quality	net ton	38–48 at Clearfield, Penn.
Magnesite, dead burned	net ton	32 50 at Chester, Penn.
Magnesite brick, 9 x 4½ x 2½ in.	net ton	90 00 at Chester, Penn.
Silica brick	net ton	45–55 at Mt. Union, Penn.

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.

St. Louis—Fire Clay, $35 to $50.

Birmingham—Fire clay, $40-$45; silica, $40-$50; magnesite, $90; chrome, $120

Chicago—Second quality, $25 per ton.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1 48	1 33
San Francisco	Douglas Fir—Green	1 35	96
San Francisco	Douglas Fir—Creosoted	2 72	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0 70	No. 1	$0 55
No. 2	.80	No. 2	65
No. 3	.90	No. 3	75
No. 4	98		
7x9x8 white oak			1 05
7x9x8 red oak, No. 4	80	No. 5	87

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels.

	New York	Chicago In Bbl.	Chicago Carloads	Denver
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0 68	$0.71	$0 69	$ 0 81
Pure destructively distilled pine oil	68	68†	.66†	53-.68
Pine tar oil, sp.gr. 1.02=1.035	45	36	.34	40–.47
Crude turpentine	51	68	.66	53 63
*Hardwood creosote, sp.gr. 0.96-0.99	24		. .	.50 57

* F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11 00 to 13 00	13 00	16.50	12 00 to 16.50
Colored mixed	8 50 to 12 00	10 00	13 00	11 50 to 14 00

WIPING CLOTHS—Jobbers' price per 1000 is as follows.

	13½ x 13½	13½ x 20½
Cleveland	$52 00	$58.00
Chicago	48 00	50.00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25-lb. keg for black powder:

	Low Freezing 20%	Gelatin 40%	Gelatin 60%	80%	Black Powder
New York		$0.27½	$0.30		$2 40
Boston	$0 22½	.24½	26½	$0 31	2 40
Cincinnati	19½	.21½	.23½		2 35
Kansas City	19	23½	26½	30	2 45
New Orleans	23½ (50%)	22½	.24½	..	...
Seattle	..	18½	21	......	.
Chicago	18½	21½	25½	......	.. ..
St. Paul	19	23½	26½		2 45
St. Louis	19	23½	25½	30	2 35
Denver	17½	22	24½	28½	2 60
Dallas	189	225	228	342	
Los Angeles	19	24	27		2 75

CHEMICALS

SODIUM CYANIDE—New York price is 30c. per lb., Denver, 42c.; Chicago, 31½c., St. Louis, 31c.

SODIUM SULPHIDE—In New York the price per pound is 4½c. for concentrated, 2c. for crystals. The St. Louis price is 6c. for 2½c. for crystals. The Denver price is 32c. The Chicago price is 6c. for concentrated, 3½c. for crystals. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 10c. per lb.; Chicago, 11c., Denver, 13c. St. Louis, 11c., less than car lots 12.

ALUMINUM DUST—Chicago price is 1 30 per lb.; Denver, 40c.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drum Per Drum
East of the Mississippi, North of Chattanooga	$106 00	$101 00	$1 52
Southeastern portion U. S. A.	115 50	110 50	1 63
Texas (except El Paso)	124 00	119 00	1 74
El Paso, Texas	126 00	121.00	1 77
Denver, Colo.	124 00	119 00	1 74
West Coast	129 00	124 00	1 81

Engineering and Mining Journal

June 21, 1919

Volume 107 *Number* 25

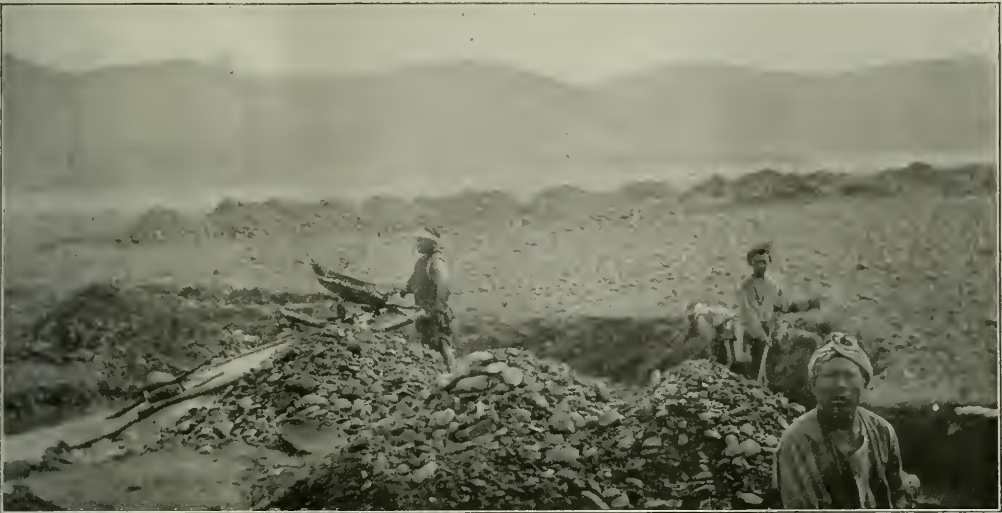


FIG. 1. CHINESE AT WORK WASHING GOLD FROM THE RUBBLE IN THE YANGTZE RIVER

Gold Washing on the Banks of the Yangtze

BY H. K. RICHARDSON*

An account of a system of gold recovery which is practiced at certain seasons of the year on the banks of the Yangtze and its tributaries. The process is essentially a crude form of placer mining, and home-made riffles are used to catch the native gold, which is afterward amalgamated with mercury and sold to the local dealers. The industry is an example of Asiatic contentment with long hours of work, small profit and slow returns, and is said to be over a thousand years old.

WHEN traveling up the Yangtze River during the low-water stage, one's attention is attracted by many mounds of pebbles seen on the banks, as soon as the boundary of Szechuen Province is passed. These mounds consist of the refuse or tailing from a crude type of placer mining which is carried on by the Chinese peasantry; and the gold which is recovered comes from the sand which underlies the pebbles. The work is performed only during five or six months of the year—from December to May, when the banks are uncovered sufficiently to make the operation practicable. A general view of one of these banks is shown in the accompanying cut. The river finds a new channel each year, and the position of the banks varies, consequently, from season to season.

Before work is begun, a hole is dug to water level and a framework erected on one side. This is about 6 ft. wide and 10 ft. long, and is made of four wooden poles, each about 3 in. in diameter and mortised together. Narrow bamboo strips are placed across the framework. These are about $\frac{3}{4}$ in. wide and the thickness of the wood, and are accurately fitted together so that no particles of gold may fall through. Alternate strips are placed from $\frac{1}{32}$ to $\frac{1}{10}$ in. below the others, so that the surface resembles that of a washing board. This portion of the machine is a triumph of Chinese skill and patience, because every one of the strips must be cut and planed by hand.

The framework is set up on one side of the well, the foot being held down by stakes and stones, and the upper end supported on trestles. The surface of the board inclines about 30°, and across the upper end is placed

---

*105 Clowes Terrace, Waterbury, Connecticut.

a wooden framework supporting a sieve or basket. This sieve is made of plaited bamboo, and is about 3 ft. in diameter and 1 ft. deep. The cycle of operations is as follows:

A load of stones and sand brought from the diggings is thrown into the basket, water is scooped up and thrown over this, and the basket is then given a shaking and rotary motion. The water and the black gold-bearing sand wash through the sieve and, spread by the fender, roll down the inclined surface of the board. The heavier particles of sand, together with the gold, find lodgment in the little troughs, and the pebbles are washed away by the water. The washing is repeated three times. The contents of the basket are then dumped on the stone pile.

The fine, black, gold-bearing sand is collected from the grooves from two to four times a day, or whenever they are full, and the gold is finally recovered by means of mercury. In this phase of the process the sand is taken up, a pinch at a time, placed in the palm of the hand, and examined. When gold is seen, a little ball of mercury amalgam, held between the thumb and first finger of the disengaged hand, is applied to the spot, and the speck is absorbed. All the sand is gone over in this manner. The resulting amalgam is sold to the village silversmith, who distills the mercury, pays for the gold, and returns the mercury to the washers.

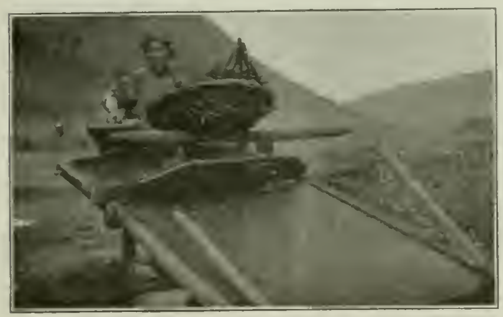


FIG. 2 THE INCLINED RIFFLE USED TO RECOVER THE GOLD FROM THE SANDS

The stone pile shown in the background of Fig. 1 consists of the gravel and stone which have been treated. A crew consists of five men—one at the washer, three men digging and carrying, and one worker recovering the gold from the sand. Information obtained from various sources revealed the fact that the seekers make only enough out of the work to pay living expenses—less than 100 "cash" per day. At the usual rate of exchange 2500 "cash" are equivalent to $1 (gold). The recovery per crew of five men is less than 500 "cash" per day. This means that five men recover less than 20c. worth of gold during a working day of from sunrise to sunset. This is probably an outside figure. This class of workers constitutes a floating population, and can subsist on 15c. per day per crew of five.

To make the return noted, the crew probably handles at least from three to four tons of stone, so that the recovery is about 5c. worth of gold per ton. The method is practiced on many of the tributaries of the Yangtze River, and, according to tradition, is about a thousand years old. As the amount recovered each year is nearly the same, it is likely the gold is being washed down from an area near the source of the river.

Belgian Iron and Steel Output

The following data concerning Belgian iron and steel production during the years 1913 to 1917 appeared in the May 1 issue of *Iron Age*, and will be of interest in showing the effect of the war on those industries:

In 1917 only one steel plant was operating and only one furnace in blast. The pig-iron output was only 2460 metric tons of bessemer and 5530 tons of steel-making (openhearth) iron. The total output of finished steel was 23,630 tons and of finished iron 51,620 tons. The accompanying table gives the production, by years, of pig iron, finished steel, and finished iron.

IRON AND STEEL PRODUCTION OF BELGIUM
In Metric Tons

Year	Pig Iron	Finished Steel	Finished Iron
1913	2,484,690	1,409,460	304,350
1914	1,454,490	866,350	151,110
1915	68,150	94,270	38,090
1916	127,825	61,900	101,300
1917	7,990	23,630	51,620

The production of steel rails fell from 341,870 tons in 1913 to 29,470 tons in 1915 and 730 tons in 1917, and of beams from 175,210 tons in 1913 to 5490 tons in 1915 and 60 tons in 1917. The merchant-steel output is given as 518,370 tons in 1913, as 36,680 tons in 1915, and as 3950 tons in 1917.

Gold Production of Dutch East Indies

Gold is found in Sumatra, the Celebes, and in Dutch Borneo in beach deposits, alluvial deposits, Tertiary gravel beds, and also in vein deposits. In 1914, according to Consul A. E. Carleton, of Batavia, in *Commerce Reports* of May 29, concessions to the number of 58 had been granted for prospecting and subsequent working of gold and silver mines.

According to a government report, the working o the gravel beds has so far been of little importance, an the dredging companies have also met little success. Th natives are employed to some extent in the washing o river sediment, and in certain parts of Sumatra the also work the Tertiary beds in a primitive way by tunnels. The larger companies confine themselves exclusively to working vein deposits.

It is understood that the greatest quantity of gold i produced in the residency of Benkulen, Sumatra. Th gold-mining area extends sometimes to a length of 2 miles, and this is specially true of the district known a Lebong, which lies about 46 miles north of the tow of Benkulen. Water power can be employed near everywhere. Some mines in central Sumatra are bein worked. The mines in the Celebes are not proving a rich as those in Sumatra. No reports are at hand a to the production of gold in Dutch Borneo.

The following table, published by the *Batavia Mark* *Report and Prices Current* on Feb. 12, 1919, gives th total production of gold in florins (the normal ex change value of the florin is $0.402) from 1911 to 191 inclusive:

Year	Sumatra, Florins	Celebes, Florins	Year	Sumatra, Florins	Celeb Flori
1911	6,434,500	1,615,000	1915	4,116,000	1,135.0
1912	5,638,000	1,425,500	1916	2,933,000	1,035.0
1913	5,047,000	760,000	1917	4,242,500	830,1
1914	6,775,700	1,224,300	1918	3,726,500	842,7

The total production for the eight years, 1911 to 191 inclusive, was 38,913,200 florins ($15,643,106) for S matra and 8,867,600 florins ($3,564,775) for the Celebe

Use of Concrete in Underground Works*

Swelling ground, and the consequent crushing of shaft timbers, led to the experiment of lining a section of the shaft with reinforced concrete. This procedure reduced cost of maintenance and facilitated ore hoisting. Concrete is also used for lining underground storage bins. During the time that the shaft work was carried on it was necessary to exercise great care to prevent injury to water mains and the power cable situated within the shaft.

MINING operations of the Wallaroo & Moonta Mining and Smelting Co., Ltd., at Wallaroo, South Australia, are carried on through two vertical main shafts, Taylor's, 2980 ft., and Young's, about 2660 ft. deep, situated 1420 ft. apart on the same lode. Levels are opened at intervals of 120 ft., measured vertically. The deepest level to be opened from Taylor's shaft is at a depth of 2910 ft.; at Young's the bottom level is 2550 ft. from the surface.

The great depth of the main workings renders special provision for ventilation necessary, and an extensive improvement has been completed. In this system the currents from the surface traveling through the downcast (main) shafts are regulated by numerous doors, which insure supplies of the cooler air at the working faces, and to increase the circulating volume of air three old shafts have been deepened and equipped at the surface with electrically driven exhaust fans of large capacity. The present depths of these ventilating shafts are: Boor's, 2310 ft.; Office, 2070 ft., and Hughes', 1470 ft. Passes through the worked-out ground winzes serve as thoroughfares for the heated air from the lower workings to reach the inlets to the fan shafts.

ORES OCCUR IN SEPARATED LENSES

The lode course is fairly continuous for a length of about 2000 ft., but the distribution of commercial ore is erratic, the mineral occurring in lenses separated by unproductive bars. The country rock is a metamorphic, micaceous schist, and the lode material consists of altered mica schist impregnated with quartz carrying chalcopyrite, pyrite, and pyrrhotite, the ore veins varying from 4 ft. to over 20 ft. in thickness, with an average stoping width of about 9 feet.

Both the country rock and lode material swell when exposed to the atmosphere, and at the deep levels, although the ground is usually firm when first opened, within a short time it begins to expand, this movement being sufficient to crush ultimately the heaviest supporting timbers, and these have to be frequently renewed in all the more important workings.

PROVIDING UNDERGROUND STORAGE OFFSETS HOISTING RESTRICTIONS

As a consequence of the constant repairs required to the timbers lining the principal shafts, the time available for hoisting and sending material underground is restricted. Under these circumstances, to provide storage for the broken ore near the shafts, and to secure the highest practicable efficiency during hoisting operations, an extensive system of underground storage bins has been provided at both main shafts.

The relation of these bins to the shafts and the general arrangement is shown in Fig. 1. In their construction winzes, 5 ft. by 5 ft. within timbers, were sunk beginning from a point in one crosscut at such an inclination that they can be equipped at each level with discharge chutes, emptying either into the shaft hauling bin from which the skips are loaded, or into the next bin below. The original practice was to remove the timber, leaving the ground unsupported, but it was found under these conditions the sides caved so badly that it was necessary to devise a method of securing them. A number were lined with circular steel tubing, 3 ft. 6 in. in diameter, the space between the tubes and timber being tightly packed with waste rock. These tubes were rolled from ½-in. plate, reinforced with heavy angle iron, and made in two sections for convenience in handling. They gave generally satisfactory results, but later, owing to the scarcity and heavy cost of suit-

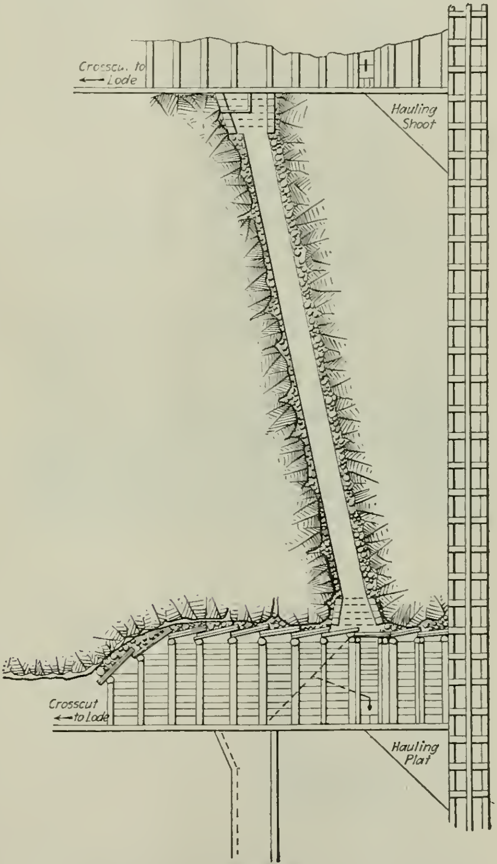


FIG. 1. GENERAL ARRANGEMENT OF UNDERGROUND ORE BINS

---

*From *Chemical Engineering and Mining Review*, Feb. 5, 1919. Prepared by members of the staff of the Wallaroo & Moonta Mining and Smelting Co., South Australia.

able plates, the bins were lined with cement concrete, as shown in Fig. 2.

Through experiment it was ascertained that, for the concrete lining successfully to resist the abrasive action of the coarse ore tipping into an empty or partly empty bin, it was expedient to use a fairly rich mixture. The mixture was composed of one part of cement, two parts of sand, and three parts of rock crushed to pass a 2-in. ring, and the minimum thickness of the concrete is about 10 in. With this method the bins were made 5 ft. in diameter, the forms being constructed in three segments, as shown in Fig. 3, and the timbers used to secure the sides during sinking were removed, the concrete supporting the ground. When the forms were taken out several weeks were allowed for the lining to dry before placing the bin in use.

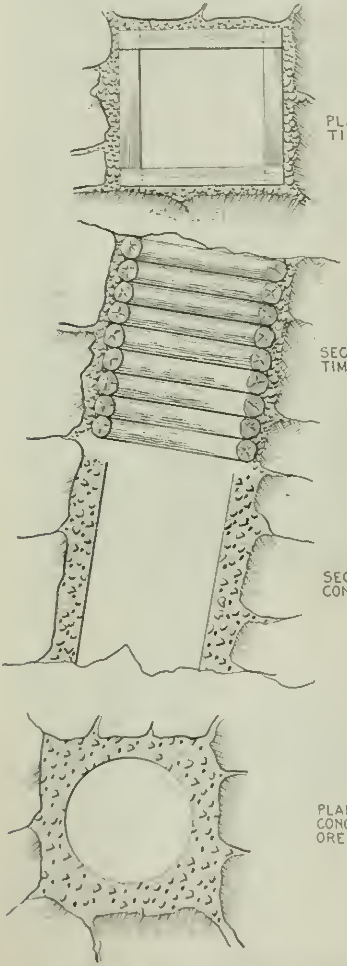

PLAN SHOWING TIMBERED ORE BIN
SECTION SHOWING TIMBERING IN ORE BIN
SECTION SHOWING CONCRETE LINING ORE BIN
PLAN SHOWING CONCRETE LINING ORE BIN

FIG 2 LINING OF UNDERGROUND ORE BINS

As already stated, the repairs due to the swelling ground are particularly heavy in connection with the main shafts, and for a considerable period after a section is constructed a large proportion of the timbers must frequently be renewed. Usually after six or seven years, however, the movement of the surrounding rock gradually decreases, although in some portions, where the ground is divided by fault planes, the swelling action is prolonged, owing to the divisions in the rock allowing air and moisture to penetrate further into the sides of the shaft. The shafts are timbered with sawed Tasmanian hardwood sets, lathed with round Australian eucalyptus, the ordinary sets being 9 in. by 9 in., whereas the principal timbers in the opening-out sets at the levels are 12 in. by 12 in. square.

The successful application of concrete to other purposes having shown its suitability for supporting excavations, at Taylor's shaft a section of the timbers about 40 ft. high was reinforced with cement concrete. This work was carried out above the 2430-ft. level, where a slide enters the shaft, making the ground so heavy that almost constant repairs to the timbers had been needed since this section was constructed, about seven years ago. As a result of the side pressure, the shaft had been forced nearly 18 in. out of alignment, which necessitated removing the old timbers as well as sufficient ground behind the sets to give room for the concrete and to allow for the straightening of the shaft.

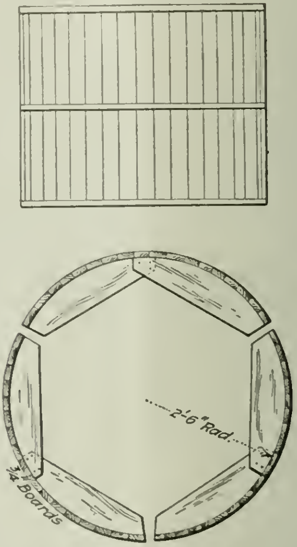


FIG. 3 FORMS USED IN CONCRETING UNDERGROUND ORE BINS

The new timbers were erected in the position required to make the shaft properly vertical, and these, lined with boards, served as forms. Owing to the nature of the rock, it was practicable to remove only one set of old timber at a time, and as soon as the new frame was in position this was filled with concrete consisting of one part of cement, four parts of sand, and four parts of rock crushed to pass a 2-in. ring. These were sent underground in separate lots, mixed at the nearest level, and passed to the required points through wooden pipes. For reinforcing, old drill steel was used for vertical bars, and strands of worn-out hoisting rope, previously annealed, as horizontal binding. The arrangement is shown in Fig. 4.

The added strength obtained by using concrete is at least 15 times that of the Tasmanian hardwood sets, and the ground is also protected from the effects of the atmosphere and moisture, which should materially assist in preventing movement.

The rock removed at the eastern end of the shaft had to be taken out without blasting, and the utmost care exercised to prevent injury to the electric cables conveying power to the drainage pumps, and disturbance of the air and water mains. To provide the required output, it was necessary to continue using the shaft for general hoisting purposes, and the renewals and concreting were carried out during the week ends, when mining operations were suspended.

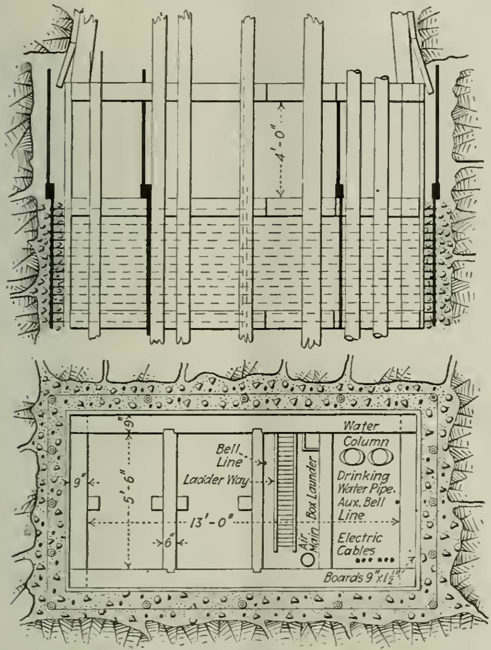


FIG. 4. PLAN AND SECTION OF SHAFT, SHOWING METHOD OF REINFORCING MAIN TIMBERS WITH CONCRETE

Keystone Copper Mining Co.

SPECIAL CORRESPONDENCE

The property of the Keystone Copper Mining Co., consisting of 16 claims, situated about two miles from Johnson, and east of the Arizona United Mining Co. in the Johnson-Dragoon mining district, Cochise County, Ariz., has passed from the class of a prospect to that of a mine ready to produce copper. The orebodies which are found in the western part of the district extend as far east as this property.

The main shaft has been sunk 635 ft. It is a two-compartment shaft, perpendicular, and well timbered. Beginning at the third level, stations and ore pockets have been cut, 100 ft. apart. These have been well timbered and completed ready for use. From close observation, it appears that the company adopted the "safety-first" plan when sinking was started.

In drifting north-east from the shaft on the third level, ore was struck. This was followed 60 ft. on the hanging-wall side. At this point the vein was crossed by another vein. No development work has been done on this vein as yet, but on the first one mentioned a raise was run 25 ft., a winze sunk 50 ft. and a cross-cut run 26 ft., which has not struck the foot wall. The ore in all these places, which is a sulphide, has averaged better than 3½% copper.

On the fourth level the ore is of the same character. Very little work has been done at this point, so the extent of the vein is undetermined. On the sixth level a red-oxide ore, running 10% copper, has been found. This is the only place in the district that this class of ore has been encountered. At present the company is working one shift, doing development. No ore will be hoisted except what is necessary, from drifts and raises, until the mill is ready for operation. This mill will be of 100-ton capacity, using concentration and flotation. Tests are being made at the present time; and, as soon as the plans are received from the engineers, work will begin on this concentrator, which will be the first one in the district.

The equipment at this shaft consists of a 30-hp. hoist and an Ingersoll-Rand belt-driven compressor, run by a 40-hp. gasoline engine. Ingersoll-Rand Jackhamers are used for all underground drilling, larger drills being unnecessary, as the formation is such that the small drills do satisfactory work. Although the ground is soft, it needs few timbers.

THE KEYSTONE COPPER MINE.

The Miller incline shaft on the O.K. claim of this company is down 375 ft. At 150 ft. from the surface this shaft runs into a high-grade sulphide copper ore, which has been continuous from that point to the present depth. Owing to a break in the machinery, this property has been shut down for the last two months. The shaft will be sunk to a greater depth. All ore taken out of the Miller shaft has been shipped to the smeltery and gave good returns. On resumption of work, the ore will be stored on the dump, and as soon as the copper market returns to normal it will be shipped. This shaft is equipped with a gasoline engine direct-connected to a compressor. An air hoist is used to do all hoisting.

W. W. Miller, president and manager of the company, is in charge, and has direct supervision of all work. The general office is at Newton, Kan. T. C. Miller is secretary.

British Import Restrictions.—According to a cable dispatch from the Consul General at London, dated May 16, zinc oxide, which is included on the British list of restricted imports, may now be imported up to 50% of 1913 importations, this being an amendment of a decision already published.

Bauxite Mining in Arkansas

BY TOM SHIRAS*

ARKANSAS produces more bauxite ore than any other state in the Union, and probably as much as is produced by the rest of the entire world. The latest statistics available, prepared by Miss H. M. Gaylord, of the U. S. Geological Survey, published June 21, 1918, in a bulletin on bauxite and aluminum, by James M. Hill, show that in 1917 Arkansas produced 506,556 long tons, valued at $2,724,007. Georgia, Alabama, and Tennessee, in the same year, produced 62,134 long tons, valued at $395,051.

ONE OF THE NUMEROUS BAUXITE MINES IN THE AMERICAN BAUXITE CO. PROPERTY

The American Bauxite Co., of Bauxite, Ark., in Saline County, operating a number of mines in the vicinity of Bauxite, is the largest producing company in the state. Modern and efficient methods are employed in every department, and in looking over the property one is immediately impressed by the fact that the company is more than a mining concern—it is an institution operated not only for the benefit of the stockholders, but for the benefit of the employees and the community as well. The entire property, covering several thousand acres, is under the direct management of Gen. J. R. Gibbons, a pioneer in the bauxite industry in Arkansas.

Bauxite is not a town, but a community, consisting of a number of villages scattered over the company's holdings. The houses occupied by the employees are owned by the company. They are neat, modern cottages, equipped with electric lights, water, natural gas, and telephones, and are rented at low rates. The company maintains one of the most modern hospitals in the state; and its moving-picture theater compares favorably with similar places of entertainment in larger cities. A bank and a number of business houses are also situated at Bauxite, but are not operated by the company.

Between 400 and 500 men are employed in the various departments on the property. When operations are being carried on to capacity, the employees on the pay roll number from 1100 to 1200.

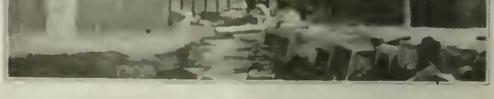
Besides the mines and plant, the company owns and operates a short line railroad, known as the Bauxite and Northern R.R., which runs from Bauxite to Gibbons and to Bauxite Junction, a distance of three and one-half miles, where it connects with the Missouri Pacific R.R., over which the ore is shipped. The output of the company is sold to the Aluminum Ore Co., of East St. Louis, and to various other consumers.

The orebodies lie in a blanket formation in a clay gangue, and are mined, by the open-pit method, with steam shovels and pick-and-shovel miners. The ore is encountered from grass roots to a depth of 150 ft., the deposits being from 1 in. to 30 ft. in thickness. The overburden is removed with steam shovels, teams and scrapers. Five steam shovels are employed by the company in the stripping and mining operations. The ore-bearing pits or mines are all within a radius of two miles from the plant. Tracks are laid in all the pits, which are connected with the plant by ground trams, the ore cars being moved with locomotives. All orebodies are sampled and assayed as soon as encountered, to ascertain the grade before mining operations are begun.

The treatment of the ore is simple. It comes from the ground in pieces weighing from a few ounces to several hundred pounds, and is crushed to a maximum size of 1½ in. There are seven Gibbons crushers, designed by General Gibbons, and four big gyratories, with a combined capacity of 2000 tons a day. The crushers are driven by a battery of gas engines, in which natural gas is used, and by an auxiliary steam plant.

The product from the crushing department goes to the drying department, which is equipped with 10 rotary driers, 5 x 60 ft.; two, 7 x 30 ft.; and one drier 3½ x 30 ft., where it is thoroughly dried. Natural gas is used in some as the heat-producing agent and pulverized coal in the remainder.

As soon as the product is dried it is ready for the market. It is moved from the drying department by a Peck carrier, or link-belt conveyor, to the foot of two inclines that lead, respectively, to two steel ore-storage bins, each having a capacity of 750 tons. At the foot of the inclines the product is discharged to conveyor belts, one leading to each bin. The ore is loaded into freight cars with a Gibbons loader, which automatically distributes the load evenly to all parts of the car.



THE AMERICAN BAUXITE CO.'S PLANT AT BAUXITE, ARKANSAS

In the bulletin previously mentioned and published by the Geological Survey on June 21, 1918, James M. Hill says:

"The American Bauxite Co., Globe Bauxite Co., E. I.

---

*Mountain Home, Arkansas

du Pont de Nemours Co., and Republic Mining and Manufacturing Co. mined bauxite from deposits in Saline and Pulaski counties. The largest production was made from the deposits near Bauxite, in Saline County.

"'The production from Arkansas in 1917 showed an increase of 35% over the production in 1916, and it is believed that, should the demand arise, the Arkansas deposits are capable of much greater output and contain considerable reserves. The bauxite mined from the Arkansas deposits is of high grade, as is shown by the fact that more than 71% of the output in 1917 was used for the manufacture of aluminum, nearly 19% for abrasives, 9% for chemicals, and 1% for refractories.

SHOWING A SECTION OF THE DRYING DEPARTMENT

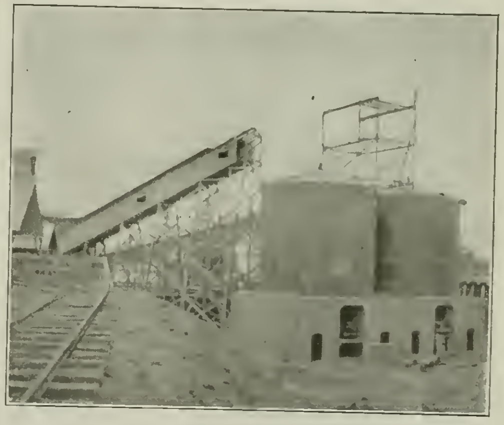
"The market for bauxite in the United States is east of the Mississippi River, the largest consumers being in or near the cities of East St. Louis, and Aurora, Ill.; Detroit, Mich.; Cincinnati, Ohio; Knoxville, Tenn.; Philadelphia and Erie, Penn.; Niagara Falls and New York City, N. Y.; and Boston, Mass. Recently a number of municipal and industrial waterworks have installed small plants for the manufacture f aluminum sulphate for local use in purification of vater.

ONVEYOR WHICH CARRIES THE PRODUCT FROM THE CRUSHING TO THE DRYING DEPARTMENT

"Bauxite is graded according to its chemical compoition and is sold to the consuming industries on the asis of analysis. Apparently, low content of silica and itanium is essential to the aluminum industry, but the ontent of iron can be fairly high, though bauxites low n iron and titanium are preferred by the makers of alum and aluminum sulphate. Makers of abrasive appear to be able to use bauxites of lower grade, and containing larger proportions of silica and iron, than are permissible in bauxite for other uses, but most abrasives are made from bauxites low in iron and silica. The bauxite used for refractories must be low in iron.

"The prices received for bauxite in 1917, as reported by producers, ranged from $4.75 to $10.50 a long ton. The average price paid for the whole of the domestic bauxite sold in the country was $5.48 a long ton at shipping point.

"The bauxite from all localities in the United States, though it may vary in chemical composition, is on the whole similar in general appearance, with the exception of the 'granitic bauxite' of the Arkansas field. The greater part of the American bauxite appears to be made up of rounded pebble-like bodies set in a fine-grained matrix, which may also consist of small rounded particles which may be as fine grained as the finest clay. The pebble or pisolite form is so general that it is the conspicuous characteristic of American bauxite.



STEEL STORAGE BINS

"There is only one way to determine the value of bauxite, and that is by chemical analysis, which should show total silica, alumina, titanium oxide, iron oxide, and water. Bauxites of commercial grade should carry at least 52% alumina."

Metallurgy of Quicksilver—The ores of quicksilver, unlike those of most metals that are won by smelting, are without exception in this country, according to F. L. Ransome in *Bull.* 666-FF, U. S. Geological Survey, treated at the mines, and the liquid metal is shipped as a finished commercial product in iron bottles or flasks containing 75 lb. each. A moderate heat, about 360° C., is enough to vaporize and decompose cinnabar, and the quicksilver is obtained directly by condensation in suitable chambers through which the fumes from the furnace are conducted. There are two classes of reducing apparatus—furnaces and retorts. In most furnaces the ore is exposed to the direct action of the flame; the volatile products of combustion, with more or less dust, mingle with the vapors of sulphur and mercury driven from the ore, and all pass together through condensers. The operation is in general continuous. In retorts, on the other hand, the ore is heated in a closed iron vessel, out of contact with the flame, and only those volatile constituents that are released from the ore pass into the condensing apparatus. In most retorts the operation is intermittent.

Transformers for Induction Motors*

BY J. B. GIBBS†

IN SELECTING transformers to be used with induction motors, there is a large field for the exercise of good judgment. The transformers must not be too small, or they will burn out when the motor is loaded. If they are too large, there are unnecessary energy losses in the system and unnecessary investment in the transformers. So it is important to know what should be expected of motors and transformers and how to group them.

Probably the most common case will be where a motor wound for 220 or 440 volts is to be run from a power line at 2200 volts. Transformers for this kind of service are built in two classes. The first class has its low-voltage winding divided into two parts, which may be connected in series for 220 volts, or in parallel for 110 volts. The second class has the low-voltage winding in two parts, which give 440 volts when connected in series and 220 volts when connected in parallel. Fig. 1 shows the development of the winding of a transformer for 2200 to 440 or 220 volts.

The size of transformers to be used with a given motor depends on several factors. According to the Standardization Rules of the American Institute of Electrical Engineers and of the National Electric Light Association, transformers are designed to have a temperature rise of 55° C. above the surrounding air when carrying continuously the load indicated on the nameplate. The reason for this is that if a transformer is situated in a hot place (45° C. or 113° F. is taken as the standard air temperature), and loaded, the coils will reach 45 + 55 = 100° C., which is as high a temperature as the insulation should be called upon to stand continuously.

A motor rarely has an absolutely uniform load, and short-time peaks much above the rating of the transformers will be harmless if the load between the peaks is correspondingly low. Usually, unless the installation is important enough to warrant a test of actual load conditions, the best that can be done is to estimate the size of the transformers required from the size of the motor, and then to inspect them at intervals for a few days or a few weeks to find whether they are getting too hot. If any doubt exists as to the transformers to use, it is better of course, to err on the side of safety.

Another thing that sometimes causes uncertainty is the difference in the way of rating motors and transformers. Motors are always rated in horsepower or in kilowatts—usually in horsepower—and transformers are always rated in kilovolt-amperes. With direct-current motors the product of the volts by the amperes gives the power in watts actually put into the motor; but with alternating-current motors this is not true. With alternating-current motors the product of volts by amperes must be multiplied by another factor, called the "power factor," to give the watts. That is, of two motors to which is being supplied the same amount of power at the same voltage, one alternating current and the other direct current, the alternating current will require more current than the direct-current machine. And as it is current and not power that heats the transformers, they must be large enough to take care of this extra current. The transformers must also supply the losses that take place in the motor itself, which makes it necessary that they be still larger.

Methods for approximating the correct size of transformers for various conditions are given in a subsequent paragraph. They are based on the assumption that the motor will carry about full load and will have an efficiency and power factor as good as a typical modern induction motor. The simplest case of alternating-current motor connection is a single-phase motor, as shown in Fig. 2. Two wires are run from the secondary of the transformer through fuses and a switch to the motor. Small motors are usually connected to the lighting circuits and treated as a part of the lighting load, but the larger sizes are likely to cause flickering of the lights, and are therefore better run from separate transformers. Single-phase motors are built in sizes ranging from a small fraction of a horsepower up to about ten horsepower. The approximate size of transformer for a single-phase motor may be found from the formula,

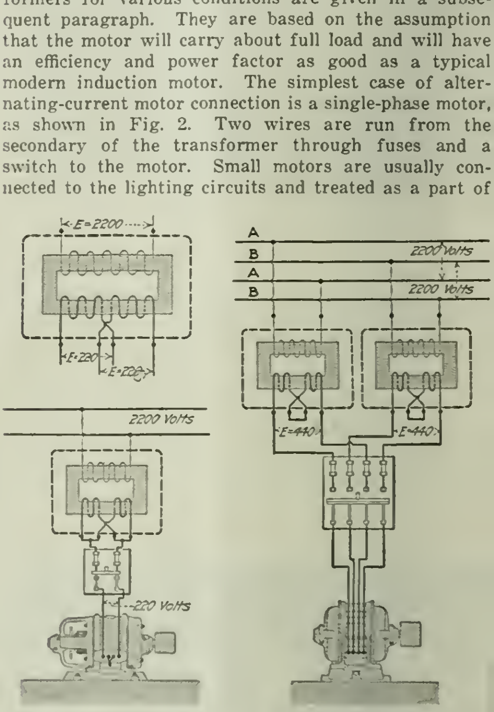


FIG. 1 TO 3. DIAGRAMS OF TRANSFORMER AND INDUCTION-MOTOR CONNECTIONS

Fig. 1. Upper left-hand corner: diagram of transformer connections. Fig. 2. Lower left-hand corner: diagram of single-phase motor connected to transformer. Fig. 3. On the right: diagram of a two-phase motor connected to two transformers.

$$\textit{kv.-a. of transformer} = \textit{hp. of motor} \times 1.25$$

In most cases where power is required it can be better supplied by polyphase motors than by single-phase motors, because the former are cheaper, have better operating characteristics, and are more sturdy and reliable. As a rule, the larger the motor the higher will be both its power factor and efficiency. High-speed motors generally have better power factor than slow-speed motors, and 25-cycle motors have better power factor than corresponding 60-cycle motors. As a rough general rule, which is easy to remember, it may be said

---

*Abstracted from *Power*, May 2[illegible], 1919.

†Engineer, Transformer Department, Westinghouse Electric and Manufacturing Company.

that each horsepower of the motor rating will need one kv.-a. of transformer rating. The figures given herewith are somewhat closer than this, but in order to use standard transformers it will often be necessary to select them larger or smaller than indicated by the figures.

Fig. 3 shows a two-phase motor connected to a two-phase line. In this case two transformers are needed, as shown, and the size of each, if the motor is small (say 25 hp. or less) may be taken as

kv.-a. of one transformer = hp. of motor × 0.58

For large two-phase motors, say 100 hp. or more, the size of transformers may be found from the expression,

kv.-a. of one transformer = hp. of motor × 0.46

In operating three-phase motors from three-phase lines, there is a choice of several connections. Fig. 4 shows the open delta, or "V" connection, which is frequently used, especially for motors of the smaller sizes. In this connection the current in the transformers is out of phase with the voltage, so a larger total kv.-a. of transformers is needed than with the delta connection. On the other hand, only two units are needed instead of three, and this is an advantage in installation. For small motors connected as in Fig. 4 the size of each transformer may be found from the formula,

kv.-a. of one transformer = hp. of motor × 0.67

and for large motors,

kv.-a. of one transformer = hp. of motor × 0.53

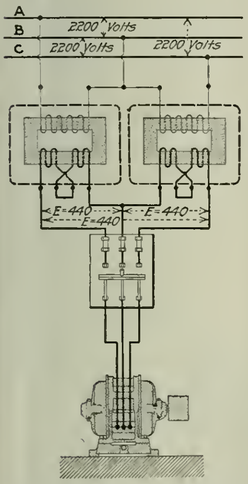


FIG. 4. THREE-PHASE MOTOR CONNECTED TO TWO TRANSFORMERS IN OPEN DELTA

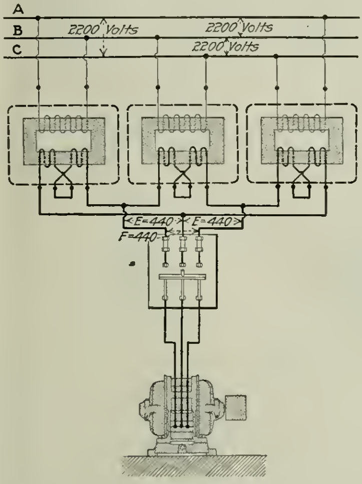


FIG. 5. THREE-PHASE MOTOR CONNECTED TO THREE TRANSFORMERS IN CLOSED DELTA

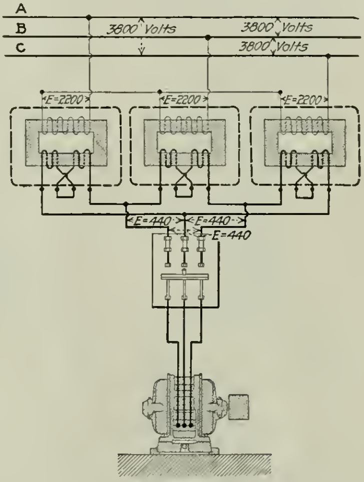


FIG. 6. THREE-PHASE MOTOR CONNECTED TO THREE TRANSFORMERS STAR TO DELTA

The delta connection, shown in Fig. 5, is also much used for transformers supplying three-phase motors. One advantage of this connection is that in case of trouble with one transformer it can be cut out, and the remaining two transformers will operate in open delta and allow the motor to carry about 58% of its normal load. The size of the transformers for small motors is,

kv.-a. of one transformer = hp. of motor × 0.39

and for large motors is,

kv.-a. of one transformer = hp. of motor × 0.31

Another connection frequently used is the star, or "Y," connection, shown in Fig. 6. It is especially convenient where it is desired to run three-phase motors from a three-phase 3800-volt line, using standard 2200-volt transformers. One high-voltage terminal of each transformer is connected to a common junction, and the remaining three terminals are connected to the three line wires, as shown. The size of transformers needed is the same as for the delta connection given in the foregoing.

Sometimes it is desired to operate two-phase motors from a three-phase power line, or vice versa. The usual connection for this case is shown in Figs. 7 and 8. Two transformers are needed, and the three-phase side is provided with special taps. Fig. 7 shows a two-phase motor connected to a three-phase line. The "main" transformer, shown at the left in the sketch, has a lead brought out from the middle point of its high-voltage winding, and this lead is connected to an 86.6% tap on the "teazer" transformer. The other end of the teazer winding is connected to the three-phase line. This causes the voltages in the secondary windings of the two transformers to be 90° apart and equal in magnitude; that is, to be two-phase voltages. The connection of a three-phase motor to a two-phase line is shown in Fig. 8. In this case the special taps are in the low-voltage windings, in the same relative positions as above. For small motors connected according to either Fig. 7 or Fig. 8 the size of transformers is

kv.-a. of one transformer = hp. of motor × 0.67

and for large motors,

kv.-a. of one transformer = hp. of motor × 0.53

Small motors are started by closing the main switch and connecting the motor directly to the line, as shown in all the figures, but for large motors this would cause too large a rush of current, so some kind of starting device, or "compensator," is used. This is connected between the motor and the main switch and usually consists of auto-transformers, or choke coils. There are several kinds of compensator on the market, and as a diagram of connections always accompanies the compensator, they are not included in the figures given here.

The direction of rotation of a single-phase motor can be reversed by interchanging the leads of the starting winding or running winding on motors of the split-phase type or by shifting the brushes on motors of the repulsion type. The details of this operation depend on the arrangement of leads, and instructions are always sent with the motor. Two-phase motors may be reversed by interchanging the two leads of either phase, and three-phase motors may be reversed by interchanging any two leads.

A volume might be written on the subject of emergency connections, because there are so many possible emergencies, but the operator must always depend on his own judgment and knowledge. It may be of assistance in forming a judgment in any particular case to point out certain facts and relations.

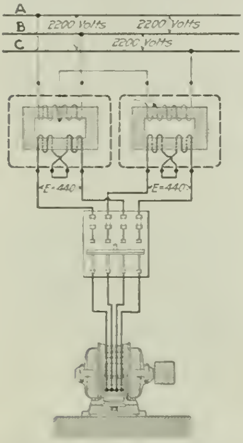


FIG. 7 CONNECTIONS FOR OPERATING A TWO-PHASE MOTOR FROM A THREE-PHASE LINE

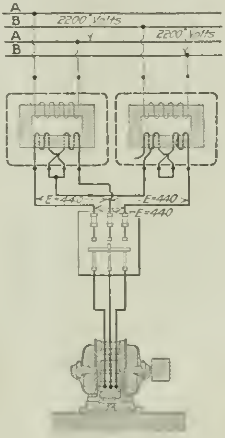


FIG. 8. CONNECTIONS FOR OPERATING A TWO-PHASE MOTOR FROM A TWO-PHASE LINE

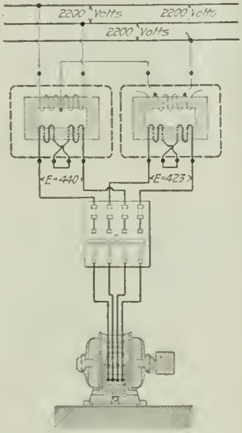


FIG. 9. CONNECTIONS FOR OPERATING A TWO-PHASE MOTOR FROM A THREE-PHASE LINE

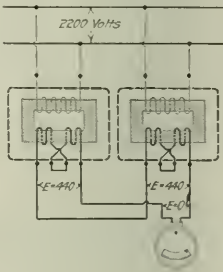


FIG. 10. METHOD OF CHECKING PARALLEL-CONNECTED TRANSFORMERS. IF LAMPS ARE USED FOR THIS TEST, ENOUGH SHOULD BE CONNECTED IN SERIES TO TAKE UP DOUBLE THE VOLTAGE FOR WHICH THE TRANSFORMERS ARE CONNECTED

Two transformers can usually be connected in parallel to give an output equal to the sum of their ratings. This is true especially if the two transformers were built by the same manufacturer and are not too far different in size. For instance, a 10-kv.-a. transformer would probably operate satisfactorily in parallel with a 5-kv.-a. or a 25-kv.-a. or any size between the limits, but it might be doubtful wisdom to connect a 5-kv.-a. in parallel with a 100-kv.-a. unit. In some cases the characteristics of large transformers are such that they will not divide the load in proportion to their ratings when connected in parallel. This merely means that the output of the bank is limited by the transformer which takes more than its share. In case of doubt it is well to ask the manufacturer whether the two transformers in mind are suitable for operation in parallel, although this is seldom necessary for transformers smaller than 100 kv.-a.

In making a parallel connection between transformers it is always well to check their polarity, especially if they were made by different manufacturers. This may conveniently be done as shown in Fig. 10. Connect one transformer to the primary and secondary lines, as shown at the left of the sketch, and connect the other transformer to the primary line and to one side only of the secondary line. Now take a voltmeter, or incandescent lamps, and test between the open side of the transformer and the other secondary line wire as shown. If no voltage is indicated, the connection is correct and may be completed. If the voltmeter shows a reading or the lamps light, the leads of the second transformer must be reversed.

Two-phase motors may sometimes be run from three-phase lines using standard transformers. For the "main" transformer select one which has its primary wound for 2200 or 1100 volts, series-parallel, and for the "teazer" transformer one which has two 5% taps in the primary. These are both standard arrangements, and the ordinary central station usually has both kinds. The two transformers are connected as shown in Fig. 9. This gives a two-phase voltage which is unbalanced and which consequently puts the motor at a disadvantage; but it will enable the motor to run and may sometimes save a long delay in getting the proper special transformers.

Swedish Iron and Steel Production

The output of iron and steel in Sweden in 1918, according to statistics compiled by the Association of Swedish Iron and Steel Works, and republished by *Iron Age*, was as follows in metric tons, as compared with that of 1917:

SWEDISH IRON AND STEEL OUTPUT

	1918	1917
Pig iron and direct castings	749,800	821,290
Puddled iron, blooms, etc	92,000	114,100
Bessemer ingots	66,500	76,900
Openhearth ingots	458,300	489,700
Rolled and forged iron and steel	361,400	378,000

(Crucible and electric ingots were not given separately.)

In 1918 Sweden exported 4,486,000 tons of iron ore, as compared with 5,613,000 tons in 1917. The pig-iron exports were 180,113 tons in 1918, as against 231,244 tons in 1917. The total iron and steel exports in 1918 were 183,753 tons, which compare with 230,204 tons in 1917 and 299,086 tons in 1916.

Manganese Ore Production in Tunis amounted to 5800 metric tons in 1917, compared with 2027 tons in 1916 and 1460 tons in 1915, according to the *Ironmonger*.

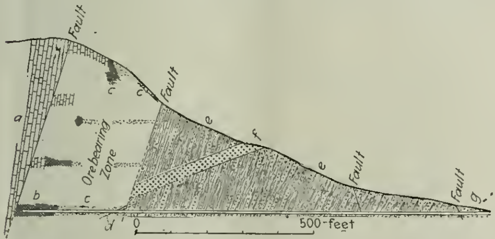
Geology and Ore Deposits of the Yerington District, Nevada*

REVIEW BY WILLIAM H. EMMONS†

THE hope that Yerington would develop into a copper district of the first class, which was held by many a decade ago, has not been realized. The Yerington district produced, nevertheless, from 1912 to 1917, inclusive, 61,200,000 lb. of copper, which places it well to the front among American copper-bearing areas of the second order.

Mr. Knopf's discussion of the geology of the region is brief but comprehensive, well balanced, and adequate for the treatment of the deposits that follows. His discussion of the genesis of the deposits is thorough and scholarly.

The region described is mainly in the Singatse Range and comprises an area of about 156 square miles. The oldest rocks, of Triassic age, include andesites, soda-rhyolite felsites, and limestone, with subordinate quartzite, shale, and gypsum. The beds are 8000 ft. thick, of which volcanic rocks make up 3200 ft. They were invaded, probably early in the Cretaceous, by basic granodiorite and soon after by quartz monzonite. These intrusions metamorphosed the rocks which they invaded, causing andesites and felsites adjacent to them to recrystallize, and converting limestone into calcium silicate rocks, among which garnetites predominate.



GEOLOGIC SECTION THROUGH TUNNEL NO. 4, MASON VALLEY MINE.

A, Limestone; B. Ore; C, Garnetiferous rock; D. Basic dikes; E, Lime-silicate rocks with intercalated felsites; F, Quartz monzonite porphyry; G, Tertiary rhyolite.

Probably one-half of the Triassic area consists of rocks made up of garnet, wollastonite, and allied silicates. Subsequently dikes and bosses or quartz monzonite porphyry were injected. Faulting followed, breaking and displacing the dikes. Along some of the faults formed at this time metalliferous solutions rose and deposited the copper ores. The Tertiary rocks rest uncomformably on the Mesozoic rocks. They are dominantly volcanic and are at least 7000 ft. thick.

An interesting feature of the geology of the sedimentary rocks is a bed of gypsum, over 400 ft. thick, near the Ludwig mine. This was described in 1912 by Rogers, who regarded it as an alteration of anhydrite. It is probably the most extensive deposit of gypsum so formed that has been described. In his discussion of this unusual deposit, Knopf agrees with Rogers as to its derivation.

The principal orebodies consist of pyrite and chalcopyrite in a gangue of pyroxene, garnet, and epidote. They attain 800 ft. in length and 100 ft. in width. These dimensions, however, are exceptional, and as a rule are applicable to the ore-bearing zones, in which the orebodies are commonly small fractions of the associated masses of barren garnet-pyroxene rock. In the Mason Valley mine, masses of barren garnet rock, in places 200 ft. thick, underlie the productive part of the ore-bearing zone. The known vertical range of mineralization in the district, in the present stage of development, is 950 feet.

The ore deposits are contact metamorphic replacements of limestones. As the replacement of the limestone extended outward from fault fissures, the orebodies, as a rule, are lodelike in form. The ore tends to occur on the limestone side of the ore-bearing zone.

The orebody at the Bluestone mine, consisting essentially of chalcopyrite and epidote, differs from other deposits of the district in that it was not formed by the replacement of limestone but of brecciated garnetite and other contact-metamorphic rocks of the first period of metamorphism. Its features emphasize the two periods of metamorphism distinguishable in the district, which occurred during the same general epoch of intrusion—an earlier, widespread metamorphism marked by the addition of the immense quantities of silica and iron to the metamorphosed limestones, and a later, localized metamorphism marked by the addition of silica, iron, copper, and sulphur. This feature of the metamorphism of the garnetite in the Bluestone mine, and the deposition of ore in the shattered garnet rock, is similar to that in the ore zone of the Cable mine, near Anaconda, Mont., which I investigated some years ago. Blocks of garnet rock and granite in the contact zone at Cable are cemented by a gold ore containing calcite, quartz, pyrite, pyrrhotite, and other minerals.

The alteration of igneous rocks by the contact metamorphic solutions from later igneous rocks forms an interesting subject of discussion. There is, however, no garnetization of igneous rocks attended by deposition of ore of the contact metamorphic type like that described by Spurr and Garrey at Valardeña, Mexico. The alteration is attended by development of hornblende, an alteration like that exhibited at Cananea and Morenci and certain other districts.

On the whole, the contact metamorphic replacements of limestone at Yerington have a more obvious relation to faulting than is generally exhibited when deposits of this type are developed. At many places the metalliferous solutions seem to have traversed the intergranular spaces between mineral grains or the cleavage cracks of minerals, for evidences of major fractures such as might have served as paths for them, in many districts at least, are wanting.

The presence of limestone has favorably influenced the precipitation of ore. The main orebodies are in the limestone adjoining the faults, but, with the deposition of the ore, large bodies of garnet and pyroxene were formed, which in amount greatly exceed the ore. To find the bodies of ore in this unprofitable envelope is one of the most difficult problems of the miner in many districts containing ores of contact metamorphic origin. Umpleby showed that ore is most likely to occur on the limestone side of the contact-metamorphic zone in copper deposits at Mackay, Idaho,[1] and in certain other districts. Knopf finds that this rule, with some exceptions, will hold at Yerington, as the ore tends to occur in the marginal portion of the contact-silicate rock where this borders the limestone. This tendency shows most clearly in the orebodies of the Mason Valley and Casting Copper mines. Any data bearing on this inquiry is valuable, for all who have puzzled over the localization of oreshoots in the contact-silicate zones will recognize the difficulties inherent in the problem.

---

*By Adolph Knopf, Professional Paper No. 114, U. S. Geological Survey.

†Professor of geology and director of the Minnesota Geological Survey, University of Minnesota, Minneapolis, Minnesota.

There is evidence of the addition of much silica, iron, sulphur, and other elements by contact metamorphism of the limestone. That the replacement of limestone by garnet is attended by little or no increase or decrease in volume is attested by the presence of a completely garnetized undistorted fossil (Holobia) in the contact metamorphic zone. Large increase or decrease in volume by contact metamorphism would have ruptured or distorted any fossils contained.

The primary ores of the district are essentially unenriched by later sulphides, supergene covellite and chalcocite being, on the whole, of minor importance.

Legal Aspect of Tailings Disposal

By Chesla C. Sherlock[*]

One of the first purposes of the law is to afford protection to property and to insure its proper use and enjoyment. It is an elemental principle that every person has a right to the free enjoyment of his own property, but that no one may exercise a right upon his own property which will curb or interfere with the rights and privileges of another. It is a well-quoted maxim which says, "The rights of one man end where those of another begin."

In mining operations, débris often finds its way onto the land of adjoining or neighboring owners, being dumped there, or carried by the streams over the adjoining land.

The deposition of tailings is, to a reasonable extent, permitted in running streams, but it is subject to limitations. It has been repeatedly held that this doctrine does not extend to authorizing the miner to flood the lands of another, or to deposit mining débris to the extent that it will deprive the neighboring owner of a substantial right, or depreciate his property.

In a California case (Hobbs *vs.* Amador & Sacramento Canal Co., *66 Cal. 161, 4 Pac. 1147*), a decision supported in Oregon and Missouri, the court held: "No person, natural or artificial, has a right, directly or indirectly, to cover his neighbor's land with mining débris, sand, gravel, or other material so as to render it valueless."

It is conceded that a miner has a right to use the channel of a stream for the disposal of tailings, refuse, or débris, but he has no right to fill the channel so that the water will overflow and thereby cause the débris or other material to be deposited on the land of a lower holder. It has been expressly held in both California and Oregon that a mine operator or owner has a right to use his claim in a lawful manner, but that no use which prevents others from enjoying their rights can be considered as lawful.

The degree of care or caution that a miner exercises, in his work, to prevent débris reaching the land of another is immaterial. He has violated the right of another if actual injury is done. Miners often attempt to justify themselves by asserting the "doctrine of necessity," but the Oregon court has said that it has no application to these cases.

California and Idaho courts have said that, though the doctrine of necessity may permit one to enter the lands of another in order to reach his own land, it does not extend to the point of allowing him to erect flumes, ditches, and buildings thereon and thereby discharge tailings from his own land. Lindley, a recognized authority, states that this doctrine is not applicable to any particular locality, but that it is generally conceded to have universal application.

In an Ohio case (*48 Ohio St. 41, 26 N. E. 630, 633*), the court said:

> "The claim of the company that it had a right to make the deposits in the places complained of, because it was necessary to the successful conduct of its business, seems wanting in substance. The effect is to measure the rights of the plaintiff in his lands and the waters of Monday Creek by the convenience or necessity of the company's business. An owner of land in Ohio is not subject to any such narrow and arbitrary rule."

The Supreme Court of California (*57 Cal. 413, 40 Am. Rep. 118*), said:

> "The refuse matter was the product of the defendant's mining operations, and was deposited in the creek through agencies controlled by the defendant; and although it was not responsible for the inundation of the plaintiff's land by water of said creek, it was responsible for the deposit of the deleterious substance with which said water was charged through its agency upon said land. This does not in any manner involve the question of the defendant's right to mine or prosecute any other legitimate business on its premises. It would not be claimed that the defendant could convey and deposit said refuse matter from its mines by means of carts and cars, without increasing its liability for any damages which the plaintiff might suffer by reason thereof. And we know of no principle upon which it could be held that a person may escape liability by doing that indirectly which would render him liable if done directly."

The U. S. Supreme Court has held that where property is thus actually invaded so as to impair or destroy its value it is, in fact, taking property without compensation. Very often, in these cases, it is urged that the right of a miner to deposit refuse matter has been sanctioned so long by custom and usage that it is not proper for the courts to change the custom or announce doctrines contrary to it. But a careful examination of the law, both at common law and under the statutes, discloses the fact that no such custom was ever in existence, or was ever recognized either under common law or the statutes. In fact, if any such custom could be designated as a mining custom it did not sanction such doctrine. It is true, however, that custom might have permitted the fouling or pollution of streams to a certain extent, but this never extended to the right of one to cause sand, gravel, or débris to be deposited on the land of another. In a Montana decision, the court said:

---

[1] Umpleby, J. B., "The "Occurrence of Ore on the Limestone Side of Garnet Zones," University of California, Department of Geology Bulletin, Vol. 10, pp 25-37, 1916

[*] Box 81, University Place Station, Des Moines, Iowa.

> "A mining custom which would allow the total destruction of a junior locator's mining operations in a gulch below prior locators, on ground which was vacant, cannot be maintained under any statute or common mining law with which we are acquainted."

The Colorado statute seems to be a clear statement of the law as it existed before the statute was enacted. The act merely announced in statutory form what the law was prior to its adoption. This statute reads: "In no case shall any person or persons be allowed to flood the property of another person with water, or wash down the tailings of his or their claim upon the claim of another person, but it shall be the duty of every miner to take care of his own tailings, or become responsible for all damages that may arise therefrom."

In another case, the U. S. Supreme Court has said: "No system of law with which we are acquainted tolerates the use of one's property in any way so as to destroy the property of another." It is well to note that this doctrine applies to any process by which foreign matter may be conveyed to the land of another and is not confined simply to instances where the débris is conveyed by means of deposit in a stream. Speaking of custom, the California court said:

> " . . . a legitimate private business founded upon a local custom may grow into such a force as to threaten the safety of the people, and destruction to public and private rights; and when it develops into that condition the custom upon which it is founded becomes unreasonable, because dangerous to public and private rights, and cannot be invoked to justify the continuance of the business in an unlawful manner."

It is generally admitted by all persons that no one would have a right to take refuse matter from his own land and dump it upon the land of another. That would be what is called directly depositing the refuse matter. That is clearly unlawful. In like measure, no person as a right indirectly to do something which he would not be legally permitted to do directly. When considered in this light, it is at once apparent that the deposit of mining débris is unlawful.

Chrome Ore in South Africa

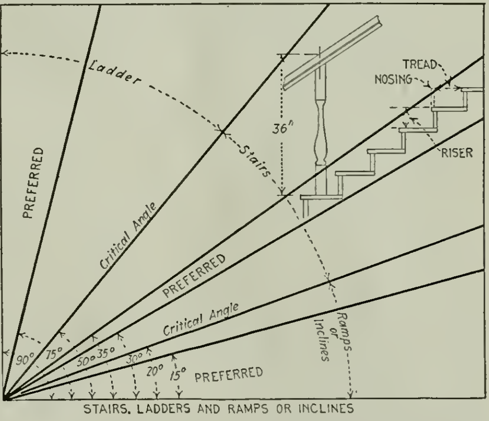
The South African chrome-ore supply is hampered considerably by the difficulty in getting it to the market over the railroads, for want of cars, and some of the ore deposits are a considerable distance from any line of railroad, all of which limits delivery at any given port. The deposits in South Africa are in the Transvaal and Rhodesia, according to Consul W. W. Masterson, of Durban, Natal, in *Commerce Reports*, and the largest chrome-ore area, with the highest percentage of chrome oxide, is in Rhodesia.

The chrome ore of the Transvaal runs between 40 and 50% chrome oxide, though there are certain deposits partly developed in Rhodesia, in which the chrome oxide is over 60%, making it about the richest chrome ore deposit in South Africa, if not in the world. In common with many other mining ventures, the industry is closely controlled, the business being in the hands of what is called the chrome-ore ring, which refuses to buy ore from any privately owned property, and as the greater portion of the ore property in private hands is at considerable distance from the railroads, the richest deposits being from 25 to 30 miles distant, it is probable that all the chrome ore deposits will eventually be absorbed by the ring.

Another serious inconvenience is the long haul of the ore from its deposit to the seacoast. The government of South Africa has been badly hampered during the war for want of freight cars, and this shortage has persisted to such an extent that the port of Durban cannot always fill its coal orders. This shortage of cars must be taken into consideration in connection with the exportation of chrome ore in any quantity. The closest and most convenient port to the ore fields is at Beira, Portuguese East Africa, but the other ports, Lourenço Marquez, Durban, and Cape Town, also are in railway communication with the chrome deposits.

Inclination of Ladders and Stairways

The accompanying illustration giving critical and preferred angles for ladders, stairways, and inclines, has been reproduced from a pamphlet issued by the American Abrasive Metals Co.. of 50 Church St., New York. It will be found useful for reference.



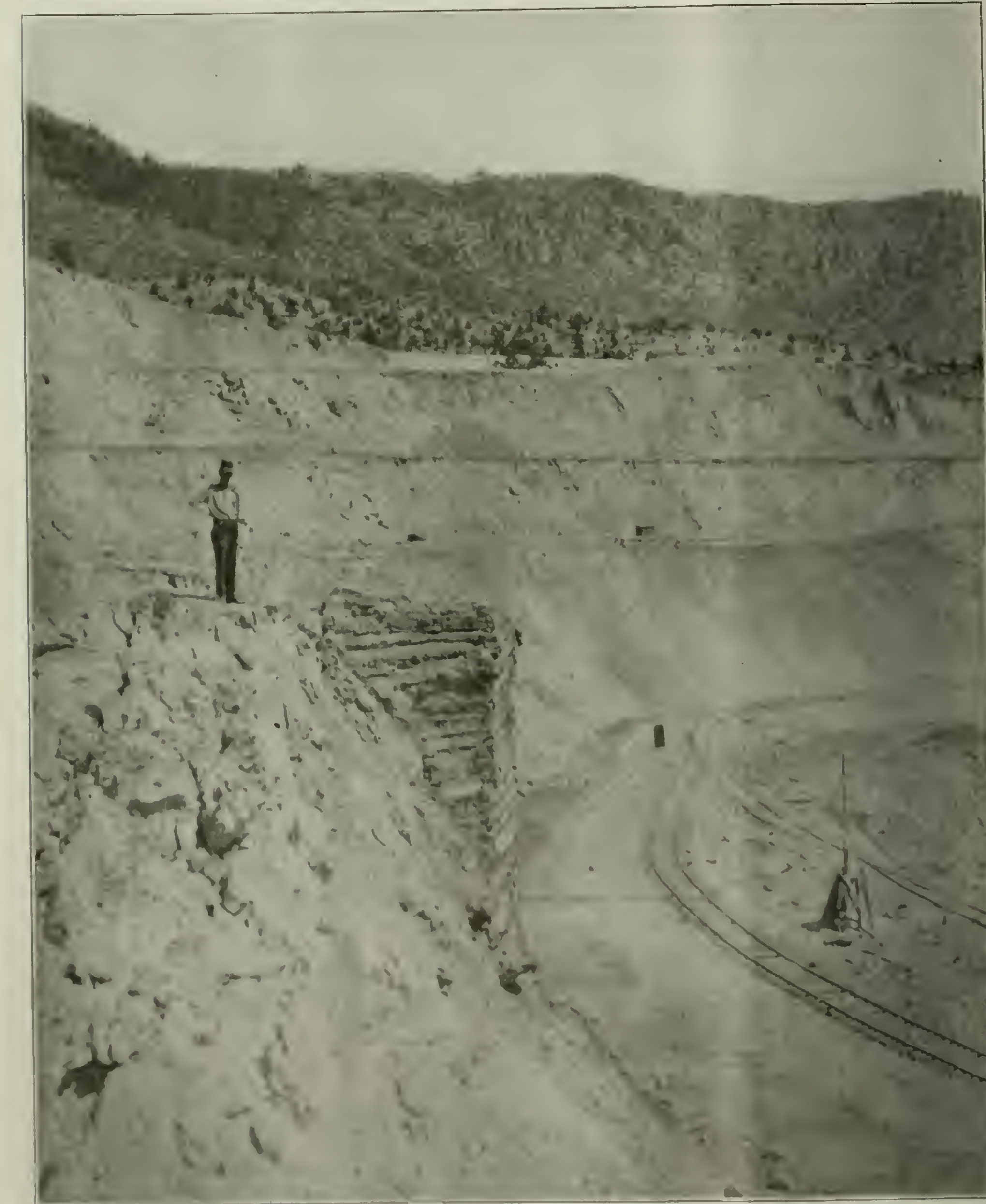
ANGULAR INCLINATION OF STAIRWAYS AND LADDERS

The table gives dimensions for risers and treads for stairways. The data were originally prepared by the safety engineering department of the Workman's Compensation Service Bureau.

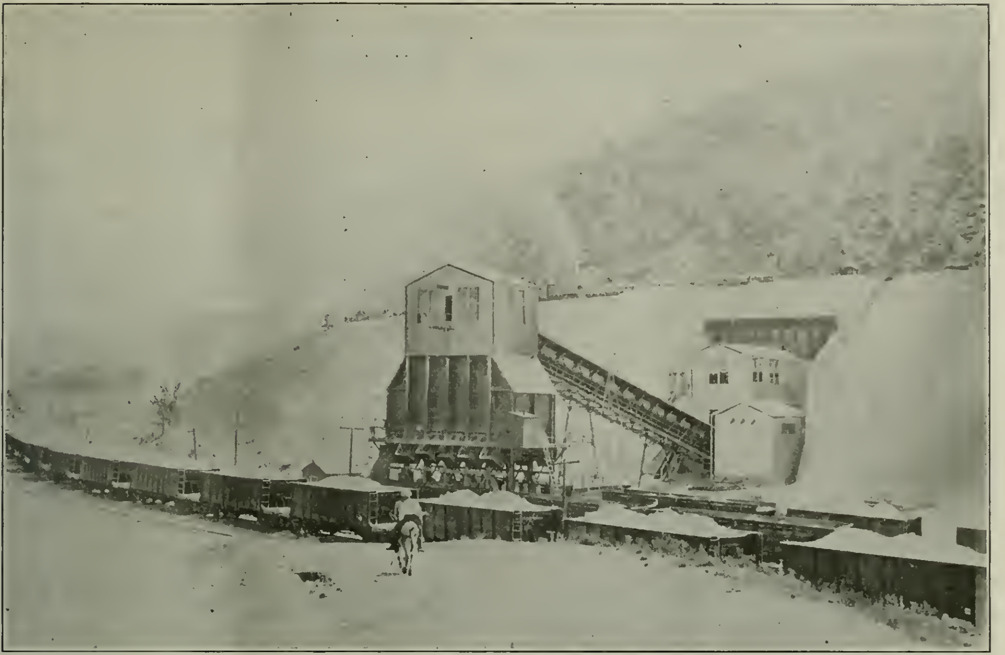
TABLE OF RISERS AND TREADS FOR STAIRS
(Tread + Riser = 17½ Inches)

Angle With Horizontal	Riser in Inches	Tread in Inches
22°–00′	5	12½
23°–14′	5¼	12¼
24°–38′	5½	12
26°–00′	5¾	11¾
27°–33′	6	11½
29°–03′	6¼	11¼
30°–35′	6½	11
32°–08′	6¾	10¾
33°–41′	7	10½
35°–16′	7¼	10¼
36°–52′	7½	10
38°–29′	7¾	9¾
40°–08′	8	9½
41°–44′	8¼	9¼
43°–22′	8½	9
45°–00′	8¾	8¾
46°–38′	9	8½

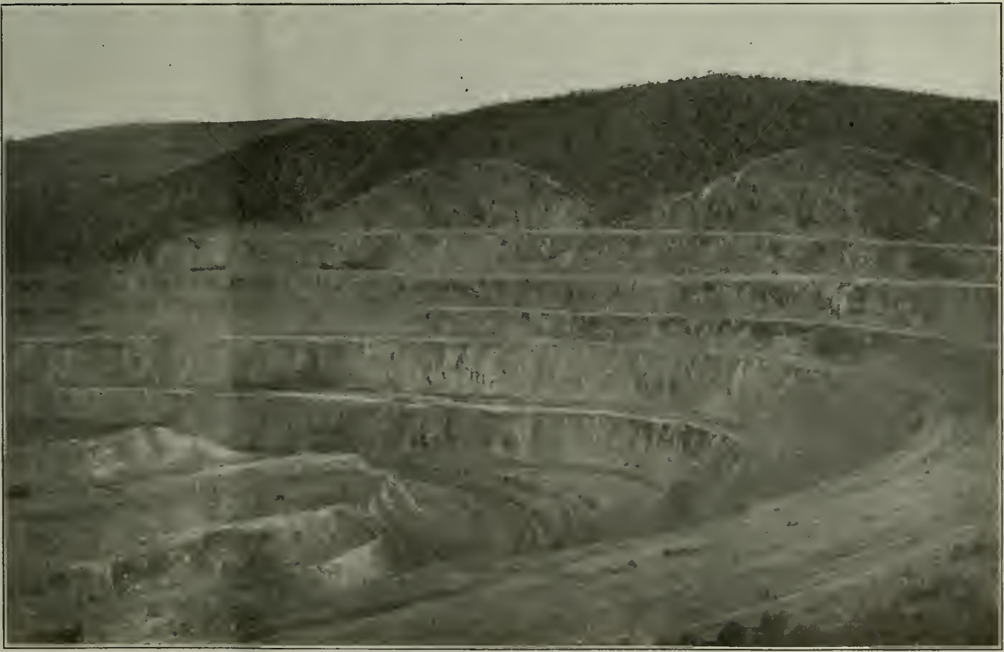
Chino Copper Company, New Mexico



OLD SHAFT SUNK BY SPANIARDS AND EXPOSED BY STEAM-SHOVEL OPERATIONS AT THE HEARST PIT OF THE CHINO COPPER CO., SANTA RITA, NEW MEXICO



COARSE-CRUSHING PLANT AND FINE-ORE BINS OF CHINO COPPER COMPANY



EAST SIDE OF HEARST PIT OF CHINO COPPER COMPANY, SANTA RITA, NEW MEXICO

Company Reports

Judge Mining and Smelting Co.

Mine development of the Judge Mining and Smelting Co. during 1918 consisted of drifts and crosscuts, 3223.4 ft., and raises, 2537.5 ft. Milling ore amounting to 47,835 tons and 10,271 tons of shipping ore were mined. The following mill operations were reported: Ore treated, 40,622 tons; lead concentrates produced, 6700 tons, and zinc concentrates produced, 4580 tons. Average capacity per 24 hours was 404 tons, the mill operating 351 eight-hour shifts.

Receipts for 1918 were as follows: Crude ore sales, $335,244.08; lead concentrates, $366,157.09; zinc dross, $34,497.10; spelter, $261,861.46; residues, $63,882.21, and interest and sundry receipts, $28,700.18. Expenditures, including mining, milling, and reduction expenses, exploration, ore expense, taxes and miscellaneous, totaled $912,001.52. Dividends amounting to $240,000 were paid. The balance on hand Jan. 1, 1919, was $72,180.27.

Consolidated Arizona Smelting Co.

The annual report of the Consolidated Arizona Smelting Co. for the year 1918 indicates that, notwithstanding the constantly increasing costs of labor, supplies, and freights, the copper was produced for the year at 14.683c. per lb., against a cost for the previous year of 14.98c. per pound.

At the Blue Bell mine, 3112 ft. of diamond drilling was accomplished, at a cost of $9142.35, equal to $2.938 per ft. This exploration resulted in the discovery of three new orebodies, two of which have been opened and put on a producing basis. During the year, 4638.5 ft. of drifts, crosscuts, and raises were driven, at a cost of $67,874.62, equal to an average cost of $14.63 per ft. of advance. The entire cost of exploration and development amounted to $77,016.97. This was charged against the mining operations for the year and amounted to $0.5875 per ton of ore shipped. The new ore developed amounted to 69,290 tons, against which the actual cost of exploration and development amounted to $1.11 per ton.

The total reserve of ore, estimated as positive, highly probable, and probable, on Jan. 1, 1919, was 470,000 tons, of which 15,593 tons was broken in the stopes. The estimated reserves show a decrease of 66,800 tons during the last year, during which period 131,090 tons of ore was produced and shipped from the mine. The average grade of all ore included in this estimate is figured at $2.50 in gold and silver and 2.80% copper.

The Blue Bell mine made a record production of 131,090 tons of ore, an increase of 30% of the 1917 tonnage and containing on the average $1.26 in gold, $1.50 in silver, and 2.771% copper. The cost of producing ore at the Blue Bell amounted to $3.786 per ton of ore produced. This cost included all exploration and development, also sorting and freight transportation to Humboldt.

No diamond drilling was carried on at the De Soto mine, but exploration and development to the extent of 874½ ft. of advance were accomplished, at a cost of $16,949.61, equal to $19.39 per ft. of advance and $0.3954 per ton of ore produced.

The total reserve of positive, highly probable, and probable ore at the De Soto mine was estimated on Jan. 1, 1919, at 33,000 tons. A considerable portion of this reserve is comparatively low in grade, and the average value is figured at $2.30 in gold and silver, and 2.60% copper. At the De Soto mine as well as at the Blue Bell mine, the content in gold and silver has tended to increase during the last few years, whereas the copper content has gradually diminished. The production from the De Soto mine was a trifle less than in 1917, amounting to 42,870 tons, containing on the average $1.54 in gold, $1.20 in silver, 2.576% copper. At present the rate of production is approximately 100 tons per day. The cost of the De Soto ore, f.o.b. Humboldt, was $3.6857 per ton.. The concentrator operated continuously throughout the year, and treated 104,633 tons of ore, or 1% less than in 1917. The average content of all material milled was $2.25 in gold and silver and 2.572% copper. The recoveries made in 1918 were: 89.52% copper, 67.16% gold, and 71.91% silver. The total cost of concentration was $1.9235 per ton, compared with $1.776 in 1917. The smeltery treated 160,328 tons of new metal-bearing material, an increase of 15% over the tonnage smelted in 1917. The recovery was 95.07% gold, 92.30% silver, and 93.82% copper. The total production of the smeltery was: 14,178 oz. gold, 442,809 oz. silver, and 18,800,073 lb. copper.

The production was derived as follows:

	Gold, Oz.	Silver, Oz.	Copper, Lb.
From domestic material (Blue Bell-De Soto ores and concentrates)	8,409	204,660	8,514,177
From custom material	5,769	238,149	10,285,896

The custom material was purchased from 67 shippers, and principally from the United Verde Extension Mining Co., the Arizona-Binghamton Copper Co., the Swansea Lease, Incorporated; Bradshaw Reduction Co., Jerome-Verde Copper Co., Swastika Development Co., and the Phelps Dodge Corporation (Copper Basin Branch). The United Verde Extension, which shipped monthly approximately 1,000,000 lb. of copper to the smeltery during the early part of the year, blew in its own smeltery at Verde during the month of June, and thereafter the most important source of the custom ore supply was cut off. However, the tonnage of custom material was maintained until almost the close of the year, although the copper content showed a great reduction, as it was necessary to substitute for the most part comparatively low-grade ores for the high-grade material which the United Verde Extension had shipped.

The cost of roasting and reverberatory smelting dropped from $4.20 in 1917 to $3.17 in 1918, a decrease of $1.03 per ton.

The net operating profit for 1918 is shown as $703,656.78, this figure being subject to adjustment, as a large amount of copper was carried unsold at the end of the year, and the actual sale price is still a matter of uncertainty.

The total production of domestic copper was 8,514,177 lb., a trifle in excess of the 1917 production. The domestic copper was produced at a total cost of $0.1468 per lb. and this figure is arrived at by crediting the value of the gold and silver produced and also the profit on custom material treated.

Ray Consolidated Copper Co.

The total ore mined in 1918 by the Ray Consolidated Copper Co. was 3,476,749 tons, containing 1.654% copper. Of the ore received at the mill, 3,426,600 tons was milling ore, and the remainder, 50,149 tons, averaging 4.46% copper, was sorted or selected ore that was sent to the smeltery for direct treatment. Mining cost was $1.76 per ton, including coarse crushing and loading. Total ore milled in 1918 was 3,411,000 tons, averaging 1.613% copper. A recovery of 74.92%, corresponding to 24.17 lb. per ton, was obtained. Cost of milling for the year was $1.01 per ton, compared with $0.83 in 1917. Production of copper from all sources was 86,919,270 lb., and the average cost per lb. was 17.695 cents.

The comparative statement is as follows:

COMPARATIVE STATEMENT, RAY CONSOLIDATED COPPER CO.

	1918	1917	1916
Operating revenue........	$19,209,311.29	$21,278,070.90	$20,060,783.48
Operating expense........	14,795,199.56	11,299,415.22	8,200,633.42
Net income	$4,414,111.73	9,978,655.68	$11,860,150.06
Other income..........	389,343.70	437,647.14	224,015.71
Total income..........	$4,803,455.43	$10,416,302.82	$12,084,165.77
Other charges............	150,000.00	715,133.08	367,737.76
Net profit.............	$4,653,455.43	$9,701,169.74	$11,716,428.01
Dividends..............	$5,125,831.75	(a) 6,624,151.80	4 337,954.75

(a) Includes $788,589.50 capital distribution.

Nevada Consolidated Copper Co.

Net reserves of developed ore at the end of 1918 for the Nevada Consolidated Copper Co. totaled 68,549,644 tons, containing 1.57% copper. This figure does not include carbonate ore in storage, amounting 165,000 tons, nor the tonnages contained in the Kimberley, Wedge, and Veteran areas, which total about 1,000,000 tons. Sulphide ore mined from the pit and shipped to the concentrator during the year was 2,711,743 tons, of an average of 1.334% copper, and that from the Ruth mine was 1,316,144 tons, averaging 1.857% copper. In addition, 14,811 tons of siliceous carbonate ore, assaying 2.99% copper, was mined and shipped to the smeltery as a flux, and 5960 tons, assaying 2.84% copper, was shipped from stockpiles. There was also mined for the Consolidated Coppermines Co. 193,093 tons of sulphide concentrating ore, assaying 1.545% copper. During the year 2,617,771 cu.yd. of capping was removed by steam shovels. The total steam-shovel mining cost of concentrating ores was 41.69c. per ton, of which 15.81c. represents taxes, leaving 25.88c. as the operating cost. The total mining cost, including taxes and a stripping-suspense charge of 34.9c., was 76.62c., as against 63.38c. for 1917. Underground costs were $1.2855 per ton.

Total company tonnage milled was 3,999,526 tons, averaging 1.506% copper, actual mill extraction being 67.28%, ratio of concentration 8.22:1, and copper in concentrate 8.33%. Total milling costs were 93.1c. per ton, but this does not include depreciation of plant. In addition, the company milled 193,093 tons of sulphide ore, averaging 1.545% copper, for the Consolidated Coppermines Co. Four reverberatory furnaces operated throughout the year and a fifth furnace was placed in operation in August. Total charge smelted was 654,650 tons. Copper production during 1918 was 76,607,062 lb., at a total cost per lb. of 17.98c. In addition, 15,191,770 lb. of copper was produced from custom ores. The comparative statement of finances is as follows:

COMPARATIVE STATEMENT NEVADA CONSOLIDATED COPPER CO.

	1918	1917	1916
Operating revenue...........	$16,787,656.68	$20,279,722.71	$24,366,291.50
Operating expense...........	14,437,280.63	11,635,375.33	9,996,022.83
Net income..................	$2,350,376.05	$8,644,347.38	$14,370,268.67
Other income................	1,051,694.48	1,293,251.29	1,065,090.47
Total income...............	$3,402,070.53	$9,937,598.67	$15,435,359.14
Dividends..................	$1,199,674.20	7,298,018.05	7,497,963.25

Homestake Mining Co.

The 1918 annual report of the Homestake Mining Co. shows that shortage of labor curtailed operations at the mine during the year, but the situation is now improving, and a return to normal conditions may be expected at an early date. Wolframite ore sufficient to keep the concentrating plant running continuously, at full capacity, was mined during the year. There remains in the mine a considerable tonnage of this ore of fair grade for concentrating.

Owing to excessive cost and scarcity of supplies, and particularly to shortage of labor, prospecting and development work in the mine on the scale heretofore in practice was cut down, although not entirely discontinued. The mine engineer reports 3661 ft. of development drifts, 1820 ft. of prospecting drifts, and 1873 ft. of development raises during the year. No shaft sinking was done.

Pertinent data as to mining and metallurgical operations are conspicuous by their absence from the report; but it is stated that the mine and surface plants are in good condition, with enough ore developed for many years' profitable operation.

Chino Copper Co.

A report covering the first quarter of 1919 has been issued to the stockholders of the Chino Copper Co., in which it is stated that the gross production of copper contained in the concentrates produced was 11,512,133 lb. The total amount of ore treated for the three months was 494,200 tons. The average copper content was 1.80%, and the ore was more favorable to concentration than that treated during the previous quarter. A total of 41,589 dry tons of concentrates, averaging 13.31%, was produced.

The financial results of the company's operations for the first quarter of 1919 were: Deficit from copper production, $218,255.04; miscellaneous income, including payments for precious metals, $44,813.17. Distribution to stockholders amounted to $652,485, leaving a net deficit of $825,926.87.

Curtailment of operations became necessary at the beginning of this quarter, owing to the large accumulation of unsold copper stocks and lack of orders. The report expresses the hope that operations can be continued at the present rate of about 50% capacity until a demand reappears for metal at prices that will afford a reasonable margin of profit. This will depend, it was stated, upon the extent of further accumulations of unsold copper and the carrying capacity of available resources.

Butte & Superior Mining Co.

The report of the Butte & Superior Mining Co. covering the first quarter of 1919, containing information respecting the principal operating features for the quarter, as compared with those for the fourth quarter of 1918, is as follows:

	First Quarter, 1919	Fourth Quarter, 1918
Dry tons of ore milled	71,298	110,039
Average zinc content, %	15.436	15.501
Average silver content, oz. per ton	6.710	6.515
Zinc concentrates produced, tons	19,307	30,391
Average zinc in concentrates, %	54.50	52.635
Total zinc in concentrates, lb.	21,044,540	31,994,804
Average silver in zinc concentrates, oz. per ton	22.012	21.047
Mill recovery (% zinc recovered in concentrates)	95.606	93.785
Direct mining cost, per ton	$6.4003	$7.948
Direct milling cost, per ton	$2.9967	$3.244
Total direct cost mining and milling, per ton	$9.397	$11.192
Indirect, or general, costs, per ton, exclusive of freight	$1.376	$0.6716
Total costs, per ton	$10.773	$11.864

The large decrease in the tonnage milled, as compared with the fourth quarter of 1918, was due principally to the curtailment of production on account of the general condition of the spelter market and the unsettled labor conditions during part of the month of February. Ore reserves were maintained at a slightly smaller tonnage than was shown at the end of the year.

The cost of mining was reduced to $6.40 per ton of ore, a decrease of about $1.55 per ton from that of the previous quarter. Indications point to further, though gradual, reduction of mining costs. The grade of ore mined and milled was approximately the same as that of the previous period.

The results of milling operations were still further improved, the recoveries of zinc being increased 1.82% and the grade of zinc concentrates improved to the extent of 1.86%. It is probable that the metallurgical results obtained for this quarter are approximately what may be expected for future operations. The cost of milling, despite the large reduction in tonnage handled, was reduced somewhat below that of the previous quarter, so that the total cost of mining and milling is $1.79 less than for the previous period, exclusive of indirect or general charges.

Financial results of operations for the first quarter, as compared with the previous period, are as follows:

	First Quarter, 1919	Fourth Quarter, 1918
Net value zinc concentrates at mill	$382,156.11	$983,362.32
Net value lead concentrates at mill and residues	250,336.85	398,352.34
Miscellaneous	19,193.61	20,262.53
Totals	$651,686.57	$1,401,977.19
Operating costs, taxes and other charges	768,065.42	1,305,470.56
Profits	$116,378.85 (a)	$96,506.63

(a) Loss.

The above statement of costs includes depreciation and expenses incurred during the strike in February, but no allowances have been made for depletion. The average price of spelter used for estimating the profits for the respective quarters was 6.189 cents.

Inspiration Consolidated Copper Co.

The Inspiration Consolidated Copper Co. reports that income from sales of copper during 1918 amounted to $17,516,323.05. The following expenses were incurred: Mining, including development, $3,743,032.25; reduction, including transportation of ore, $1,673,142.91; refining and selling, including transportation of metals, $2,323,403.59; administration and Federal corporation taxes, $1,065,743.07—a total of $11,805,321.82. Copper on hand Dec. 31, 1918, was valued at $2,978,099.43, and this amount, added to the income from sales of copper and deducting expenses, gives a balance of $8,689,100.66. Charging off a depreciation amount of $750,000, and crediting $290,062.94 for other investments, gives a balance of $8,299,163.60. Dividends amounting to $9,455,736 were paid, which leaves a balance of $12,784,432.71 as of Dec. 31, 1918.

During 1918, a total of 5,110,101 tons of concentrating and 29,031 tons of siliceous oxide ore were mined. No development work for the purpose of increasing ore reserves was performed during the year. Average output of ore per man-shift for all labor chargeable to the mining department was 21.5 tons. A total of 14.88 miles of underground openings was driven. The concentrator operated an average of 15 sections during the year, the yield of copper from concentrating ores being 19.08 lb. per ton.

The following additions were made to mine and surface equipment: Installation of an underground ventilating system; automatic block-signal installation on underground haulage system; installation of air-driven mucking machine; enlargement of changehouse; purchase of railroad equipment for the transportation of employees, and an addition to the power plant of four 713 hp. Sterling boilers, which installation, at the end of the year, was 75% complete.

Quincy Mining Co.

The copper-rock output of the Quincy Mining Co. during 1918 was 1,174,147 tons, from which was produced 31,970,969 lb. of mineral, yielding 19,948,965 lb. of refined copper, or 16.99 lb. per ton of rock. Total expenses, including mining, development, taxes, smelting, and transportation charges, were $3,733,133.25. Metal sales totaled $4,857,085.15 and other income was $81,475.02. Deducting $342,382.52 for construction at the mine and smeltery and for accident account, there remains a business income of $863,044.40. Dividends of $935,000 were paid.

Development totaled 24,580 ft. Shaft operations at No. 2 shaft, which is being sunk to the 80th level, progressed 115 ft.; No. 6 shaft was sunk 125 ft. and No. 8 shaft, 187 ft. Among the changes and improvements during the year were the following: A power scraper for underground work was perfected and an underground power shovel was successfully used. Four storage-battery locomotives were added to the underground tramming equipment. A new hoisting-engine house was practically completed at the end of the year. Additions were made at No. 1 and No. 2 mills, and provisions made for the installation of five 8-ft. Marcy ball mills and 240 additional tables. Fifty dwelling houses at the mine and six at the stamp mills were completed. An investigation was made as to the quantity of silver that could be recovered from mineral at the stamp mills, and this work yielded 13,982 oz. of 80% silver and 20,800 oz. of silver between 12 and 20% pure.

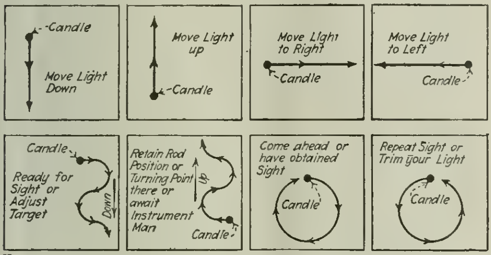
French Export Restrictions have been relaxed in a decree signed by the President of France on May 13, according to *Commerce Reports*. The number of classes of goods for which French export licenses are required is reduced from 111, as provided in the decree of Jan. 20, to only 19. The list includes the following minerals and metals: Phosphates of lime, bauxite, coal and coke, crude gold, platinum, and silver, iron ore, and metallic money.

Details of Practical Mining

Mine Surveyor's Lamp Signals

By Roy H. Poston*

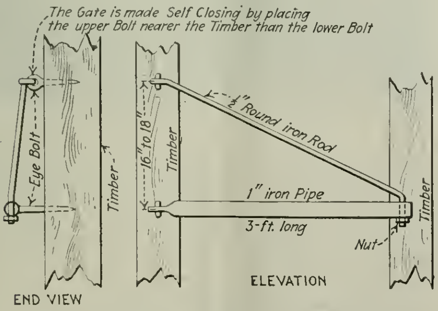
In underground surveying, the various noises that are inherent to mining often make it impossible for spoken directions and signals to be understood between the mine engineer and his helpers, so that it is necessary to resort to some other manner of communication, and this is usually done by means of lamps or candles. The sketch illustrates a few of the signals that are used in connection with a system adopted by one of the mining companies in Southeastern Missouri. Blueprints showing a complete set of such signals are prepared for the mine surveyor and his helpers, and they are expected to familiarize themselves with their use.


Candle
Move Light Down
Move Light up
Candle
Move Light to Right
Candle
Move Light to Left
Candle
Candle
Ready for Sight or Adjust Target
Down
Retain Rod Position or Turning Point there or await Instrument Man
Up
Candle
Come ahead or have obtained Sight
Candle
Repeat Sight or Trim your Light
Candle

LAMP SIGNALS FOR USE UNDERGROUND

Self-Closing Manway Gate

A safety guard for manways that closes automatically and eliminates the danger of a passageway being left unguarded is shown in the sketch and is described in the Mar. 22 issue of *Ax-i-dent-Ax*, the safety publication of the U. S. Smelting, Refining and Mining Company.



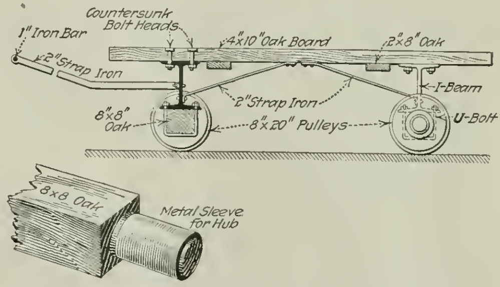
TYPE OF SAFETY GATE AT MAMMOTH MINE

The principle upon which the gate operates is not new, for it can be seen wherever garden gates are used, and consists of an arrangement of the hinges which insures the gate closing each time after being opened. Construction of the gate requires only one piece of 1-in. pipe, 3 ft. long; one piece of ½-in. round iron 3 ft. 6 in. long, and two pieces of ½-in. round iron 6 in. long (for I-bolts). At most mines these materials may be found in the scrap pile, and as any blacksmith can do the necessary work in half an hour or less, the cost is trifling. The gates are light, and anyone who can drive a nail can install them. When the stope is worked out, and they are no longer needed at one point, the gates can be easily taken down and used elsewhere.

Those in use at the Mammoth mine, at Kennett, Calif., are made to a standard size of 3 ft., but, owing to their extreme lightness, they could be made longer to guard a wider opening without being less effective.

A Home-Made Shop Wagon

The shop wagon shown in the accompanying sketch was built entirely of discarded materials, the only cost being that of the labor. The contrivance has been in continual use for six years, and, except for the need of an occasional nut or bolt, has required no attention.



SHOP WAGON MADE FROM DISCARDED MATERIALS

Automatic Car-Dumping Device

By L. H. Goodwin*

An automatic car-dumping device, shown in the illustration, was used on a 4-ton wooden ore car in connection with a small and somewhat makeshift installation. Other designs might have been found more suitable to manufactured types of cars, but in the above instance I found that the use of this appliance answered all the requirements of dumping the car at the proper time and place. The car was used to lower ore from a bin at the top of an incline to another bin at the bottom. An attendant at the upper bin hoisted the empty car, loaded it from the chutes, and then lowered the load to the bin below, where the car dumped automatically. After hoisting, the attendant closed the doors and adjusted the dumping device before loading.

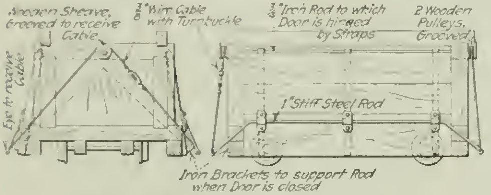
The car was provided with a V-bottom, and the doors were hinged at the top so that they would swing outward when dumping. Steel rods of 1-in. drill steel were held across both doors by means of straps so placed that the rods would rotate freely. These rods protruded about 2 ft. at either end beyond the doors, and were bent downward and outward at this point, the ends being provided with eyes. The projecting rods at either end of the car were connected by means of a ⅜-in. cable that passed over a small wooden sheave at the top of the car. Turnbuckles were placed on the cables, and it was possible to adjust them as required and secure the proper length as the cables stretched.

---

*St. Francois, Missouri.

*Mining engineer, 42 Broadway, New York.

In the sketch, the doors are shown in the closed position. When the car is filled, the force exerted by the pressure of the ore against the sides is transmitted along the projecting rods or arms and is communicated to the cable, which becomes taut. It will be seen that in the closed position of the arms no force applied upon the doors from within could open them unless it were sufficiently great to stretch the cable to such a point that the toggle angle formed between the door and the rod would be destroyed. The force of the ore against the sides has only a slight leverage, and, consequently, no trouble will be experienced, and as long as the rods remain in the position illustrated the doors cannot open unless something breaks.


Wooden Sheave, Grooved to receive Cable
⅜" Wire Cable with Turnbuckle
¾" Iron Rod to which Door is hinged by Straps
2 Wooden Pulleys, Grooved
Eye to receive Cable
1" Stiff Steel Rod
Iron Brackets to support Rod when Door is closed

AN AUTOMATIC CAR-DUMPING DEVICE

To free the doors from the grip of the cable it is necessary only to rotate one pair of the arms slightly outward. In doing this the other toggle angle, namely, the one between the cable and the arm, is destroyed, and both doors are free to open. A small force applied to the end of the arm is sufficient to move it outward, because it possesses the advantage of a 2-ft. lever. It is evident that with a 4-ton load in the car the pressure against its sides will be considerable, and that the cable will have sufficient force applied to it to keep it tight and without slack. Granting this, it is again evident that when the arm is rotated, even though its arc of rotation is slight, the cable must be lengthened ever so little. With the advantage of the lever, however, this tiny stretch in the cable is easily made, and the force required to trip the arm is slight.

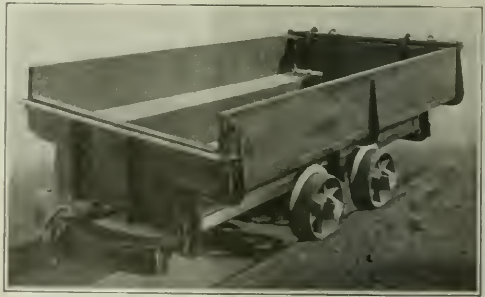
The arm is tripped at the unloading point by means of a steel shoe placed at such a point that it will engage one of the arms at the front of the car at the moment when the car is in the proper position for dumping. This shoe is given sufficient slope so that its contact with the arm causes rotation of the latter, thus freeing the doors. Once the doors are released, the pressure of the ore causes them to open, and the car empties itself easily. Points which need especial attention may be noted as follows: The slope of the V-bottom should be sufficiently steep to give the ore a good momentum when it leaves the car, otherwise it will not dump clean; a steel bottom aids greatly in securing that result. Much depends upon the steel rods, as they are subjected to considerable strain. Doors should be hung on a slight batter, so that they will close more easily. They must be strong, as they have little support at the bottom. Sufficient room should be left at the dumping point to assure that the ore, as it leaves the car, is not impeded in its passage. The track must be kept clear of obstructions which might act as trippers and prematurely dump the car. The idea was obtained from an old and discarded coal-handling and stacking plant, in which apparently several cars had been operated on one cable and dumped in this manner.

New Type of Mine Car

A type of mine car, recently produced by the Anniston Steel Co., Anniston, Ala., for one of the Alabama coal companies, is illustrated in the accompanying sketch. The design embodies several novel features which will be found applicable in the mining field. Specifications for this car are as follows: Capacity, 2000 lb.; inside length, 7 ft.; height, 18½ in.; height over rail, 30 in.; width at top, 4 ft.; diameter of wheels, 12 in.; track gage, 36 in., and wheel base, 20 inches.

All body irons are made of structural shapes formed to exact dimensions. Stiffening bars are made from Z-bar, 1¾ x 2 x 1½ in., all riveted to the body binders and bolted at each end to the bumper. This arrangement holds the car in perfect alignment. The draw bars are made from 2 x 3½ x ⅜-in. tees. Attached to the ends of this bar are electric cast-steel drawbar hooks and eyes, with electric-forged steel hitchings.

The assembling of the truck and its attachment to the bottom of the car are done by means of 3 x 3 x ⅜-in. angles or 10-in. 15-lb. channels, as required, all riveted to the body irons as well as to the draw bar and the stiffening Z-bar. The wheels are provided with ⅜-in. pipe plug for oiling purposes. The axle housings are bolted through the channels or angles, passing through the entire bottoms and inside washer plates.



SPECIALLY DESIGNED MINE CAR

The axles are made from sufficiently high-carbon steel to permit turning and hardening to exact dimensions that part of the axle used for a bearing surface. The wheels are of electric cast steel, and are cast in steel chillers to insure perfect concentricity, thus facilitating the machining and boring.

The wheels are greased or oiled before assembling and are bored to a tolerance of 0.002 in. for application of the Hyatt shock-absorber roller bearing. The housings are also electric steel castings, designed especially to prevent dust and other disintegrating substances from entering the bearings, and are well packed with felt to accomplish this purpose.

The oak used in the manufacture of the cars is selected stock of the best grade obtainable.

Ore Dressing and Metallurgy

The precise action of commonly used materials is likely to be ignored, and the notes on the use of lime will draw attention to an important phase of metallurgical work. The electrical explanation as to the settlement of a ground ore by an electrolyte such as lime may not be generally acceptable, as it is now known that other coagulation phenomena, dependent on adsorption of the metallic ion of the electrolyte, take place when the particles are all of the same electric sign, and should, therefore, remain mutually repulsed. No final explanation of coagulation is available, but further discussion will help to throw more light on the subject.

Preliminary testing work may lead to the adoption of the proper process and the most efficient equipment, but control of operations is always simplified and results are almost invariably improved by a continuance of experimental checking. The flotation flask described has been designed with a view to insuring accurate forecasting, and will prove a most useful adjunct in the laboratory.

Lime as a Settling Agent

BY PAUL T. BRUHL*

Lime is so common a reagent in cyanide practice that one is, in general, more content to tacitly acknowledge its beneficial effects than to attempt any explanation of the way in which it functions. To admit that lime is useful because it counteracts any acidity in the ore and promotes settlement is, of course, merely a statement of fact. To explain "why" a certain effect takes place is usually easier than to explain "how" it takes place. For instance, it is known that lime aids settlement by causing coagulation of the slimes. This statement, however, gives no information as to how the effect is produced. If it be possible to learn exactly how it is that lime functions, it will become practicable to control its use in the most economical way. The proper settlement of slime is of importance in cyanide mills where decantation is practiced, and it would be helpful to discover the causes to which poor settlement may be attributed.

A dirty overflow, as poor settlement is sometimes described in mill parlance, is often due to the fact that pulp is being sent to the thickener in quantities in excess of the machine's capacity. It may be caused when the pulp is of too high a specific gravity, and, therefore, of a viscosity too great to permit a sufficiently rapid settlement of the solid particles. As the viscosity of a solution increases with fall of temperature, the solids in a cold pulp will not settle as quickly as in a warmer one. Time of settling depends also on the physical condition of the slime, for as it becomes finer the influence of gravity becomes less and less, and surficial forces between solids and solution have a correspondingly greater effect, owing to the increase of internal surface. When the slime is in the colloidal form settling may become economically impossible. I remember a run-of-mine ore which settled well when the protective alkalinity was maintained at 1 lb. per ton. The ore, however, that was obtained from a certain section of the mine was clayey in character, causing the thickener overflow to become dirty. Even at a short distance the overflow looked clear, but floccules of gelatinous material could be distinguished on closer examination. These soon choked the pores of the cloths in the clarifying filter, necessitating frequent treatment with hydrochloric acid. The protective alkalinity was varied from 0.5 to 3 lb. per ton without improvement. It is probable that the floccules consisted in large part of a precipitate formed by chemical action between some constituent of the ore and calcium hydrate.

It is regarded as probable that quartz particles acquire charges of negative electricity on their surfaces and that these similar charges cause the particles to repel one another and thereby hinder settling. The lime dissolves with the production of positive ions in excess, which neutralize the negative charges borne on the surfaces of the quartz particles, and so deprive them of their capacity for mutual repulsion. I have noticed, however, that some ore slime will settle more readily in a solution that carries undissolved slaked lime than in one that has all the lime in solution, and, temporarily, a higher protective alkalinity. This observation indicates that the solid slaked lime possesses a property that enables it to effect a more rapid settlement than the same quantity of lime in solution. What is this property?

In metallurgical practice it is the aim to use the smallest quantity of lime that will insure sufficiently quick settling. It may well be, then, when small amounts of lime are used, that the negative charges of the quartz particles are not all neutralized, but that some of the particles are discharged, and that these, by reason of collisions with other particles that are still charged, again acquire negative charges (which are naturally weaker than the original ones), and so, as a whole, the system becomes less intensely electrified, and the force of repulsion becomes too weak to hinder settlement. It is possible that the more rapid subsidence of the slime observed when some undissolved slaked lime is present is due to the lime particles carrying larger charges of positive electricity. Lime when used in too great an excess may retard settlement, because, though the charges on the quartz particles are neutralized, so much positive electricity is present that the quartz now acquires a positive charge, and subsidence of the slimes is again impeded.

Lime is added either in crude form directly to the ore, or the addition is made after slaking. The latter method is undoubtedly preferable, because slaked lime is about 30% more soluble than unslaked lime, and it produces a more marked settling effect. Some chemical reaction other than that represented by the recognized equation—$CaO + H_2O = Ca(OH)_2$—is probable; otherwise this difference is hard to explain. Oxygen in excess and water at a minimum must cause a change that does not occur, at any rate so markedly, when the lime is put in a large bulk of solution.

---

*American Venture and Mines Corporation, Thomson, Georgia.

From the considerations mentioned it would appear that the best results are obtained when lime is added continuously, as slaked lime, preferably in the form of a spray at or just below the surface of the solution in the thickener.

Experimental Flotation Flask*

By Will H. Coghill†

In flotation experiments it is desirable to have a hand device correlating successively with the experimental and commercial machines. This phase of flotation has not been sufficiently developed. I purpose describing a device which is intended to fill this gap.

Success in designing a machine depends upon the priciples selected to govern its detail. The principles that are applicable in the selection of this device are that the pulp density and the ratio of solids to frothing surface must be the same as in well-designed machines. The importance of these factors can best be emphasized by quoting from Del Mar.[1]:

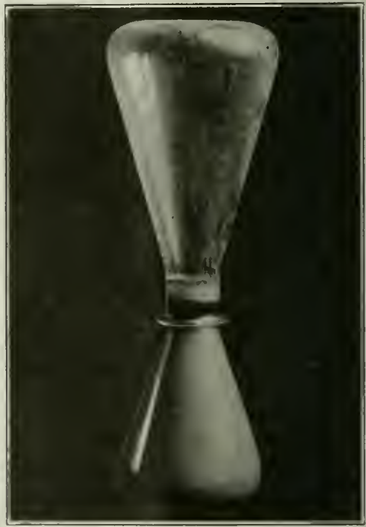
> Under manipulation may be included the shape or form of the collecting chamber of the flotation machine, for the cells in any flotation system are used for two purposes, either to float a dirty concentrate, which must be cleaned before marketing, or to float a finished concentrate, which is ready for shipment. In the former case the collecting chamber of the machine should favor a quick discharge; that is, there should be a narrow chamber, but when we require the finished product the box must be sufficiently wide to allow the settlement of occluded waste or gangue. Manufacturers of flotation machines miss this point, and therefore the same machine is often used for roughing and for cleaning, although the two operations require entirely different manipulation. This important structural feature in the flotation chamber may make the difference between success and failure, for not only must a concentrate be produced, but it must attain a certain grade of metallic content to be fit for shipment.

On observing successful laboratory flotation machines of the mechanical agitation type, it is found that, when the pulp density is 3 to 1, there is from 30 to 60 gm. of ore for every square inch of frothing surface. Take a test tube of such a diameter that it gives a frothing area of 0.6 sq.in. The quantity of ore required is, then, say, 30 gm., and for a 3 to 1 pulp, 90 c.c. of water must be added. But the ordinary test tube of this diameter will hold only 85 c.c. of water and is 8 in. long. After making allowances for the volume of ore and air, the test tube would have to be about one foot long.

It is obvious that the adoption of these proportions in such a device would not be consistent. A loaded bubble which chanced to be at the bottom of the tube at the end of the agitation period would have to travel upward a distance of nearly twelve inches against a falling column of solids before it could deliver its burden to the froth. Needless to say, it would be wrecked at the outset and buried beneath the column of ore. Moreover, the test tube has no facilities for discharging the froth.[2]

The device which is recommended here has been used at the Northwest station of the U. S. Bureau of Mines at Seattle. It consists of two Pyrox flasks, one of 250-c.c. and the other of 500-c.c. capacity. A rubber nipple is placed on the neck of the smaller one, so that when the flaring portion is ground off it will fit snugly into the larger, as shown in the cut. To prepare a test, the smaller flask is filled with a mixture of ore and water of the desired consistence and emptied into the larger one, after which about 3 c.c. of water is added. After the desired flotation reagents have been added, a stopper is placed in the flask and the experimenter is ready to proceed with the test. The procedure of testing is by means of hand agitation for, say, five minutes. The stopper is removed, the flasks are united, and, after a brief agitation, placed in the position as shown. The extra 3 c.c. of water referred to elevates the lower level of the froth so that it will overflow into a collecting pan when the larger flask is removed. The agitation may be repeated as often as desired by adding a little extra water each time.

The efficiency, of course, is low as compared with the mechanical devices, but the relative floatability of minerals and relative effects of flotation reagents may be quickly determined. There are two reasons why the efficiency is low—there is no opportunity for the froth to build up during the agitation period, and a small quantity of gangue lodges on the bench formed by the union of the inner and outer tubes, and by joining the overflow reduces the grade of the concentrate.



HAND DEVICE FOR FLOTATION EXPERIMENTS

The quantity of modifying reagents must be determined by calibrated devices. Otherwise impressions may be misleading, and deductions which are unwarranted might be made. This is demonstrated by the following example: When four drops of oil was added from a medicine dropper, the pyrite floated so freely that the results were adverse. The dropper was then calibrated and it was found that 4 lb. of oil per ton of ore had been used. The test was then repeated with one drop of oil, and the results were encouraging.

This device then has three points of advantage over the test tube: It has convenient discharging facilities, and it provides for desirable pulp densities and a constant area of frothing surface.

---

*Published by permission of the Director of the Bureau of Mines.

†Metallurgist of the Bureau of Mines.

[1] Del Mar, Algernon, "Differential Flotation of Lead and Zinc Sulphides," *Min. and Sci. Press*, Vol. 117, Nov. 23, 1918, p. 692.

[2] The separatory funnel which has been recommended by "A Special Correspondent," *Min. and Sci. Press*, July 31, 1915, p. 122, and by Ralston, O. C., and Allen, Glenn L., *Min. and Sci. Press*, Jan. 8, 1916, p. 44, is faulty because the proportions are not good and the froth has to stand until the tailing is removed.

The Engineering Standards Association

The establishment of the American Engineering Standards Association is the development of a constructive principle of broad purpose, and through coöperation of technical societies and Government departments it is possible to unify standardization work which, if carried out by various organizations operating independently, has a tendency to produce diversification, rather than an effective coördination of industrial practice. Standardization will not only stabilize conditions governing commercial and technical matters, but it will also prevent duplications and waste motion and an overlapping of effort.

THE importance of standardization in many lines of engineering was emphasized by the war, and the work that has been done in that field shows clearly the need of coöperation, to prevent the confusion caused by the promulgation of overlapping standards by independent bodies. During the war the Government departments coördinated these efforts in certain lines and greatly assisted in unifying them.

The American Institute of Mining and Metallurgical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, and the American Society for Testing Materials, recognizing the value of what had been done, invited the Government departments of War, Navy, and Commerce to appoint representatives to collaborate with them in continuing this work. The body so formed is known as the American Engineering Standards Committee. Considerable time has been required definitely to formulate its objects. and arrange methods for accomplishing them that would be effective without in any way interfering with the many organizations that have been doing such excellent work in the accomplishment of this object.

This committee has just completed and adopted a revision of its constitution, which has been sent to the governing boards of all the departments and societies represented on the committee, with a request for its ratification. The new constitution changes the name to American Engineering Standards Association, the change from "committee" to "association" more fittingly ndicating the wide scope of the interests involved.

PURPOSES OF THE STANDARDS ASSOCIATION

The objects of the association are stated as follows: To unify and simplify the methods of arriving at engineering standards; to secure coöperation between various organizations and to prevent duplication of standardization work; to promulgate rules for the development and adoption of standards; to receive and decide on recommendations for standards submitted as provided in the rules of procedure, but not to initiate, define, or develop the details of any particular standard; o act as a means of intercommunication between organizations and individuals interested in the problems of standardization; to give an international status to approved American engineering standards; and to coöperate with similar organizations in other countries, and thus promote international standardization.

Means are provided for increasing the number of representatives in the association by invitation or upon request. Several important organizations interested in standardization will be invited to appoint representatives as soon as the necessary power is obtained.

The routine work of the association will be conducted by its secretary, under the direction of a board of directors. This board will have power to deal with all of the affairs of the association except the final approval of the standards submitted to it.

CONDITIONS GOVERNING FORMATION OF SPONSOR SOCIETIES

Any organization may request the association to approve standards which it has formulated, or to approve committees that it has appointed, and by so doing becomes a sponsor society. Such a request is entirely at the option of the organization that has formulated or expects to formulate the standard. At the request of the sponsor, approval of the standards is given when they are the substantially unanimous conclusions of a committee made up as follows: (a) Sectional committees dealing with standards of a commercial character (specifications, shop practices, and similar matters), shall be made up of representatives of producers, consumers, and general interests, no one of these interests to form a majority. A producer is a person, or the representative of a firm or corporation, directly concerned in the production of the commodity involved. A consumer is a person, or the representative of a firm or corporation, that uses the commodity involved, but is not directly concerned with its production. General interests include independent engineers, educators, and persons who are neither consumers nor producers, as defined above. (b) Sectional committees dealing with standards of a scientific or non-commercial character shall consist of persons specially qualified, without regard to their affiliations.

It is anticipated that in nearly all cases the approval of standards and committees by the association will be requested. If considered advisable, the association is authorized to call a meeting of those who would be interested in the formulation of a new standard or the revision of an old one, to select one or more sponsor societies. The sponsor society or societies will appoint a sectional committee to formulate or revise the standard. This sectional committee will report to the sponsor when its work is completed. The sponsor may then request the association to approve. The association deals only with the sponsor and acts only at its request.

Provision is made in all publications that a standard must be referred to as that of the sponsor, using whatever title the sponsor has given it, followed by the statement "approved by the American Engineering Standards Association." The approval may be given in one of three ways, either as recommended practice, tentative standard, or standard, the expectation being that nothing will be approved as standard until it has been shown that it is generally acceptable.

The association thus acts only to bring together those interested in a common object, and, when they have completed their work, will at their request certify that it has been done in such a manner as to justify its adoption. Nothing revolutionary is proposed; it is merely an extension of present practice. The executive committee of the American Society for Testing Materials now passes on the composition of committees, ascertains that their conclusions are substantially unanimous, and, if so, reports them to the society for acceptance or rejection. The association does the same for groups of organizations. Its board of directors performs the same functions as the executive committee of the American Society for Testing Materials, and the association as a whole accepts or rejects. It neither selects sponsors nor sectional committees; it does not consider the subject matter of a standard, nor the procedure under which it is arrived at, except that it requires sufficient information from the sponsor to show that the conclusions are substantially unanimous and that the sectional committee is balanced and representative. It requires that in all publications the sponsor shall be given full credit.

In addition to the work of assisting in the selection of committees and certifying that their work has been done under proper conditions, the association will act as a bureau of information regarding standardization. It will collect information regarding existing standards and as to the bodies that have formulated and adopted them, and furnish information desired by the working committees regarding what has been or is being done on similar or related lines. It will establish relations with similar bodies in other countries and can do much to promote the acceptance of international standards.

EFFECTIVE MEANS DEVISED FOR THE ADOPTION OF STANDARDS

It is the unanimous conclusion of all those who have been consulted who have been active in standardization work that such an organization is urgently needed. Two or more organizations have on many occasions formulated standards for substantially the same thing, and though often these differences have been slight, neither has been entirely acceptable to the other interested person, firm, or organization. In the majority of such cases, if the organizations had been brought together at the beginning they could have agreed on a standard that would have been satisfactory to both.

The American Engineering Standards Association will furnish a means by which any organization intending to define a standard can readily ascertain what others are interested and should be consulted in regard to it. At present there is no such means. There is nowhere anything approaching a complete list of the organizations doing standardization work, much less any list of the standards proposed or in preparation.

The advantage of having any standard generally accepted, and the much greater probability of accomplishing this if it is prepared under definite conditions that have proved effective in the past, will, it is believed, cause most of the organizations engaged in such work to ask and receive the assistance of the American Engineering Standards Association. It provides definite machinery for securing coöperation and preventing duplication of work. It establishes definite rules to secure the absolute autonomy of any group engaged in the development of standards, and insures that this group shall receive full credit for its work.

With the assurances of coöperation that the American Engineering Standards Association has already received, it is believed that there is no question of the advisability of forming the more broadly representative association. Several organizations have already presented requests for the approval of existing standards and many others only await the notification of the committee that it is fully organized.

Monthly Copper Production for 191

The table which appears herewith is compiled fron reports received from the respective companies (excep in the cases noted as estimated), together with th reports of the U. S. Department of Commerce as t imported material, and in the main represents th crude-copper content of blister copper, in pounds.

MONTHLY CRUDE-COPPER PRODUCTION, 1919

	February	March	April	May
Alaska shipments (c)	5,176,033	1,471,398	2,153,691	....
Arizona:				
Arizona Copper	3,360,000	2,800,000	2,400,000	2,400,00
Calumet & Arizona	6,612,000	4,602,000	3,822,000	4,308,00
Cons. Ariz. Smelting	1,000,000	720,000	770,000	690,00
Inspiration	6,600,000	6,700,000	6,900,000	6,200,00
Magma	1,211,175	1,000,212	674,943	....
Miami	4,462,578	4,551,115	4,489,748	4,989,58
New Cornelia (a)	2,014,000	1,980,000	2,000,000	1,408,00
Old Dominion	2,360,000	2,574,000	2,389,000	2,564,00
Phelps Dodge	7,410,000	6,434,000	6,560,176	6,783,90
Ray	4,150,000	3,792,000	3,650,000	3,975,00
Shattuck Arizona	376,166	2,452	*Nil*	....
United Verde	2,850,000	*Nil*	*Nil*	1,250,00
United Verde Extension	1,239,120	*Nil*	*Nil*	*N*
California:				
Mammoth	1,506,000	1,475,000	1,386,000	620,00
Michigan:				
Calumet & Hecla	9,263,868	9,652,053	8,554,113	6,796,81
Other Lake Superior (b)	6,500,000	6,500,000	6,500,000	6,500,00
Montana:				
Anaconda	12,400,000	13,900,000	13,750,000	13,500,00
East Butte	633,560	1,700,230	1,347,580	1,414,46
Nevada:				
Mason Valley	947,336	*Nil*	*Nil*	*N*
Nevada Cons.	4,150,000	3,650,000	3,763,000	3,700,00
New Mexico:				
Chino	3,552,676	3,770,000	3,498,747	3,583,39
Utah:				
Utah Copper	10,335,000	8,366,000	9,420,000	9,125,00
Eastern smelters (b)	1,400,000	1,400,000	1,400,000	1,400,00
Total reported	99,509,512	87,040,460	85,428,998	....
Others, estimated	12,140,000	15,000,000	13,380,000	....
Total United States	111,649,512	102,040,460	98,808,998	....
Imports: Ore and concentrates, etc.	13,824,200	10,146,979	9,773,655	....
Imports in blister, etc.	33,369,626	49,564,536	22,781,489	....
Grand total	158,843,338	161,751,975	131,364,142	....
British Columbia:				
Granby Cons.	2,610,737	667,142	707,301	1,267,6
Mexico:				
Boleo	1,807,680	2,039,520	1,433,040	....
Cananea	3,000,000	3,200,000	3,000,000	3,000,0
Phelps Dodge, Mexican properties	1,775,000	1,900,000	1,702,000	1,552,0
Other foreign:				
Cerro de Pasco	4,586,000	4,838,000	4,780,000	4,034,0
Chile	5,376,000	4,568,000	5,024,000	5,066,0
Katanga	3,877,890	3,262,800	....	....
Backus & Johnston	1,642,898	2,144,825	....	....

(a) Only electrolytic cathodes are entered. New Cornelia also produces son copper from ores sent to Calumet & Arizona smeltery. (b) Estimated (Official figures of the U. S. Department of Commerce; includes Kennecott pr duction from its Alaska mines.

Production of the United States by months sinc the beginning of the year and the corresponding figure for 1918 were as follows:

	1918	1919
January	165,431,568	135,733,5
February	160,011,364	111,649,5
March	185,525,168	102,040,4
April	163,207,096	98,808,9

The grand total includes, under "Imports in ore an blister copper," the production of such companies a Granby, Cananea, Braden, Cerro de Pasco, and Chil As a matter of record, however, the individual figure are given after the total. We also report the coppe output of the Boleo and Katanga companies, which doe not come to the United States.

British Export Regulations.—A cable dispatch from th Consul General at London announces that a proclamation May 10, 1919, grants a general export license for certai commodities, among which are the following: Iron billet blooms and slabs; iron ore; iron sheet and bars; steel bi lets, blooms and slabs; steel ingots; steel sheet and bar

Industrial News from Washington

By Paul Wooton, Special Correspondent

New Potash Bill Considered

The domestic potash industry has not found an enthusiastic friend in the Ways and Means Committee of the House of Representatives. This became evident during the hearings on the bill introduced by the chairman of the committee, Representative Fordney, of Michigan. Mr. Fordney's bill contains the licensing plan which was in the bill that was reported favorably by the Senate Committee on Mines and Mining at the last session of Congress.

The bill as it came from the committee on that occasion has been reintroduced in the Senate by Senator Henderson. The Fordney bill contains, in addition, a provision for a duty of 10c. per unit of potassium oxide, effective five years after the proclamation of peace. The licensing powers terminate at that time.

The potash producers have made practically the same case in this hearing as was presented by them before the Senate committee at the last session. They are able at this time, however, to bolster their claim by evidence that the German and Alsatian interests already are busily soliciting orders in this country. The expert testimony also is much the same, but many minor points of interest which are new are brought out.

The hearing was opened by George Otis Smith, Director of the U. S. Geological Survey. He was questioned at length by members of the committee. Among the references to the Alsatian deposits, Dr. Smith said:

> Seven mines are now in operation, and several other mines are being put into operating condition. Able technical talent has been secured and excellent progress made in restoring these properties. The mines compare fairly well in size and equipment with the best German mines. The daily production is about 2300 tons of potash salts, averaging about 20% of actual potash—that is, about 460 tons K_2O, in terms which I have used for the United States product. That would represent about 150,000 tons K_2O per year, or three times our own production last year. They have stocks on hand there which in April were at least 8000 tons of actual potash. February quotations for domestic consumption, delivered at Rotterdam, was about 60c. per unit of potash, a unit being 1% of a ton, or 20 lb. K_2O. Export prices have not been established, so far as Mr. Gale could learn. The shipping cost from Mulhausen to Rotterdam is given by him at about $2.50 a ton.

The producers' position, as stated to the committee, is that they prefer a tariff bill with a duty on potash, but they fear the President would veto such a measure. They are of the opinion, however, that he would not veto a licensing bill. Representative Kitchin, the ranking minority member of the committee, stated during the hearing that he assumes the President would sign any bill that would be in the interest of the American people, whether in the form of a tariff or a license. Representative Garner rather chided the producers for trying to get protection by indirect methods. The spokesman for the producers hurried to point out that no effort was being made to mislead anyone, but that a licensing bill will reduce the expense to the farmers by $10,000,000, assuming that a tariff would take $20,000,000 to protect the industry. The producers also made formal denial that there had been any combination among them to hold up the price of potash.

The producers lost no opportunity to impress upon the committee the necessity of prompt action. They pointed out that 90% of all potash used in this country goes into fertilizer and that 75% of the fertilizer is manufactured by six large concerns with abundant capital and highly efficient organizations. Under such conditions, it was argued that importations could be made quickly, once the bars are down. It was argued on the other hand, however, that the stories of a great German surplus are mythical and that quantity production in Alsace is a matter of years. It was also stated that pre-war prices on imported potash never again will prevail. The opinion was expressed that the price of German potash under present conditions would not be less $1.25 per unit when laid down at our Atlantic ports.

The argument on the other side of the question is that domestic producers have enjoyed four years of absolute embargo and a price six times the normal. If they have been unable, under those conditions, to establish an industry, two or three years more hardly would affect the result. The opinion was expressed that the low-cost and properly capitalized producers can compete with foreign potash at present, whereas only prohibitive protection would be of assistance to high-cost producers.

The United States Tariff Commission in a formal statement to the committee declared that potash presents one of the most complex tariff problems in the tariff schedule. No recommendation is made, however, but the commission presents "some of the facts likely to be most significant in determining the fate of the new industry." The situation before the war is reviewed. The significance of potash in agriculture and in the chemical industries is pointed out. The development of the industry in the United States from the beginning of the war to the signing of the armistice is outlined. The development in other countries is referred to briefly and detailed information is given concerning the individual salts. That the peace treaty may have a large influence on the potash situation is pointed out by the Tariff Commission.

Survey Mineral Data Used in Paris

Important use was made at the Peace Conference of the U. S. Geological Survey's data on foreign mineral deposits, according to J. B. Umpleby, who has just returned from Paris, whither he took the extensive exhibit. In fact, these data were practically the sole source of information for the territorial and economic specialists in considering the mineral aspects of the situation. There were scores of mineral problems, of which the following are typical: The dispute between Poland and Czechoslovakia concerning the Teschen coal fields; the oil fields of Roumania; the relation of the Idria mercury deposits in the area represented by the Fiume controversy; the value of German colonial mineral deposits; the coal resources of the Sarre valley; the iron-ore resources of German Lorraine; and the mineral deposits in the Shantung region.

In the opinion of Mr. Umpleby, it will be five years before the iron and steel output of the Minette region will regain the 1913 volume of production. This is due not so much to reduced furnace capacity as to reduction in the coke capacity of adjacent coal fields. Mr. Umpleby is also of the opinion that Asia Minor will attract great attention from mining men, if stable governments are established in that region.

In the course of his work Mr. Umpleby was brought into contact with information regarding the fuel situation in Europe. In his opinion that situation is serious. Not only are supplies short for industries, but they are insufficient to insure the domestic population against serious hardships this winter. English production has been cut down by generally understood causes; strikes have interfered materially with the output from the Westphalian basin, and the disputes between the Poles and the Czechoslovaks have almost stopped coal mining in the upper Silesian basin. Belgium will have no coal for exporting. Lack of production is only one factor, as transportation offers almost as serious a problem.

The action of the German armies in destroying the coal mines and in preserving the iron mines in the territory they occupied is regarded by Mr. Umpleby as cold-blooded foresight, since Germany was an exporter of coal and an importer of iron ore.

War-Minerals Work Delayed

Delay in classifying the war-minerals claims geographically and by metals is resulting because some of the claims are in the hands of the War-Minerals Relief Commission, which is holding hearings at points easy of access from the mining districts. It was necessary for the commission to take many claims for use at hearings. As soon as these claims can be returned to Washington and placed in the hands of the clerical force, a number of important tabulations will be made.

Despite the fact that June 2 is specified by the law as the last day on which claims may be received, they are coming in at almost the same average as was the case prior to that date. No record, however, is being made of such claims.

The following procedure has been adopted in connection with claims arising under the act of Mar. 2, 1919, known as the Minerals Relief Act, according to an announcement made on June 16, by the Secretary of the Interior, Franklin K. Lane:

"The findings of the Minerals Relief Commission will be made and thereafter 20 days will be allowed claimant to file typewritten or printed brief based upon the record already made, making such comment on the commission's findings as may be desired. At the end of 20 days the case will be finally submitted to the Secretary of the Interior. No new facts will be considered, those which have been submitted to the commission only being given consideration. No oral argument will be heard."

Tariff on Tungsten Sought

A straight protective tariff on tungsten is being urged upon the Ways and Means Committee of the House of Representatives by the domestic producers. Representative Timberlake, of Colorado, has introduced a bill (House Bill 4437) providing that the duty shall be $10 per unit of tungsten trioxide, or $1 per lb., in the case of imports of metallic tungsten, tungsten powder, ferrotungsten, commercial tungstic acid, calcium tungstate, sodium tungstate, and all other salts of tungsten and other manufactured materials containing tungsten, including high-speed tungsten steel, all alloy steels containing tungsten, and all other compounds containing tungsten. The hearings were opened on June 10.

A telegram from Colorado producers was presented to the committee. It pointed out that all the Colorado mines and mills are closed and that two of the largest mills are being dismantled. Owners of other tungsten properties are considering similar action, it was stated. The mines already have sustained great damage, it was said, because no one without more encouragement than is offered at present is willing to go to the expense of keeping them free of water. The producers called attention to the fact that $3,000,000 has been expended in developing the industry, $1,000,000 of which went for the purchase of the 21 mills in the Colorado tungsten district. The industry, it was said, employs 1500 men, at an average daily wage of $4.85.

J. H. Holmes, Jr., is the authorized representative of the producers in attendance at the hearing. The principal argument for the duty was made by Representative Timberlake, who, in presenting the usual arguments in favor of a protective tariff, included a comparison of the wage and living scales between the tungsten producing sections of China and South America with those of the United States.

The new bill was designed to replace Mr. Timberlake's previous bill, which inadvertently allowed the free entry of ferrotungsten from American Pacific islands, and wherein no definite provision was made to prevent such free entry of ferro manufactured from Chinese or other foreign ore. Nelson Franklin, of Denver, and J. H. Holmes, Jr., of Boulder, were in attendance.

Other tariff bills may come up for hearing at any time, and those interested in manganese, chrome, pyrites, magnesite, antimony, barytes, mercury, mica, molybdenum, sulphur, potash, and graphite have been urged to transmit information promptly to Nelson Franklin or J. H. Holmes, Jr., at the headquarters of the American Mining Congress, Washington, D. C.

May Import German Periodicals

The War Trade Board announced on June 13 that applications will be considered for licenses to import into the United States from Germany or elsewhere scientific books and journals which were printed in Germany. Licenses covering such importations will not, however, be issued until the importer in the United States has made effective arrangements to make the purchase price of such books or journals available for the purchase of foodstuffs for Germany, by depositing said purchase price with the American Relief Administration for remittance through said administration to the persons thereto entitled. The duplicate receipt issued by the American Relief Administration must be submitted to the Bureau of Imports of the War Trade Board when applications for such licenses are filed. In cases where the purchase price has been paid prior to Apr. 6, 1917, payment of the purchase price to the American Relief Administration above referred to will not be required. Conclusive proof of such prior payment must be furnished.

American Zinc Institute Holds Annual Meeting in St. Louis

ZINC has been shorn of its nicknames. Spelter, blende, jack, and like misnomers have been cast aside. This is one of the objects which has been attained by the American Zinc Institute during its ten months' existence. Members of the Institute, numbering 140 and representing practically every zinc-mining and zinc-smelting interest in the United States, met in annual convention at St. Louis on June 9 and 10, and, among other things, decided that zinc is zinc, and nothing else. Already many trade papers and the U. S. Geological Survey and the Bureau of Mines have agreed to call zinc by its right name.

The members were cordially welcomed by Hon. Henry W. Kiel, Mayor of St. Louis, and a felicitous reply was made by F. C. Wallower, of the Golden Rod Mining and Smelting Corporation. The members also adopted the slogan "Make It of Zinc," and this trenchant advice is to be blazoned throughout the country. Another worthy object accomplished was the practical obliteration of the differentiation between zinc miners and zinc smelters. This was commented upon by Charles T. Orr, president of the Institute, at the closing session. The invitation to join the Chamber of Commerce of the United States was accepted by the Institute, and Charles T. Orr was named as national councillor.

The annual dinner at the Hotel Statler was largely attended. Dr. W. F. Gephart, dean of finance and economics at Washington University, St. Louis, acted as toastmaster, and Edward Gengenbach, industrial commissioner of the St. Louis Chamber of Commerce, spoke on "Confidence and Progress." Pope Yeatman, at whose suggestion the Institute was formed, journeyed from New York to St. Louis to meet his old friends in the zinc world, and to talk to them on the "Influences of the War on the Zinc Industry." The speeches of the evening dealt with present and future conditions in the business world, the dominant note being "forward, march!" The members voted to ask George C. Stone to make in person, in the interests of the Institute, a survey of zinc conditions in Europe. Mr. Stone expects to sail early in July.

New uses for zinc were discussed at length, the papers on this subject being read by George C. Stone, by E. H. Wolff, general manager of the Illinois Zinc Co., and by George S. Harney, of the American Zinc Products Co. The presentation of these papers was followed by a lively discussion on the part of the other members of the Institute, and resulted in the board of directors setting aside a considerable amount of money to advance this work. In this connection the plans of Dr. John Johnston, who during the war was an active member of the National Research Council, were referred to the proper committee for a prompt report to the board of directors.

Among the other interesting papers read at the meetings were the following: "Some Causes of the Unsound Economic Position of the Zinc Industry in the United States," by William A. Ogg, president American Zinc, Lead and Smelting Co.; "Tri-State Mining and Production," by Otto Ruhl, C. E., Joplin, Mo.; "Mining and Production in Wisconsin," by A. M. Plumb, Wisconsin Zinc Co.; "Production of Zinc in the Southeastern States," by J. N. Houser, vice-president, American Zinc. Lead and Smelting Co.

One of the most interesting papers presented was that on "Early Days of the Industry," by C. E. Siebenthal, of the U. S. Geological Survey. The Geological Survey, largely owing to the efforts of Mr. Siebenthal, has had for some time the story of zinc since 1880, and Mr. Siebenthal, by patient research, has completed the gathering of information respecting the industry prior to that time. Another interesting paper of the meeting was that by R. C. Allen, director, Geological and Biological Survey, Michigan, on "Mines Taxation."

A budget and financial plan were approved by the members, which now number nearly 200, and the following officers and directors were elected:

OFFICERS

Term expiring 1920: President, Charles T. Orr; first vice-president, Edgar Palmer; second vice-president, James L. Bruce; third vice-president, F. C. Wallower; treasurer, Howard I. Young; secretary, Stephen S. Tuthill.

BOARD OF DIRECTORS

Term expiring 1920: George O. Argall, Joseph Brennemann, Arthur Thacher, C. M. Loeb, Edward M. McIlvain, George E. Nicholson, F. C. Wallower; term expiring 1921: J. H. Billingsley, P. B. Butler, Julius W. Hegeler, Cornelius F. Kelley, William A. Ogg, Edgar Palmer, O. S. Picher; term expiring 1922: James L. Bruce, A. P. Cobb, A. S. McMillan, Charles T. Orr, Victor Rakowsky, William Rossman, E. H. Wolff.

A pleasing innovation was the interesting moving picture lecture by B. F. Tillson, at the close of the Monday meeting, the title of the film being "Safety Lessons in Metal Mining." On Monday and Tuesday luncheon was served to the members, in the grill adjoining the meeting room. The badges were made of zinc, and a diversified exhibit of new uses for zinc was displayed at the unique registration booth of the Institute in the corridor of the Hotel Statler.

Upon the adjournment of the meeting on Tuesday, it was the opinion that the American Zinc Institute had become a permanent institution, and that through its efforts the American zinc industry was being stabilized.

The next meeting is to be held in Chicago, the second Monday in May, 1920. The voting of a working budget of $20,000 for 1919-1920 augurs success in working out the aims of the Institute.

Petroleum Institute Favored

Petroleum refiners of the United States are urging that a petroleum institute be established, with headquarters in Washington, that will serve during peace in similar capacity as did the petroleum war-service committee during the war. The fact that stocks of petroleum oils are rapidly decreasing in the face of a greatly increasing demand calls for more scientific oversight and efficiency than are possible under present conditions. It is thought that Government action in this direction will be forced, owing to urgent necessity, unless those in the industry coöperate to bring about the desired end.

Speaking of a petroleum institute, Mark L. Requa said: "In the field of production, in the field of refining, and in the field of marketing and foreign trade, a petroleum institute can render a service to the industry which can be secured in no other way."

As to the question whether such an institute would work, Mr. Requa said no organization can long exist that attempts to run counter to economic laws; that penalizes one party at the expense of another; that attempts to set up artificial currents of trade or that circumscribes individual effort.

Mr. Requa said, further, that the objects of the institute shall be in all lawful ways to afford a means of coöperation with the Government in all matters of national concern; to foster foreign and domestic trade in American petroleum products; to promote in general the interests of the petroleum industry in all its branches; to promote the mutual improvement of its members and the study of the arts and sciences connected with the petroleum industry.

It was pointed out by Mr. Requa that the organization would not be created for the purpose of becoming a lobby. He said that similar plans are under consideration in practically every European country.

Ontario Mineral Production

Returns received by the Ontario Bureau of Mines for the three months ended Mar. 31, 1919, are tabulated below, the figures for the corresponding period in 1918 being given for comparison:

	1918	1919
Gold, oz.	113,387	98,188
Silver, oz.	4,114,856	3,105,002
Copper, blister, lb.	.....	1,724,631
Copper in matte, tons	4,727	2,674
Nickel in matte, tons	9,677	5,610
Iron ore exported, (a) tons	501	4,840
Iron, pig, (b) tons	17,404	14,170
Cobalt, metallic, lb	37,545	13,594
Cobalt oxide, lb	81,760	127,954
Nickel oxide, lb.	.....	5,070
Nickel, metallic, lb.	44,154	1,830,569
Other nickel and cobalt compounds, lb	143,381	31,370
Lead, pig, lb.	60,283	567,716
Molybdenite, concentrates, lb.	17,410	

(a) Includes briquettes. Total shipments of iron ore to both foreign and domestic points in 1919 were 33,376 short tons. (b) Total output of pig iron was 170,325 tons Figures in the table represent proportional product from Ontario ore.

Although the gold output shows a decrease of 24,104 oz., as compared with the first quarter of 1918, the outlook is such that a substantial increase may be expected for the full year. With the Dome mill, now in operation at Porcupine, and the Kirkland Lake and Tough-Oakes mills, at Kirkland Lake, an improved showing is anticipated for the half-year report. A great deal of interest is being shown in the gold fields of northern Ontario, and much prospecting and development of new properties are in evidence. In the period, with the exception of a few days at the end of March, only the Hollinger and McIntyre mills were operating at Porcupine, and at Kirkland Lake the Lake Shore and Teck-Hughes were the only mills at work. For the quarter 206,603 tons of ore was milled, as compared with 262,577 tons milled in 1918.

Silver from Cobalt and outlying silver camps was marketed to the extent of 3,080,104 oz. In addition, 24,878 oz. was recovered from the refining of gold ores and nickel-copper matte. Mines producing over 250,000 oz. are given in order: Nipissing, Mining Corporation of Canada, Kerr Lake, McKinley-Darragh-Savage. Some rich ore running over 8000 oz. to the ton has been taken from the Foster mine, under lease to Messrs. Campbell and Fairbairn.

Southern Ontario refineries treated 1257 tons of ore and concentrates, and 919 tons of residues, recovering therefrom 1,354,441 oz. of silver, in addition to the cobalt and nickel compounds, as enumerated in the table. Although 170,478 lb. of metallic nickel was produced, only 16,284 lb. was marketed.

Of nickel-copper ore, 229,822 tons was raised and 226,954 tons smelted, as compared with 354,689 and 325,386 tons, respectively, for the first quarter of 1918. The cessation of hostilities immediately resulted in a decreased nickel demand, and the period of reconstruction has not yet provided a market sufficiently large to absorb the war-basis output. In consequence, there has been a great curtailment in production, both by the International and Mond companies. Of a total output of 12,529 tons of bessemer matte, 2960 tons was refined at the Port Colborne plant of the International Nickel Co. of Canada, the products being metallic nickel, blister copper, silver, and gold. The last two mentioned are present in small proportion. Heretofore the only metallic nickel recovered in Ontario was the small quantity obtained by the several refineries which treat the silver-cobalt-nickel ores of Cobalt. Since the Port Colborne plant began operations in July of last year, metallic nickel has been produced within the province from nickel-copper ores.

Iron ore smelted in the period by six companies operating 10 blast furnaces was 362,656 tons, of which 332,479 tons was imported from the United States. The total output of pig iron was 170,325 tons. Steel produced by the Algoma Steel Corporation and the Steel Co. of Canada totaled 194,505 tons. In addition, there was an output at the "Soo" of 11,631 tons of spiegel and 107,635 tons of coke.

It has not been profitable to operate molybdenite mines since the close of the war, owing to decreased demand.

Gypsum Output in 1918

The total quantity of crude gypsum mined in the United States in 1918 was 2,056,462 short tons, a decrease of 639,764 tons, or 24%, according to R. W. Stone, of the U. S. Geological Survey.

CRUDE GYPSUM MINED IN THE UNITED STATES, 1917-18, IN SHORT TONS

State	1917	1918
California	30,552	(a)
Iowa	461,864	327,927
Kansas	79,331	54,958
Michigan	375,803	286,768
New York	606,268	531,038
Ohio	270,538	199,456
Oklahoma	158,017	126,208
Texas	257,328	157,388
Wyoming	55,844	41,877
Other States *b*	400,681	330,842
Total	2,696,226	2,056,462

(a) Included with "Other States" *b* Includes, 1917: Alaska, Arizona, Colorado, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Virginia; 1918, Arizona, California, Colorado, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Virginia.

The decrease in production was least in New York, where the output fell off only 12%; in Oklahoma, Michigan, and Ohio the decrease was 20 to 26%, or about the average for the country. Texas recorded the greatest reduction in output, or about 39%. Utah was the only state that produced more gypsum in 1918 than in 1917.

Editorials

A Change in Mexican Policy

THE prompt dispatch of American troops into Mexican territory on the morning of June 16 suggests a change of policy in the handling of border disturbances, and we congratulate the authorities on the vigor with which the action was taken. There is, however, another phase of the situation, which we hope has been fully considered. Villa is a rather resentful bandit, and the assistance rendered by the Americans to the Juarez garrison in driving Villa's men south will not be appreciated by him. There are a number of Americans in Mexico upon whom Villa can easily place his hands, and they are likely to suffer the consequence of this last excursion unless it is followed up with sufficient activity to impress upon Villa that we can and sometimes will fight.

Speaker Gillett and Mexico

AT A SESSION of the second Pan-American Commercial Conference, Frederick H. Gillett, the new Speaker of the House of Representatives, took Mexico severely to task for her failure to remedy the unsatisfactory conditions which exist in that country. He stated that present conditions were an obstruction to trade and that no merchant would risk profits in Mexico while foreign capital is unprotected and the nationals of other countries may not live in security there. He urged unity of action by the other American republics to remedy the situation. In a subsequent statement he declared:

"I believe that every nation should be alert to guard its citizens wherever they may be, and I trust our South American friends hold the same opinion and will coöperate with us in asserting and enforcing it."

The frank statement of Speaker Gillett will be appreciated by mining men and engineers who are interested in Mexico. Coming as it did unexpectedly at the conference, his words have had the effect of directing attention in no uncertain way to the Mexican question.

All that is asked from Mexico is protection of life and property. This is the prime requisite of a government. Granting that the Mexican authorities have had and are having great difficulty in bringing order out of the chaotic conditions, the fact remains that it is to the best interests of Mexico to take the most energetic steps to eliminate banditry and lawlessness. It is the duty of our Government to see that this is done in so far as American interests are affected.

European Conditions

IT IS A HUMAN failing to underestimate conditions which do not come under our direct observation. We are also sometimes guilty of exaggeration when we try to convey to another individual an account of a happening which we have ourselves observed. Perhaps this tendency to exaggerate is caused by an unconscious feeling that many of our listeners have the failing first mentioned. There is, however, little exaggeration in the accounts of European conditions which come to us. It is probably beyond the power of any one mind to survey the whole and convey an adequate picture of Continental Europe. Hence, there is food for thought and especial significance when a man like Frank A. Vanderlip says:

> The situation in Europe is more serious than has been grasped on this continent; more serious indeed than has been grasped by a good many Europeans as yet.
>
> Superficially, you would see something like a normal Europe if you had been over the ground that I have—London, living its great luxurious life as usual; Paris, much the same. Superficially, you might think no greater thing had happened to Europe. You might well be excused after seeing Europe if you still held the belief which I think most people do hold in the United States: that the war is over; that, of course, it has been a great blow; that there has been a sad devastation, but that it is over, and with the signing of peace Europe will pretty rapidly tend back toward the normal; that there is a great industrial skillful people; that there are great territories quite unharmed by the war; that the hurt of the war, after all, is comparatively small, and that all that is needed is a little time to bring Europe back to pretty nearly its pre-war conditions.
>
> Now, that picture is not true. Europe has received such a shock from the war as has not been measured by those who have seen it at close range, but it is not that direct shock that concerns me nearly as much as a greater hurt, the hurt of disorder, industrially, over that Continent, a disorder so great that industry is in a large measure paralyzed. Men in great numbers are idle. The difficulties of restarting the industrial cycle are almost unmeasured, and the consequences that will flow from continual idleness and want and hunger from revolution which will follow on that combination if it lasts long enough will involve two hemispheres; they cannot be confined to one, should they occur.
>
> Now, don't understand me as predicting a conflagration in Europe. I don't believe there is to be such a conflagration, but I believe Europe is balancing on a knife edge.
>
> I think it can be saved. I think aid can be given to those European states that will help them restart industrially, that will help them put their people at work, and no one can save Europe but European people. They can't be saved in idleness; they must be saved by the sweat of their brow and labor.

We must take into consideration the affairs of the countries across the Atlantic when we are reviewing our own conditions. Mr. Vanderlip's account should jolt us out of our tacit underestimation of the world situation in respect to ourselves. We are no longer insular. We have a leading part to play.

Unquestionably we are doing our share in relieving the food shortage. But this is only a part of the problem. Our neighbors must be saved by labor—by the sweat of their brow. In these illuminating words Mr. Vanderlip has touched a great fundamental truth which contains the solution of difficulties represented by the prevailing unrest.

A busy man is nearly always a happy man. He is also a useful man. In proportion as industry is resumed in England and Continental Europe, so will unrest be diminished.

One important circumstance that has operated to prevent a resumption of normal industrial life, and that we hope will soon be eliminated, is the prolongation of the peace negotiations. This has affected our own industries as well as those of all of our neighbors. It is imperative that there be whole-souled coöperation of America with Europe. Whether that course be popular or not, our country must assume the duties and responsibilities that the Great War and the conditions resulting from it forced upon us. We have got to be prepared to make sacrifices. In a word we must take a broad view of the problem, and act accordingly.

Transatlantic Flight

ON JUNE 15, 1919, Capt. Jack Alcock and Lieut. Arthur W. Brown completed an airplane flight of 1932 miles, from St. John's, Newfoundland, to Clifden, Ireland, in 16 hours and 12 minutes, at an average speed of nearly 120 miles per hour. This historic feat was accomplished under unfavorable weather conditions, and must be regarded as a great victory not only for the intrepid aviators, but also for the airplane. The machine was a Vickers biplane equipped with a Rolls-Royce engine.

An achievement of this character always carries with it interesting and valuable suggestions to the scientist and the engineer. For example, it demonstrates in a most conspicuous manner the great possibilities of the internal combustion engine wherein high power is combined with light weight, and carries with it the suggestion that the factor of horsepower per pound of metal, in any mine or mill power plant, may be worthy of consideration by the mining engineer who is called upon to recommend power equipment for temporary purposes, or where the transportation problem is difficult.

Concrete in Mining

MORE and more is the use of concrete gaining recognition among mining engineers. It has the important advantages of high compressive strength and of being fireproof and easy of application, and it is not highly expensive except where the mine is so situated that the bringing in of materials and supplies involves high transportation charges. In addition, two advantages attend its use which are sometimes not given the attention which they deserve. One is that the concrete acts as an effective water seal and materially reduces the movement of underground water in the vicinity where it is placed. Ordinary timber support will not do this. As the movement of underground water is often a contributory cause of the development of rock pressure or movement which results in pressure upon the timbers, it is obvious that the judicious use of concrete where timbers regularly fail due to cumulative rock pressure may go far toward remedying that difficulty.

The second advantage is that the rock surface is covered and the action of the atmosphere largely prevented. Just how much loosening of the rock mass bounding an excavation may be due to the disintegrating action of the air is problematical, but it is within the experience of most mining engineers that, as time elapses, the walls of some mine excavations begin to fail as a result of this action. Timber support does not stop it, though it may retard it to a certain extent. On the other hand, a relatively thin skin of concrete is an effective stop.

The most important objection to the use of concrete, excepting its cost under the unfavorable conditions mentioned, is its inability to resist tensile forces. It is, therefore, best used in such a form as to avoid tensile stress within the mass. By the use of steel reinforcement this objection can to a considerable degree be overcome. Reinforced steel-concrete beams, as well as flat slabs of the same material, have been successfully used in mining operations.

Where there is extensive movement in rock masses not due to superficial causes the use of concrete is not indicated. On the other hand, if concrete is used under cumulative pressures it is necessary to use a sufficient thickness to resist fully the maximum pressure that may be expected to develop during the life of the structure, as concrete structures cannot be eased, as is done where timbers are employed under similar circumstances.

For air stoppings, bulkheads, and dams concrete possesses important advantages. In an article in this issue the use of concrete as a lining and support for ore chutes and bins, as well as for the support of a shaft in swelling ground, is described. The examples are worth the attention of mining engineers.

To build from the foundation upward appeals to the constructive mind. There is an inborn instinct in the human race to recognize fundamentals, whether they apply to the construction of a mining plant or have to do with a sociological problem. It is because of this admirable quality that the Boy Scout movement derives especial force in making its appeal for support. The movement has for its purpose the direction of the boy's activity into useful and wholesome purposes. The school occupies a considerable part of the youth's time. Chores consume another part, but there is a relatively large amount of time that under ordinary circumstances is given over to play. The problem is to direct the boy's play into channels that will develop character and manliness. Too often the boy is allowed to direct his own play activities, with the result that the outcome is not always a happy one. A clean, useful citizen is the hoped-for product of the boy. Left to chance, the surprising thing is that so many boys turn out well. Intelligent, systematic direction of the boy's activities will produce more men who will be physically fit and capable of wholesome fun. The Boy Scout movement deserves the support of every grown man. Those who are back of this movement should be made to feel by the support that is given them that their work is recognized as of substantial benefit to the community. Particularly is it necessary to initiate and support the movement in our mining communities, for there the conditions are not especially favorable for youth.

Close control upon the distribution of explosives was effected during the war period. Subsequent developments in the anarchistic menace raise the question as to whether it is not an excellent thing to continue this regulation, modified to some extent to conform with existing conditions. Director Manning of the U. S. Bureau of Mines calls attention to the inadequacy of state laws to prevent unauthorized persons from obtaining explosives. The recent bomb outrages fully demonstrate the necessity for stringent control. With the signing of peace the Federal regulations will lapse. It is highly desirable that uniform state or Federal laws be drafted to cover the situation. Delay only increases the possibility of additional depredations. There is urgent necessity, therefore, for prompt action to provide for severe restrictions against the sale of explosives to individuals who can give no proper reason for possessing them or accounting for their use.

There is encouragement in the oil-speculation situation when reputable oil men resent the methods employed by unscrupulous promotors and dishonest brokers. It is difficult to distinguish between the legitimate enterprise and the stock-selling job. To prevent being tarred by the same stick, the men who have the best interests of the oil industry at heart must organize to lend their efforts, as well as their moral support, to the legal authorities whose business it is to protect the investing public from fraud. Bankers and commercial interests in oil-development communities should coöperate to protect the good name of their localities, for their prosperity may depend upon substantial, well-organized and honest development of local resources.

A significant move that will perhaps be of far-reaching importance is seen in the admittance of negroes into the rights and privileges of the labor unions by the American Federation of Labor at its recent Atlantic City convention. The immediate effect will be to increase largely the number of organized workers in many communities, particularly in the Southern States, and also in some of the Northern States into which negro laborers have gone in large numbers in response to the demands for labor growing out of the exigencies of the war. In part, at least, this recognition of the negro workmen will be beneficial, in that it removes one form of repression with which our negro population has had to contend. In proportion as the American Federation uses wisdom and justice in directing the destinies of organized labor, so will benefit accrue not only to the country as a whole but to the negro population as well. A broad policy, conceived not along narrow and selfish lines, but with the interests of the entire citizenry taken into consideration, will be of lasting good to all concerned.

BY THE WAY

Speaking of accidents in the early days of Nevada mining, Dan de Quille, in "The Big Bonanza," says that it was by no means unusual for the remains of men to be collected at the bottom of a mine and sent to the surface in candle boxes—to such an extent are the bodies and limbs of many who fall into shafts rent and scattered. On one occasion of this kind when the jury of inquest had finished hearing the testimony, and were sitting silent around the fragmentary remains, considering their verdict, a man came hurriedly in with a candle box under his arm, approached the foreman, and said to him in a reverent tone: "Wait a moment, please—I've got some more of him."

"Never did tell 'e tha story of 'ow Tom Trevarthen barely missed makin' a fortun', did I, m'son?" said Cap'n Dick. "H'only gaws to show 'ow does'nt do too much to trus' to 'uman natur', an' tha moor a man 'olds to 'imsel', tha better h'off 'e be. Tommy, 'e wuz workin' on contrac' in a gol' an silver mine h'out Wes'. Baout that time h'everybody wuz gawin wild on these 'ere minin' stocks, an' tha market wuz boomin'. H'every time a strike wuz made h'up would gaw tha stock o' tha mine w'ere she wuz to. Tommy an' 'is partner 'ad jus' shot h'off a blas', an', gawin' back to see 'ow tha 'oles 'ad blawn, they foun' tha shootin' 'ad struck a gert bunch o' this 'ere 'orn silver. Baout that time 'long come super an' sees un. 'Boys,' sez 'e, 'say nothin' baout this 'ere. Keep yer mouth shut an' we'll make some money.' So Tommy an' 'is partner gaws h'up shaf' an' says never a word. That night, super 'e gaws to tha h'engine room, bursts tha compressor with a 'ammer, an' next moornin' w'en shif' comes on 'e tells all to gaw 'ome, that tha mine's to be laid h'up for repairs. Then dam-me, 'e takes next train for tha city, tells the manager w'ot's h'up, an' fixes with 'im to keep the mine closed. Super, 'e figgers tha manager an' 'im 'd sell their stock; tha mine bein' closed daown, tha stock 'd gaw daown, an' they'd buy at tha low price an 'start tha mine h'again. Meantime, Tom an' 'is partner wuz sittin' tight an' wonderin' 'ow much they'd make h'on tha deal. Tha super, 'e sold 'is stock an' spent tha time standin' raound waitin' for tha market to 'it bottom, but, dam-me, h'up she stays, an' 'e can't figger un h'out. Truth to tell, tha manager, 'e wuz buyin' h'all tha stock, an' w'en 'e 'ad un h'all 'e fires tha super an' runs tha bloody mine 'imself. An' dos't thee naw, m'son, tha stock's payin' regular naow. But Tommy Trevarthen, 'e's still workin' for day's pay. W'ot's think on un, any'ow?"

It is a regrettable but undeniable fact that some mines crowd into the limelight of technical literature, to a degree somewhat disproportionate to their past, present, or potential production; and other properties, like the little old car of well-known fame, ramble right along and produce fat dividends for their fortunate owners, never seeking publicity of the sort that promotes stock sales. Years ago in a slightly advertised section of the State of Sinaloa, Mexico, a herdsman, while searching for a stray animal, lost his rosary, which caught on a twig, which snatched it from about his neck. Wishing to recover his keepsake as well as the animal, he tossed his hat down to mark the spot. Although night overtook him, when he returned from his chase, he had no difficulty in finding his hat. Philosophically, he built a fire and camped on the spot, intending to search for the precious beads by daylight. Along in the wee small hours he rolled a cigarette for breakfast. While lighting his corn-husk soother in the lingering coals of the campfire he noticed a peculiar glistening substance that had not been in evidence the night before. After due investigation by his employer, the substance was pronounced to be silver, which it most certainly was; though possibly contaminated (?) by 30 to 50% of gold. Such is the story told to account for the name of the mining district of The Rosary, or *El Rosario*. The principal mine of the district, known as El Tajo, was owned in 1883 by a Mr. Bradbury, a Mr. Kelly, and others of Mazatlán. Though the nominal capitalization of the company is rated at only $120,960. Mexican currency, the 1909 production was reported as $572,000, and the dividend distribution for that year as just $225,000 U. S. currency. Query : Do the Bradburys oppose cigarettes?

Personals

A. P. Watt is in Virginia.

W. W. Mein has returned from Nicaragua.

R. B. Lamb, of New York, is in Colorado on professional work.

A. F. Victor is sales manager of the Lake Superior Loader Co., Duluth, Minn.

O. Wiser, president of the Republic Mining and Milling Co., at Hanover, N. M., is in New York on company business.

Jay A. Carpenter visited Pioche, Manhattan, and Rochester, Nev., recently on professional business.

John A. Udden is chief geologist with the Sinclair Gulf Oil Co., Burk-Burnett Bldg., Fort Worth, Texas.

Capt. John D. Hubbard is superintendent of the Forks of Salmon River Mining Co., Siskiyou County, California.

George A. Laird has become connected with the office of W. G. Williams, consulting engineer, of Oklahoma City.

Horace F. Lunt has been appointed Commissioner of Mines for the State of Colorado, succeeding **Fred Carroll**, who has resigned.

J. M. Sias, of the iron-ore department of the United States Steel Corporation, New York, returned recently from a five months' stay in Brazil.

R. G. Hall, resident manager Burma Mines, Ltd., has left Namtu, Northern Shan States, Burma, for London, on business for the corporation.

L. S. Cates, general manager, Ray Consolidated Copper Co., of Ray, Ariz., is visiting the larger mining camps of the southern part of Arizona.

W. H. Janney, who has been in charge of Chino Copper Company's mill at Hurley, N. M., is recovering from a recent operation upon his eye.

H. G. Officer, of the Andes Copper Co., of Potrerillos, Chile, recently visited Ajo, Ariz., where he inspected the operations of the New Cornelia Copper Co.

George W. Chamberlain has been appointed chief engineer of the Minnesota mines of the Tod-Stambaugh Co., with headquarters in the Alworth building, Duluth.

C. B. Swan, of Medicine Hat, Alberta, an experienced oil operator, has been delegated by the Alberta government to make a thorough inspection of the Peace River oil field.

Lieut. Lewis Douglas, mining engineer, the son of **James S. Douglas**, of the Verde Extension, has just returned from France and is recovering from an operation for appendicitis.

G. M. Butler, director of the Arizona Bureau of Mines, was reëlected president of the Southwestern Society of Engineers at the annual convention held recently in El Paso, Texas.

J. C. Gwillim, of Queen's University, Kingston, Ontario, will make an examination of the foothill country in Alberta to determine whether iron ore occurs in commercial quantities.

Norman Carmichael, governor of the Arizona Chapter, American Mining Congress, of Clifton, Ariz., was a visitor to Phoenix on June 5 and 6, where he presided at a meeting of the chapter.

James F. Rose, mining engineer, of Hibbing, Minn., has left for Canada, where he will have charge of 200 miles of reconnaissance survey for the Canadian Pacific Ry. The work will lie north of Ottawa.

J. A. Burgess, general manager, United Eastern Mining Co., Oatman, Ariz., is visiting Phoenix, where he will appear before the Arizona Tax Commission with reference to 1919 valuations for assessment purposes.

C. J. Sarle and **M. Ehle**, professors of the departments of geology and mining engineering, respectively, of the University of Arizona, will conduct a summer field course in geology and mining, to begin July 1 and end Aug. 18.

Daniel C. Jackling and **William H. Thompson** are on the board of directors of the Sinclair Consolidated Oil Corporation. Mr. Jackling has recently inspected the Chino Copper Co.'s property at Santa Rita and Hurley, New Mexico.

Francis J. Webb, general manager of the northern ore mines of the Republic Iron and Steel Co., and **John N. Reese**, assistant to the vice-president of the company, have completed a tour of the company's Minnesota and Michigan iron mines.

William B. Daly, formerly general superintendent of the Anaconda Copper Mining Co., has been promoted to be assistant general manager of mines. **Chauncey L. Berrien**, who was assistant superintendent, assumes Mr. Daly's former place.

E. L. Porch, Jr., has opened an office in the Alamo National Bank Bldg., at San Antonio, as a petroleum geologist and mining engineer. Mr. Porch was formerly assistant geologist in the Texas Bureau of Economic Geology at Austin, and served during the war as a first lieutenant in the Aviation Service.

H. E. T. Haultain, formerly professor of mining in the University of Toronto, and for some time director of vocational training in connection with the Soldiers' Civil Reëstablishment Department, has resigned his position. Professor Haultain believes that all positions in the organization can be filled by returned soldiers.

Societies

Society for the Promotion of Engineering Education will hold its 27th annual meeting at the Johns Hopkins University, Baltimore, Md., June 25-28, 1919. John B. Whitehead is chairman of the local committee. Officers for the meeting are: John F. Hayford, president; John T. Faig and E. R. Maurer, vice-presidents; W. O. Wiley, treasurer, and F. L. Bishop, secretary.

American Institute of Mining and Metallurgical Engineers, New York Section, will hold the monthly meeting on June 26 at the Machinery Club, 50 Church St. Dinner will be served at 6.30 p.m., and program will begin at 8 p.m. An address will be made by Maj. A. S. Dwight, on "War Experiences," which will be illustrated by moving pictures. Horace V. Winchell, president, will also speak.

Engineers Club of Northern Minnesota will entertain, on June 21, the national convention of the American Society of Civil Engineers, adjourned from Minneapolis, and the members of the Duluth Engineers' Club. A part of the entertainment will be an automobile trip across the range from Hibbing to Eveleth. A conservative estimate places the number of guests and members likely to be present at 600.

Lake Superior Mining Institute's plans for the next meeting are indefinite, although it was intended to hold a session in the copper country this summer, and the possibility of a joint meeting with the American Institute of Mining and Metallurgical Engineers at Chicago in September has been discussed. It is probable that a meeting of the council will be held at an early date, at which time a decision will be reached. The last gathering was held at Birmingham, Ala., in March, 1917.

Colorado Engineering Council, at its last regular business meeting, appointed H. S. Sands, of the Westinghouse Electric & Manufacturing Co., as chairman of a committee to present to the council a report on "Governing Factors in the Return of the Wire Transportation Systems to Their Owners." L. G. Carpenter was appointed chairman of a similar committee to present to the council a report on "Governing Factors in the Return of the Rail Transportation Systems to Their Owners." It is desired by the council to use the substance of these reports for preparing a statement to be issued to Colorado representatives in Congress at an early date.

American Institute of Chemical Engineers held the eleventh semi-annual meeting at Boston, Mass., on June 18 to 21. Some of the papers, among many important ones, were as follows: "The Future of the Electric Furnace," by C. T. Bragg, of the Michigan Smelting and Refining Co.; "Utilization of Electric Brass Furnaces," by W. H. Gillette, Bureau of Mines; "Problems Encountered in Electric Furnace Practice," by P. E. McKinney, Washington Navy Yard; "Electric Furnaces of the Resistance Type—III" (motion pictures) by T. F. Baily, of the Electric Furnace Co.; "Ajax-Wyatt Induction Furnace" (slides), by G. H. Clamer, Ajax Metal Co.; "Some Practical Results Secured With High-Frequency Induction Furnaces," by Edwin F. Northrup, Palmer Physical Laboratory, Princeton University; "Booth-Hall Rotating Furnace" (motion pictures), by Carl H. Booth, Booth-Hall Co.; "Rocking Electric Arc Furnace," by E. L. Crosby, the Detroit Furnace Co.

Industrial News

Du Pont Chemical Company, Wilmington, Del., announces the removal of the executive and sales offices to new quarters on Vandever Ave., east of Market St.

The Borden Co., manufacturer of Beaver pipe tools, has opened offices at Room 501, No. 549 West Washington Boulevard, Chicago. Charles A. Greene is the Chicago representative.

The Royal Netherland Legation, Washington, D. C., has recently established a commercial department for the express purpose of fostering trade between the United States and Holland, and is in a position also to give commercial information about trade between the two countries to American merchants.

Rosenburg & Co., machinery dealer, has moved its offices and sales rooms to 303-305 East 3rd St., Los Angeles, Calif. In addition to the large stock of new and used mining and smelting equipment at its Los Angeles plant, this firm has just purchased the equipment of the Lincoln Mine at Crown King, Ariz. The latter will be moved to Rosenburg & Co.'s branch at Congress Junction, Arizona.

Bailey Meter Co., Cleveland, Ohio, has secured the services of E. A. Hitchcock as vice-president. Mr. Hitchcock will supervise the training of technical graduates for the company's service and sales departments. For the last six years he has been connected with the E. W. Clark & Co. Management Corporation as advisory, consulting and power-sales engineer. Previous to that time he was professor of experimental engineering at Ohio State University.

The Sullivan Machinery Co. announces the establishment of a new branch office at room 810 Park Bldg., Cleveland, Ohio, under the management of Ralph T. Stone, for several years sales engineer associated with the New York office. George H. Richey has been appointed New England sales manager, succeeding George Elmer Wolcott, who died on May 10. Mr. Richie was associated with Mr. Wolcott as sales engineer in New England and eastern Canada for several years.

Nash Engineering Company, South Norwalk, Conn., has issued an illustrated pamphlet, announcing that the name of "Hytor" will be applied to all Nash products hereafter, and will represent a hydroturbine type of compressor and vacuum pump for air and gas, vacuum or pressure. It is claimed that the "Hytor" will deliver air absolutely without pulsation. Various liquids may be used in the casing as the displacing medium which permits of handling acid gases, a liquid being adopted which protects and neutralizes the effect of the gas upon the metal.

F. H. Niles & Co., Inc., Woolworth Bldg., New York, announces the opening of a branch office at Bridgeport, Conn., Room 608, Security Bldg., 1115 Main St. The office will be in charge of F. H. Andrus, formerly with the Winchester Repeating Arms Co., of New Haven, and recently salvage expert in the War Department, Bridgeport District Ordnance office. The opening of this office is expected to facilitate the business of the company, not only in the regular lines, machine tools and foundry equipment, but also in new and old metals, both as to buying and selling. The main office is in New York, where the company has a seat on the New York Metal Exchange.

Trade Catalogs

Chain Drives. Morse Chain Co., Ithaca, N. Y. Pamphlet, 6 x 9; 12 pp.; illustrated, containing a reprinted article by J. S. White on "Chain Drives," in the 1919 year book of National Association of Cotton Manufacturers. The article is a short synopsis on the general subject.

Improved Impact Screen. Colorado Iron Works Co. Pamphlet No. 9C; 6 x 9; 24 pp.; illustrated. Descriptive of the improved impact screen for the wet or dry sizing of all kinds of materials, containing chapters on the construction, operation, adaptability, and installation of this company's screens. Table giving data on wire cloth, parts list and capacities are included.

Sprague Electric Dynamometers. Bulletin 48701-A; 8 x 10½; 12 pp.; illustrated. Descriptive of the Sprague electric dynamometers as applied to laboratory and production testing of gasoline and kerosene engines. Capacities of dynamometers furnished by the company are from one hp. to 1000 hp. Those described in bulletin are for a 50 hp. machine suitable for engines having a maximum torque of 50 to 200 ft.-lb. up to a 400 hp. machine for engines having a torque capacity of 800 to 1600 ft.-lb.

Boiler-Feed Control. Northern Equipment Co., Erie, Penn. Bulletin, 8½ x 11; 8 pp.; illustrated; embodying specifications for the Copes system of boiler-feed regulation. A cover is provided with punched holes for adding future bulletins or specifications. The following subjects are discussed: Principle of operation; heat storage; reduction of furnace temperature fluctuations and sudden load change; service performance; constant characteristic; thermostat; control valve; standard dimensions and drilling; and the Copes steam pump governor. The last page is devoted to a review of the company, and the history of boiler-feed regulation.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Drilling—Rock-Drilling Machine. Gustaf Anderson, Stockholm, Sweden. (U. S. No. 1,300,100; Apr. 8, 1919.)

Electric Furnace and Transformer for Use Therewith. Frederick Edmund Berry, Hayes, England. (U. S. No. 1,299,664; Apr. 8, 1919.)

Excavator-Bucket Cleaner. Truls Loken, Kenosha, Wis., assignor to Frederick C. Austin, Chicago, Ill. (U. S. No. 1,298,978; Apr. 1, 1919.)

Filter Presses—Means for Indicating the Thickness of Cake Formation in Filter Presses. Daniel T. Nicholson, Visalia, Calif. (U. S. No. 1,299,996; Apr. 8, 1919.)

Flotation—Method of and Apparatus for Separating Minerals. Henry W. Allen, Earlysville, Va. (U. S. No. 1,301,532; Apr. 22, 1919.)

Flotation—Separation of Mixed Sulphide Ores. Rowland Thomas Dryll Williams, Broken Hill, N. S. W., Australia, assignor, by mesne assignments, to Minerals Separation North American Corporation. (U. S. No. 1,300,516; Apr. 15, 1919.)

Gas Producer. Erle Stafford Huntley, Friezland, Queensland, Australia, assignor to the Hampden Cloncurry Copper Mines Ltd., Melbourne, Australia. (U. S. No. 1,300,839; Apr. 15, 1919.)

Hoist—Mine-Cage Hoist. Thomas Price, Nanaimo, B. C. (U. S. No. 1,300,647; Apr. 15, 1919.)

Hoisting—Elevator. Walter O. Borcherdt,, Austinville, Va. (U. S. No. 1,297,992; Mar. 25, 1919.)

Ingot Molds—Teeming Ingot Molds. Emil Gathmann, Baltimore, Md. (U. S. No. 1,298,036; Mar. 25, 1919.)

Ingots—Process for Making Metal Ingots. Lewis B. Tebbetts, 2d, St. Louis, Mo. (U. S. No. 1,298,825; Apr. 1, 1919.)

Metal-Cleaning Apparatus. Abraham Hoyt Levy, New York, N. Y., assignor to Syracuse Smelting Works, Brooklyn, N. Y. (U. S. No. 1,298,229; Mar. 25, 1919.)

Mine Gate—Automatically Operated Mine Gate. Samuel W. Warman, Brownsville, Penn., assignor of one-third to Reuben M. Fry, Uniontown, Penn., and one-third to Charles Oppermann, Orient, Penn. (U. S. No. 1,299,074; Apr. 1, 1919.)

Mining-Car Coupling. Nicholas Mandabach, Vincennes, Ind. (U. S. No. 1,298,238; Mar. 25, 1919.)

Ore Loader. Sylvester H. Hunt, Bessemer, Mich. (U. S. No. 1,302,046; Apr. 29, 1919.)

Editorial Correspondence

SAN FRANCISCO—June 13

California Petroleum Production in April totaled 8,374,620 bbl., or a daily average of 279,154. Shipments from the field totaled 8,317,310 bbl. Crude oil stocks on Apr. 30 amounted to 32,543,145 bbl., an increase of 57,322 bbl. in the month. There were 8726 wells producing, including 40 new wells brought in. Drilling was started on 335 wells and 54 new rigs were installed. Only three wells were abandoned.

Comstock Northend Mines, at Virginia City, Nev., produced $13,700 from a total of 674 tons of ore treated at the Mexican mill, the mill running 92% of the time in week ended May 31. Consolidated Virginia sent to mill 193 tons of average value of $22.67 per ton. Ophir sent 481 tons, averaging $19.31 per ton. The mill shipped five bars of bullion to the San Francisco mint. The highest-grade ore in Consolidated Virginia was extracted from the 2100 level. Good milling ore was taken from all points mined. Prospecting on the 1800 level of the Ophir gave ore sampling $64.50 per ton. Conditions are good in other properties, prospecting and repairs being well advanced.

BAKER, ORE.—June 12

Homestead Mines Co. at Homestead is running mill of the Iron Dyke mine at full capacity. Iron Dyke is the largest copper producer in Oregon. The remarkable body of ore found in this mine has placed the district in the limelight. There will be a great deal of activity here this summer. Homestead is on the Snake River and is the terminus of the branch line of Oregon Short Line from Huntington. District extends from the Iron Dyke mine to the Seven Devils country, 40 to 45 miles long and 8 or 9 miles wide. Lack of transportation is holding back a number of promising properties further up Snake River. Some talk of railroad from Homestead down the river 135 miles to connect with Lewiston, Idaho. Principal orebodies are found along shear zones, usually when cut by intrusive dikes. Jerry Hayes, backed by Spokane capital, is extending a tunnel on the Copper Syndicate group. Operators in the Copper Queen group, on the Idaho side of the river, and four miles below Homestead, are hauling out and shipping some of their high-grade ore. Operators of the Olympic group, held under lease and bond by D. M. Drumheller, Jr., are now in 220 ft., crosscutting for a vein. The McCarty property, on Herman Creek, has opened up a large body of copper ore, and there is some talk of constructing a wagon road and putting in a concentrator. The White Swan mine, eight miles out of Baker, Ore., has been purchased by H. B. Smalley and E. Kilfeather, of Spokane, who plan active development work.

WALLACE, IDAHO—June 12.

The Coeur d'Alene District, after 20 years of industrial peace, is again threatened with a strike in all mines, which, if called, will unquestionably result in closing down every mine in the district. The trouble of 1899, when the Bunker Hill & Sullivan mill was blown up, marked the end of the Western Federation of Miners in the Coeur d'Alenes. A few years later the International Union of Mine, Mill and Smelter Workers formed local unions in the district, but not until the last few months did the union show any vitality. Union men was employed in the mines, but most of the employees were non-union. Relations between the employers and employees were most cordial. But following the reduction of wages last March from $5.25 to $4.25, an active campaign was started to get the employees into the union. A few weeks ago the state organizer of the American Federation of Labor, with which the miners' union is affiliated, arrived and is still present. The mining companies advanced wages 50c. per day about a month ago, making the pay $4.75 per day, but this did not stop the steady increase in union membership, and it is now believed that at least 75% of the men are in the union. A communication has been addressed to the managers of the various mines requesting them to meet representatives of the union in conference to consider the following propositions: "The establishment of the eight-hour day in all departments of the industry in its true and actual meaning; a blanket increase in the schedule of pay of 50c. per day; an agreement to form a basis of relationship between employers and employees such as can be arranged in friendly conference." To this a signed reply was made by all the mining companies of the district in the form of a published statement addressed to "employees of the mines," in which they stated that they were adhering strictly to the eight-hour day; that the condition of the industry does not permit further increase in pay; that all the mines are operating on a narrow margin of profit and that some of them are actually operating at a loss; that the present rate of $4.75 per day is the same as the Butte scale and higher than the pay in Utah and and California. To the third proposition the mining companies replied as follows: "The third proposition is the old demand of the union for 'recognition.' It has always been the policy of the mines of the Coeur d'Alenes to operate on an 'open-shop' basis. No discrimination is made against union labor. But recognition of the union always means discrimination against non-union men; the union denying to the non-unionists the liberty of action which they so loudly claim for themselves. There will be no recognition of the union, and the mines will continue to operate on the open-shop basis." Upon the request of the union, the Department of Labor will send a representative to act as mediator between union and mining companies.

BUTTE, MONT.—June 13

The Anaconda Copper Mining Co. has under way a program for the fireproofing of all its 50-odd shafts in the Butte district, which will represent an outlay of about $2,000,000, the process consisting of "gunniting" a sort of lathe work attached to the wall plates of the shaft, permitting easy access to the timbers in the event of it being necessary to realign the shaft. Cement guns have a considerable utility in the equipment of the larger mines, and an increase of their use generally throughout the district appears to be indicated.

SALT LAKE CITY—June 14

The Park City Strike, after lasting about five weeks, has reached a stage where the miners are moderating their demands. The men are now asking an increase of 75c. a day in wages and an eight-hour shift "from collar to collar" and no discrimination against the men who have been out, as compared to the original demand of an increase of $1 per day and a six-hour shift. June 15 has been set by them as a time limit for the receipt of an answer from the operators, after which, if their demands are not complied with, they threaten to declare the strike permanent. There is a desire on the part of many of the men to return to work, and the conservative element made itself felt so as to gain a modification of the demands, although it was not strong enough apparently to call off the strike. It is apparent, however, that a large number are tired of the strike. It is not probable that the owners will treat with the men unless they agree to return to work under conditions prevailing before the strike was called.

PHOENIX, ARIZ.—June 13

A Strike of Linemen and Operators on the 17,000-kw. hydro-electric system of the Salt River Valley Water Users' Association for a while cut off Inspiration power supply from Roosevelt. It made little difference, as the reverberatories of the Miami smeltery furnish enough steam for camp uses at the present diminished rate of production.

Attorney General W. E. Jones has decided that the time taken by miners in eating their noonday meal should be included within the eight-hour work day, from collar to collar, unless the meal should be eaten above ground, the latter contingency affecting only the smaller mines.

Directors of the Arizona Chapter, American Mining Congress, met in Phoenix on June 6 to consider certain subjects affecting the mining industry of the state, this meeting being preliminary to the one to be held by the directors of the chapter, at the Saint Francis Hotel, in San Francisco, on June 27 Directors of the chapter are all representative mining operators of Arizona. Norman Carmichael, general manager of the Arizona Copper Co., Ltd., at Clifton, Ariz., governor of the chapter, presided at the meeting.

OURAY, COLO.—June 12

In the Ouray District of Colorado several new developments and improvements are under way. The Mountain Top Mining Co. is mining high-grade ore from its Terrible vein and is planning to increase mill output. The Chipeta M., M. and S. Co. is opening El Mahdi mine and putting in air-drill equipment, besides driving a crosscut on the H. A. C property. The Atlas M. and M. Co., at Sneffels P. O., is planning enlarged mine development and increased mill output, under new local management. Fred Carroll, State Commissioner of Mines, who organized this property and company some years ago, has resigned his state position and returned to the management of the mines, succeeding James A. Lannon. The property covers some of the best veins in the Camp Bird-Tomboy-Revenue district and has yielded a large tonnage of low-grade silver-lead ore through the Atlas mill. There is much undeveloped ground in thes Klondyke vein, which will be opened up in the near future. The mill tonnage has fallen lower than the average, but it is expected that this will be brought back and possibly some selective flotation practised, to recover the lead and silver together and throw the zinc into a separate concentrate. The Atlas mill is well known as having been practically the pioneer, in the United States, in employing cold, non-acid flotation; also for its uniform recovery of over 90% of both the lead and the silver, over a period of some years. Construction a few years ago left room in the building for additions to plant, which may installed later this season.

FORT WORTH, TEX.—June 4

General Strike in Oil Fields of north Texas may be called, it is reported here, on account of order issued by Texas Producing Co. discharging all men who joined the International Oil Field, Gas Well and Refinery Workers' Union.

BATESVILLE, ARK.—June 12

Claims Filed by Manganese Operators in the Batesville field of Arkansas have recently been investigated by a committee of three representing the War-Minerals Relief Commission. The three members of the commission investigating this field are Fred P. Williams, engineer, and Guy L. Langton and William H. Dunn, accountants. The Relief Commission was scheduled to arrive in Little Rock, Ark., on June 19 It is expected that the field men will require several weeks to complete their work.

JOPLIN, MO., June 12

Consolidation of Mines is one of the developments that is confidently expected in this district as a result of the poor zinc-ore prices, and one instance has just been recorded The Blue Bonnet mine, at Hockerville, the Beck mine, at Picher, and the Silver Plume, near Treece, Kan., and the Central, near Tar River, Okla., have been consolidated under one ownership Walter H Logan will have the management of properties. He has been manager of the Blue Bonnet, which has become one of the best producers in the field in the last few months The Blue Mound mine also has taken over the Lucky Strike property south of St Louis, Okla, and will develop it Other combinations and consolidations are rumored

Construction of a Third Concentrator is being begun by the Union Metal Mines Co on its lease near Waco Mo The new mill, which will be known as the No [illegible] will have a capacity of at least 1000 tons in 24 hours, and probably will exceed this. It will be equipped with a mixed pressure turbine, the first one to be used in the district. Three shafts are already down to ore on the company's lease, where No. 3 mill will be built, which is on the Kansas side of the line, opposite No. 2, which is in Missouri. Completion of the mill is not expected by the manager, P. B. Butler, of Joplin, before Oct. 1, or possibly Jan. 1 next.

DULUTH, MINN.—June 12

Iron-Ore Shipments from the head of the Lakes, as of June 1, show a falling off of 645,676 tons, as compared with the 1918 season The lead which 1919 achieved over 1918 by virtue of the early opening of navigation has been more than offset by the lassitude of the independent shippers, but it is confidently reported that these will start in increasing volume after July 1, and there are numerous indications for an uncommonly heavy movement during the last half of the season. Shipments to June 1 compared with last year follow, in tons:

	1918	1919
D. M. & N., Duluth	3,111,843	3,751,336
G. N., Superior	1,815,322	1,113,617
Soo, Superior	237,892	159,648
D. & I. R., Two Harbors..	1,669,043	1,300,292
N. P., Superior	134,371	79,047
C & N. W., Ashland . .	741,598	733,649
Soo, Ashland	156,753	83,357
Totals	7,866,622	7,220,946

MARQUETTE, MICH.—June 14

Iron-Ore Shipments from the Marquette Range have not thus far during the season approached the figures reached during either of last two years. During May, 151,749 tons was shipped from Marquette, but it is believed that shipments from the mines will be on a normal basis before the close of the season, and there are now more steam shovels loading from the stockpiles.

In the Gwinn district progress is being made in dewatering the Stephenson mine, which was flooded about a year and a half ago. Two Lane and Bowler, eight-stage, electrically driven pumps have been installed at this property. One of these is suspended to a depth of 300 ft. and the other 500 ft., and each is pumping about 1800 gal. per min. The installation includes several interesting features.

The 2500-cu.ft., electrically driven, direct-connected, Type P. R. E. No. 2 air compressors have been installed and are in operation at the Cliffs Shaft mine and one air compressor is in operation at the Lake mine, Ishpeming. Similar installations, one each, are being made at the Negaunee and Maas mines, Negaunee. The Cleveland-Cliffs Iron Co., the largest operator on the Marquette Range, has been conducting considerable exploration north of Ishpeming. The Lake Angeline mine, at Ishpeming, has been reopened for the season and is conducting underground and surface work, the later consisting of scramming and cleaning out of small orebodies. The South Jackson mine, Negaunee, has been reopened and ore is now being loaded from the pit by means of a steam shovel. William Nichols is in actual charge of operations. Underground work began at Rolling Mill mine, recently acquired by Clement K. Quinn and associates, on June 16. Ralph S Archibald is manager, Alfred Piper mining captain, and Guy Neault in charge of surface operations.

In the Palmer district, the Empire mine, F. D. Klinglund, superintendent, is exploring, by means of test pits, an adjoining property, and is also conducting underground operations in a small way The Maitland and Isabella mines are operating and shipping

The Republic mine, at Republic, is just completing the installation of a new hoisting plant at its No. 9 shaft The hoisting drum is 12-ft diameter and has a capacity for 4600 ft of 1½-in rope Power is furnished by two 500 hp. G E motors. The shaft is vertical and is 2400 ft in depth A storage-battery locomotive has recently been placed on the 2100 level, and its use is proving most satisfactory It is reported that the Williams Iron Co is planning to do some diamond drilling on its property near Humboldt

HOUGHTON, MICH.—June 11

Quincy's General Underground Conditions are showing maintenance of quality In 1918, the average output was 16.99 lb. per ton, refined copper Now it is running 20 lb The betterment has been steady from the first of the year In April it was a fraction over 17 lb Production has decreased 20%, normal tonnage being 100,000 per month, but the average physical contents of copper is bettering steadily.

A contributing factor to the betterment in copper contents is the increase in efficiency of underground employees. More experienced miners are now at work than it was possible to secure a year ago. The demarcation between the mineralized amygdaloid lode and the barren trap rock is not distinct. The formations blend one into the other, so that it requires capable miners to avoid sending poor rock to the surface.

Quincy is now operating on six different branches of the Pewabic lode, the mineralization being practically the same on all. The amount of mass and barrel work is up to standard and comes from all sources. Opening and development work is going forward at the rate of 2000 ft. a month and is keeping about two years ahead of the stopes. The mine now has better than nine miles of ground opened, altogether. Last year 24,580 ft. in all of new openings was made. Two of the Pewabic lode branches are continuing to show a considerable amount of silver. Last year there was a total profit of $54,580 from this source.

No. 2 shaft, of the three operating shafts, continues to produce the largest tonnage of rock for the stamp mill, as well as the largest amount of copper. This, despite the fact that the ore is leaner than that from No. 6. No. 2 secures more mass copper than any other. The ground in the lower openings, particularly to the north, is heavy with it. More recent openings show a larger total of mass, a condition which is rather out of the ordinary at greater depth. The Mesnard shaft, designated officially as No. 8, is not as deep as the others and has not been as high in copper contents as they have. There has been, however, a slight change in general appearance in practically every new opening in this shaft.

VICTORIA, B. C.—June 13

The Position of Dolly Varden Mining Co. is still occupying attention in mining circles in British Columbia. Notification was received by the British Columbia government from Ottawa to the effect that a petition had been submitted there asking for the disallowance of the provincial legislation under which the Taylor Engineering Co. is taking over and proposes operating the Dolly Varden company's property at Alice Arm. This was done, it is understood from authoritative quarters, at the instigation of George Wingfield, Reno, Nev., in whose name there stands a mortgage against the mine amounting to $150,000. It is understood that as soon as it was realized that the property was required by the recent statutes to pass to the control and ownership of the Taylor Engineering Co., in default of settlement in cash of its claims against the mining corporation, Mr Wingfield took the course indicated ,with a view to obtaining adequate protection for his mortgage. Apparently having been satisfied in the meantime that his investment under the new conditions was in no way jeopardized, Mr. Wingfield has caused the petition for disallowance to be recalled It therefore would appear that there is no likelihood of the provincial government's legislation being questioned from Ottawa, and the Taylor Engineering Co. is free to proceed with its plans for the opening up and the placing upon a producing basis of the Alice Arm property.

TORONTO, ONT.—June 13

Mine Workers of Kirkland Lake Camp to the number of about 360 went out on strike on June 12. The mining companies refused to grant the demand made by the men for a 44-hour week, underground wage of not less than $4.50 per day, and recognition of the union. The mines are not at present making any endeavor to operate Large numbers of the miners have left the camp. It is not believed that the strike will spread, as Porcupine miners have declared against a strike, and the attitude of the Cobalt mine workers at last accounts was stated to be conciliatory.

Salt Deposits Along the Athabasca River have been investigated by J. L. Coté provincial secretary of Alberta, and Prof J A Allan, of the University of Alberta, with a view to their commercial development Drillings 510 ft. deep at Fort McMurray were inspected Numerous saline springs have been discovered in this vicinity, but these in every case occurred at considerable depth An examination was also made of the bituminous lands along the Athabasca the industrial development of which is understood to be dependent on investigations now in progress at McGill University Montreal

The Mining News

ARIZONA

Cochise County

BORAS LEASING (Bisbee)—Exploration on 310 level has opened gold-silver body, from which three cars have already been shipped to Douglas reduction works. Will sink to 450 level, and crosscut to new orebody. L. R. Bailey, manager.

NIGHT HAWK LEASING (Bisbee)—Encouraged by finding commercial copper ore in 125-ft. winze sunk from 500 level, company plans immediately to extend shaft from 575 to 700 ft. Superintendent McKenna gone to El Paso and Denver to purchase hoisting machinery.

SHATTUCK-ARIZONA (Bisbee)—Have made some alterations in milling plant and will conduct some experiments during June and July looking to greater recoveries. Production not yet resumed. Water pumped into mine at time of fire, filling it to within five feet of 700 level. Pumping stopped last month. Water seeping away at rate of 8 in. per day, and on June 10 had fallen to within 21 ft. of 700 level. Fire thought to be out, but water will be permitted to remain 30 days longer.

HILLTOP M. AND S. (Hilltop)—Continuing development in three tunnels which cut orebodies at 450, 1050, and 1350 ft. respectively. Will install concentrator.

Greenlee Couoty

ARIZONA COPPER (Clifton)—No. 6 shaft retimbered and equipped with water spray system.

Mohave County

CARR (Kingman)—To be operated by local leasing company, headed by R. C. Jacohson. Property in Cedar Valley district.

CYCLOPIC (Kingman)—Mill being enlarged to 150 tons' daily capacity. Thomas Bell, owner, in charge.

RURAL-BUCKEYE (Kingman) — Old Mineral Park properties taken over by M. B. Dudley and New York associates, who will build 100-ton mill. Large tonnage silver ore already available in stopes and on dumps. Main owners, with Dudley, are G. C. Buschenes, Samuel Weil, S. I. Rabinovich, and Milton Gross. Mines five miles from Chloride railroad and one-half mile from electric power line.

ARIZONA MOSSBACK (Oatman)—To start work in July on large mill. Shaft nearing 700 level. Stations to be cut at 600 and 700 ft. and vein explored on those levels. Ample ore for mill said to have been developed on 500 and above.

UNITED EASTERN (Oatman)—Main shaft down about 1400 ft. in sinking to cut ledge on dip. Tom Reed has 1450 ft. depth and Gold Road 1500.

Pima County

YELLOW BIRD (Tucson)—Company formed to take over old silver properties of Lincoln camp, in Papago district. W. E. Fuller, assistant cashier of Tucson National Bank elected treasurer; Deputy U. S. Marshal James M. Treahy, trustee.

Pinal County

RAY BROKEN-HILL (Ray)—Long tunnel from Mineral Creek level has broken into oxidized zone at point 450 ft. below collar of shaft, tapping large flow of water. Property lies short distance below Ray.

Yavapai County

GRAND ISLAND (Jerome)—Management announces property will soon be prospected by diamond drill. Negotiations for drilling contract under way with International Drilling Co., of San Francisco.

UNITED VERDE EXTENSION (Jerome)—Production resumed at blast furnace at Verde, expected to be standard at 3,500,000 lb. a month till market conditions better for copper. Work at mine restricted by lack of good miners. Haulage tunnel construction to be completed within 60 days.

FRANCO-AMERICAN (Mayer)—Former Governor Oddie of Nevada and Senator Gorman, of West Virginia, principals in developing company. Situated two miles from Stoddard and eight miles from Mayer.

ARKANSAS

Boone County

GLORIA (Zinc)—Force of miners reduced to four men. Mill will not be operated until market rises. Large tonnage already blocked out.

RHODES-MANCHESTER (Zinc)—McCurry Mining and Milling Co., operating Rhodes-Manchester zinc mine, will complete new 100-ton concentrating plant on property this month.

Marion County

LONNIE BOY (Rush) — Development work, which has been in progress since last Autumn, has been discontinued. Three tunnels, 45, 75, and 200 ft. long, respectively, have been driven into body of high-grade zinc carbonate 14 to 16 ft. thick. Stanley Hanford, one of the owners, states ore sufficient to produce 5000 tons of hand-cobbed ore and concentrates has been blocked out. Three carloads of hand-cobbed ore are in bins ready for shipment, much running as high as 53% metallic zinc. As soon as market warrants concentrator will be erected.

CALIFORNIA

Alameda County

WRIGHT MANGANESE (Livermore)—G. W. Gardner, of San Jose, Calif., awarded $44,000 in claim against W. A. Wright. This is half interest in profits derived from sale of manganese during period of war.

Amador County

CENTRAL EUREKA (Sutter Creek)—Milling ore being drawn from 3500 and 3600 levels Sinking of main shaft to 3700 level now in progress.

OLD EUREKA (Sutter Creek)—Station cut on 3000-ft level, from which development work north and south of shaft will continue.

Butte County

BAUXITE (Oroville)—Chamber of Commerce investigating possibility of manufacture of aluminum. Large deposits of bauxite and power available at price attractive to aluminum manufacturers.

Inyo County

DARWIN DISTRICT improving since advance in price of silver. Rip Van Winkle mine, adjoining Defiance, has struck good orebody. Wallace mine has several men employed. Lucky Jim producing regularly. Whole Darwin district shows prospect of good season.

Nevada County

MORANDI (Grass Valley)—Ledge recently uncovered by crew employed in state highway work, crossing between Morandi place and Ben Franklin mine.

SOUTH STAR (Grass Valley)—Development work on high-grade ore recently discovered shows commercial values to be continuous in vein averaging 4 ft. in width.

CLEVELAND (Sierra City)—Mill capacity to be doubled by adding 10 stamps. R. G. Gillespie, owner, and S. E. Montgomery, manager.

GASTON (Washington)—Surface plant, including 30-stamp mill, destroyed by fire on June 3.

Shasta County

GARFIELD (Redding)—Garfield mine, formerly large producer, optioned by Garfield Mining Co., and adjoining claims acquired. Permitted by State Corporation Department to issue stock.

Siskiyou County

FORKS OF SALMON RIVER (Forks of Salmon)—Ten men at work. Running three No. 5 giants with 6-in. nozzles. Elevator, 18-in. opening, installed. About 3000 inches carried in main flume and 2000 inches in lead water flume. Head in pit 235 ft. Largest operating mine in district since La Grange shut down. Capt. John D. Hubbard in charge.

Trinidad County

LA GRANGE HYDRAULIC MINE (Weaverville)—Orders received by management to close property indefinitely. Reported company found it impossible to operate profitably under heavy burden imposed by war exigencies, including 30% tax imposed by British government. Company largely composed of British investors, subject to taxes levied from London.

COLORADO

Boulder County

COLORADO METALS (Magnolia)—Has acquired Senator Hale group of properties, and is installing mining machinery preparatory to active development.

BOND SYNDICATE LEASING (Ward)—Remodeling Strong mill for treatment of low-grade milling ores from district. M. W. Loomis manager.

Clear Creek County

CHICAGO BELLE (Dumont)—Acquired by Bonanza Mines Co, recently organized with following officers and directors: George W. Taylor, president; C. L. Jaynes, Idaho Springs, vice-president, and manager; B. D. Arbuckle, treasurer; C. E. Angell, secretary; Frank Heilig and A. E. Gees. A force of men is employed in placing property in condition preparatory to general development campaign.

Gilpin County

FULLER-MacCULLOGH CO. (Russel Gulch)—Has acquired considerable mining property recently, and is planning to operate Becky Sharp, Iron, Pewabic, Old Town, and Silver Dollar properties. At present company is shipping 25 tons of ore per day and expects to increase production to 100 tons by Sept. 1. Unwatering operations in progress, and underground workings in Old Town, Pewabic, and Iron Mines being repaired preparatory to active development. J. Gillingham Hibbs, consulting engineer.

IDAHO

Shoshone County

YUKON GOLD (Murray)—Dredge operating on Prichard Creek closed down two weeks for repairs, being first time lost on this account in last year.

BLACK BEAR (Wallace)—New directors announce work will begin about July 1 after being idle many years. Much lead-zinc ore in sight, and company expects to begin shipping soon after starting. Negotiating to lease mill.

ST. LAWRENCE (Saltese, Mont.)—Fifteen men employed on development. Raise completed from lower to upper tunnel, 200 ft., and drift from raise in good ore. Also raising to catch oreshoot 200 ft. east. Property six miles from railroad. Hauling and freight cost prohibit shipping.

TARBOX (Saltese, Mont.)—Richard Daxon, manager, now in East making financial arrangements for construction of mill. Large body of lead-zinc ore developed on three levels.

KANSAS

Joplin District

KING-BRAND (Baxter, Kan.)—New mill completed. Air drifts between two shafts cut. Operations to start at once.

SILVER PLUME (Baxter)—Has just installed engine in mill completed some weeks ago, and will start operating June 15.

WAUCHUSETTS (Commerce, Okla.)—After making record production with five hand jigs, company has purchased mill. A. Mayerhoff, Commerce, Okla., manager.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—Big dredge in operation, after having been overhauled in drydock at Point Mills. Revolving screen removed. Grinding and leaching plants doing full duty, and oil flotation in connection therewith will be in operation in three months. Calumet & Hecla output down to 50% basis. Thirteen stamp heads out of 28 running at mills, handling conglomerate exclusively. Small tonnage from Osceola amygdaloid comes from necessary shipments of rock taken in openings. But 14 furnaces working at smeltery. Only construction in progress is erection of steel work for flotation plant at mills. When this plant is working all conglomerate slimes will be either floated or leached.

MOHAWK (Mohawk)—Now has in operation two four-ton trolley locomotives in No. 4 shaft and two in No. 6, in addition to two endless-rope haulages in No. 6. During 1918 number of raises decreased below normal, discrepancy being explained on basis of large number of chutes needed to serve new-style haulage. There was general remodeling of mine cars and considerable car construction. All Mohawk shafts now furnished with concrete collars and stringers, No. 1 being last to receive them. Water pipe from surface to 18th level installed at No. 5 shaft. Pump from No. 2 at 20th level overhauled, and now running at No. 5 on 18th level. Draining from No. 2 handled by electric pumps from No. 1.

Marquette Range

ROLLING MILL (Negaunee) — Operations began June 16 at full capacity by Clement K. Quinn & Co., which recently took over lease of property from Jones & Laughlin Co. Crew of 100 miners put to work under William Piper, who recently came here from Alpha, Michigan.

MINNESOTA

Vermilion Range

ZENITH (Ely)—Ownership of lease on Zenith passes from Oliver Iron Mining Co. to Zenith Iron Mining Co., which will operate property. New company organized by T. F. Cole, R. B. Whiteside, R. M. Sellwood and Frank A. Kent, who also control fee of property. New lease runs for 50 years, minimum for 1919 to be 200,000 tons, and 300,000 tons for each year thereafter, royalty to be 20% of Lake Erie selling price. Zenith produces high-grade bessemer ore of excellent structure. Estimated there are over 1,000,000 tons immediately available.

MISSOURI

Joplin District

SILICATE MINING (Topeka, Kan.)—Has purchased 150-ton mill, and will erect at lease in Corry field, near Greenfield, Mo. H. E. Reicherter superintendent.

MONTANA

Beaverhead County

BOSTON & MONTANA (Wise River)—Crosscutting from upper Idanha tunnel under way. Ore showing strong in Idanha fissure in this working. Expect to cut Central, Elkhorn, and Park veins within 90 days, and Elkhorn, nearest vein, within month. Largest trestle of Montana Southern Ry., subsidiary, completed last week, and rail laying in full swing, with rapid progress being made.

Cascade County

CASCADE SILVER (Neihart)—Mill recovery running low, with tailings high, and a conflict has arisen with state game warden department over polluting of stream with tailings. Director P. A. Gow, of Butte, has instituted suit in District Court against president, George Brabrook, and vice-president, H. L. Maury, and other officials to compel restitution to treasury of 150,000 shares, voted by officers to themselves for "services rendered."

Missoula County

POTOMAC COPPER (Potomac)—Road construction nearing completion and transportation of air-compressing machinery will be started within several weeks. Tunnel will be driven to open old "Copper Cliff" at depth of about 800 ft. and fissure system higher up mountain side at depth of 1200 feet.

Silver Bow County

ANACONDA (Butte)—Shaft of Orphan Girl mine will be sunk from 500 to 1000 ft. and Orphan Girl, Orphan Boy, and Anglo-Saxon fissures opened at that depth. Orebody 35 ft. wide on 500 level of Anglo-Saxon vein continuing. Showing good on Orphan Girl vein on 500 level. On Orphan Boy fissure 2½ ft. ore. Pilot-Butte mine's showing one of best in district Twenty-eight hundred level of Stewart continues in first-class ore, shaft being sunk to 3400 level Company hampered by lack of skilled miners, and, during enforced suspension of Diamond mine, shaft will be concreted. New stack at Washoe smeltery put into full operation, together with Cottrell smoke treating plant, which estimated will add 1% to metal recovery of reduction works

BUTTE & SUPERIOR (Butte)—No. 2 shaft raised from 2050 level to 1900 about completed, and its sinking will start soon for 2500 level. Mill recovery for May, 97%, one of record months.

CRYSTAL COPPER (Butte)—Five feet of ore cut in North vein on 500 level of medium grade. Two-foot high-grade stringer opened about 30 ft. away and apparently heading into larger oreshoot. Development work started on fissure to south, showing more than 6 ft. of mineralized quartz.

ELM ORLU (Butte)—Shaft sinking continuing. Station will be cut at 2500 level and Rainbow fissure crosscut. Objective of shaft is 3000 level.

TUOLUMNE (Butte)—Cutting of station at 1000 level of Sinbad shaft of Main-Range mine to begin within 10 days, and crosscutting for Spread Delight fissure at this depth within two weeks. Estimated vein distant about 700 ft. and will be reached about last of August. Sinking to be pushed simultaneously with crosscutting.

NEVADA

Lincoln County

HARNEY (Pioche)—Suit filed against Nevada Volcano Mines Co., owner of Harney group of claims, by Lloyd brothers, of Pioche, to recover possession of European claim, located by Lloyd brothers on Jan. 1, 1915, and subsequently relocated and patented by Thomas Harney, who asserts Lloyd brothers failed to perform location work. Lloyd brothers claim never to have yielded title and that patent was obtained without their knowledge. Claim of considerable value, through strike of high-grade silver-lead ore thereon six months ago by Stindt & Donohue, leasing from Harney. Subsequent production of claim to date about $75,000.

PIOCHE MINES (Pioche)—Shipping ore to Southern Nevada mill for concentration. Milling operations hampered by water shortage.

PRINCE CONSOLIDATED (Pioche)—Moving all machinery from old incline shaft and installing at new vertical shaft completed last year. Old incline shaft to be abandoned to permit mining of shaft pillar, containing large tonnage of iron-manganese ore.

VICTORIA-NEVADA (Pioche)—Commenced operations on Donohue group of claims, adjoining Poorman mine, and will explore extension of Poorman veins.

NEW MEXICO

Grant County

REPUBLIC M. AND M. (Hanover)—Annual report shows net earnings $52,000 for 1918, and a total of 44,000 tons ore blocked out and 6000 tons 20% zinc ore on dumps; and 500,000 tons iron ore is indicated, assay 58% Fe. Orebody is contact between porphyry and garnet silicates. Ira L. Wright, engineer.

LAST CHANCE (Lordsburg)—Has cut 14 ft. ore on 200 level. Working mill half shift, because of water scarcity.

VIOLA (Lordsburg)—Pyramid Mining Co. has completed unwatering of 408-ft. main shaft and has cut 9 ft. silver ore on 300 level. Will begin development work on lower level at once. B. Prescott manager.

OKLAHOMA

Miami District

GOLDEN ROD M. AND S. (Joplin)—Has purchased Dallas-Picher mill on one of its leases, and is razing it. Company's No. 4 mill being enlarged to handle 1500 tons in 24 hours. Surface railroads will haul dirt from No. 6 and from Dallas-Picher tract to No. 4.

LADD (Picher)—Has purchased Scott-Eagle mill, near Quapaw, and will move it to lease two miles north, not far from Picher.

ALAMO (Quapaw) — Has purchased Lucky Bob mill and lease north of Quapaw, and will operate it.

SOUTH DAKOTA

Lawrence County

IRON HILL (Carbonate) — Fire destroyed shafthouse and equipment. Plant has been used by contractor, who is driving 1350 ft. tunnel to tap lower workings. Electric power line will be extended to portal and motor-driven compressor installed. Tunnel advanced 500 feet.

HOMESTAKE (Lead) — Ellison shaft, now down 2090 ft., including sump, being deepened. Next level will be opened at 2150 ft. Storage for 10,000 tons of bituminous coal completed. Coal removed from open bin by means of ¾-yd. Erie clamshell shovel.

Pennington County

SUMMIT (Hill City)—Preparations being made to resume. Mine will be unwatered and active development started soon. New boilers being installed. James Graham in charge of work.

UTAH

Summit County

SILVER KING COALITION (Park City)—Re-hearing in suit with Conkling company over ore alleged wrongfully extracted refused by District Court of Appeals sitting at St. Louis. Appeal to U. S. Supreme Court probable. Conkling company awarded about $500,000.

TEXAS

Brazoria County

WEST COLUMBIA FIELD PRODUCTION for first week in June was 30,900 bbl. per day, compared with 17,000 bbl. three weeks ago. Producers are: Texas Co., 10,000 bbl.; Gulf Production Co., 8050 bbl.; Humble Oil and Refining Co., 7550 bbl.; Crown Oil and Refining Co., 4700 bbl.; Sun Oil Co., 600 bbl.

HUMBLE OIL AND REFINING (West Columbia)—Waters No. 1 well, brought in June 3, making 3000 bbl. from depth of 3380 ft. Best well of week reported from south Texas.

GULF PRODUCTION CO. (West Columbia)—Phoenix No. 1 flowing by heads about 1000 bbl. per day from 2300 ft.; Phoenix No. 2 flowing 200 bbl. from depth of 1850 ft., but showing signs of sanding up; Eyers No. 5 well, brought in June 5, flowing 150 bbl. from 3200 ft.

Eastland County

PRAIRIE OIL AND GAS (Eastland)—Slayden No. 3 well, on Arenbeck survey No. 2, brought in recently, with production of 500 bbl. from 3440 ft. Slayden No. 7 well, on same survey, making about same production from that depth. Terrell well, on Arenbeck survey No. 1, making 80 bbl. from 2441 ft. Other wells producing in this district: Golson, Moorman & Co. brought in well June 2 on Harrison tract of York survey, making good production from 3440 ft.; Hupp & Perkins No. 1 well making top showing of 300 bbl., with 150 ft. to go to Ranger sand. This well offsets Ballentine's Pleasant Grove Church well, and is five miles north of Eastland.

SINCLAIR GULF (Ranger)—J. E. Barns well, three and one-half miles west of here, making 1,500,000 ft. of gas from depth of 3410 ft.

Hardin County

SUN OIL (Saratoga)—Brought in 100-bbl. gusher in eastern part of field at depth of 2000 ft. Expected strike will increase activity here.

T. H. Y. CO. (Sour Lake)—Well brought in June 1 on Lucy Moore lease in old "Shoestring" field, making 50 bbl. at 850 ft., with indications of improving. Company local organization.

Harris County

SOUTHLAND OIL (Humble)—Hirsch No. 11 well abandoned at 1250 ft.

PETROLEUM REFINING (Humble)—Stevens No. 15 well brought in as 100-bbl. pumper.

TEXAS CO. (Humble)—Landslide No 236 well has come in at 3000 ft., producing 1500 bbl., according to official statement

Lampasas County

CONSIDERABLE DRILLING now in progress; Howell well No. 1, on White ranch, has good showing of oil at 1030 ft. Standard rig, new boiler and engine being installed. Robert well No. 1, on Conradt ranch, north of Lometa, has good showing at 1070 ft.; setting casing Key well No. 1, on Baxter ranch, drilling in dark limestone of Bend formation, reported some oil showings. Nelms-Marmion No 2, on McCrea ranch, Groves No. 2, and St Mary's No. 1, on Le Compte ranch, all drilling.

Liberty County

GULF PRODUCTION (Hull)—Phoenix No. 2, that came in flowing 300 bbl., has sanded and now making only 80 bbl.

The Market Report

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	June	Sterling Exchange	Silver New York, Cents	Silver London, Pence
12	4.6100	112¼	54¾	16	4.6075	112¼	54¾
13	4.6113	110¾	54	17	4.6050	112⅜	54⅞
14	4.6075	111⅛	54¼	18	4.6113	112½	54⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper	Tin	Lead		Zinc
	Electrolytic	†Spot.	N. Y.	St. L.	St. L.
12	17.60	72½	5⅜@5.40	5.10@5.15	6.50@6.60
13	17.75@17.85	72½	5⅜@5.40	5.10@5.15	6.55@6.65
14	17⅜@17⅝	72½	5⅜@5.40	5.10@5.15	6.50@6.55
16	17⅜@17⅝	72½	5⅜@5.40	5.00@5.10	6.50@6.55
17	17.55@17.65	72½	5.35@5.40	5.00@5.05	6.50@6.55
18	17.60	72½	5.35@5.40	5.00@5.05	6.45@6.50

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

June	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
12	80	80¾	83½	237	233⅜	22½	22¾	36¼
13	81¾	82½	85½	238	235	22¾	23	36½
14		....	...		..	.	..	..
16	83	83½	86	241½	237¾	23⅛	23⅜	36½
17	82¾	83	86	240	235¾	22⅞	23⅛	36½
18	84	84¾	86½	242½	238	22⅞	23⅛	36½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—June 18, 1919

The metal markets were quiet and irregular during the last week, being more or less disturbed by the ups and downs of the stock market. The strike at important copper-manufacturing centers and the fear of labor troubles in Western mining districts were disturbing factors.

Transatlantic freights have become easier, it being now possible to get rates of $16 per 2000 lb. to British ports. The rate from Pacific ports to Hongkong and Kobe remains at $14.

The stocks of metals in the hands of the British Ministry of Munitions on June 1. with the corresponding figures for May 1 in parentheses, were as follows: Copper, 107.502,080 lb. (114.531,200); lead. 134.295 short tons (122,093); zinc, 43,039 short tons (38,045); aluminum, 12 229 short tons (12,927); nickel, 7,956,480 lb. (5,750,080); antimony, 5040 short tons (4996). The increase in lead and zinc stocks was of course due to arrivals of metal previously held elsewhere.

Copper—Demand was light during most of the week. This was but natural, in view of the large business which previously had been done, while the labor troubles at some important copper-manufacturing centers naturally checked inquiries. Rome and Ansonia have been completely tied up, and yesterday the trouble spread to Waterbury, and there were reports this morning that all of the plants there had been closed. On June 12 the market was very firm on the basis of 17.60c., cash New York, or 17¾c., delivered, regular terms. On June 13 some of the large producers raised their price by ⅛c. and booked some small business at the advance. With the reaction in the stock market and the absence of inquiries from manufacturers some speculative and other interests offered copper more cheaply and accepted some small business at relatively low prices on June 14 and 16. On June 17 there was some substantial inquiry from wire-drawers, who took some round lots on the basis of about 17.60c., New York, and today the market was steady at that price, with some of the larger producers holding for higher prices.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 20¼@20½c. in carload lots, f.o.b. mill.

Tin—The unsold tin in the hands of the U. S. Steel Products Co. on June 9 was 1071 tons. Sales from June 9 to 14 were 494 tons. Balance unsold on June 16 was 577 tons. The War Trade Board under date of June 16 announced that import restrictions would be removed and that licenses to import pig tin would be granted subject to the following conditions and limitations: Importation only of shipments made from points of origin on or after June 30, 1919. Such import licenses will not be valid for entry until Aug. 1, 1919. It seems probable that the allocated tin will be fully placed before the end of June. It is to be inferred from the dates fixed by the War Trade Board that the American smelters are to have a month in which to market their stocks of tin, which heretofore they have had to hold. In the meanwhile, there is gossip that surreptitious business in tin has been going on.

Lead—A fair business was done during the week, the major part of which was at the full price, but here and there some shading was done, and toward the close the market seemed to be a little softer. Such weakness as was exhibited was due mainly to the offerings of speculative interests, the principal producers being in a very strong statistical position, and being very firm in their ideas. The imposition by the Canadian government of a duty of 1c. per lb. on imports of lead into Canada has created some concern among the producers of Mexican lead. Japan was again a buyer of lead this week.

Zinc—On speculative buying the advance in this market continued, but upon its cessation the market became easier. A moderate business with consumers was done in brass special and high-grade intermediate spelter. Advices from Europe are to the effect that the Belgian smelters have made a large contract for Australian ore and are preparing to resume smelting soon, but in view of the high cost of both ore and coal, especially the latter, it is expected that the cost of spelter will be relatively high.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 33c. per lb. Unchanged.

Antimony—The market was quiet at 8⅜@8½c. for spot. Futures were quoted at 8¼@8½c., duty paid, New York, for June-July shipment from the Orient.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Supplies in the New York market continue scarce, and the price is strong at $92. San Francisco telegraphs $89, strong.

Silver and Platinum

Silver—Silver has ruled fairly steady the last week, except for a drop in the London market on June 13 to 54d. but the market quickly recovered and closes quiet in London at 54⅞d. There has been a demand outside London bidders for silver from bankers with Far Eastern connections at higher prices and probably to satisfy commercial requirements in payment for exports. Tendency easier at close.

Mexican dollars at New York: June 12, 85⅞; June 13, 85; June 14, 85¾; June 16, 86⅝; June 17, 87; June 18, 87.

The general stock of money in the United States on June 1, 1919, totaled $7,592,078,992. Of this, $3,092,037,699 was in gold coin and bullion, $308,978,930 in standard silver dollars, and $243,679,762 in subsidiary silver. The money in circulation on June 1 was $5,834,268,212, or $54.29 per capita.

Platinum—Refined ingot is quoted at $105@107½, and practically the same price is realized for sponge as for ingot. Some manufacturing consumers are as willing to use one form of the metal as the other. During the last week or ten days $105 has even been realized by producers for the platinum content of crude metal. The Government is making plans to liquidate its stock of platinum. This will probably be divided among the distributors in the business for sale over a fairly long period, so as to avoid any disturbance of the market. In view of the diminished production. platinum is manifestly in a very strong statistical position.

Palladium—Strong at $120.

Zinc and Lead Ore Markets

Joplin, Mo., June 14—Blende, per ton, high, $44.20; basis 60% zinc, premium, $42; Prime Western, $42; sludge and flotation, $40@35; calamine, basis 40% zinc, $25@22. Average settling prices; blende, $39.60; calamine, $24.76; all zinc ores, $39.18.

Lead, high, $61.85; basis 80% lead, $58@57; average settling price, all grades of lead, $57.45 per ton.

Shipments the week: Blende, 10,344; calamine, 294; lead, 1226 tons. Value, all ores the week, $487,220.

The Butte-Kansas company closed down its large mill in the Waco area, making five mills in this productive camp now idle. Though the market held firm all week at $42 basis, buyers said today buying was easier, producers selling more readily.

There is a fair-sized reserve stock of zinc ore, but it has been long held in strong hands. Though this stock is in evidence, it is a fact also that several thousand tons have been sold ahead of production.

Platteville, Wis., June 14—Blende, basis 60% zinc, $44.50 base for premium grade, and $42.50 base for high-lead blende. Lead ore, basis 80% lead, $97 per ton. Shipments reported for the week are 2530 tons blende, 80 tons galena, and 564 tons sulphur ore. For the year to date the totals are 46,307 tons blende, 2248 tons lead, and 6370 tons sulphur ore. During the week 2722 tons blende was shipped to separating plants.

Other Ores

Manganese Ore—Metallurgical ore is quoted at 50c. per unit for spot, and 60c. per unit for shipments.

Pyrites—Spanish pyrites is quoted at 20c. per unit for furnace ore, c.i.f., New York or other Atlantic port. Unchanged.

Tariff on Pyrites—Representative Slemp, of Virginia, has introduced a measure (H. R. 5215), which has been referred to the Ways and Means Committee, designed to obtain revenue and to promote and encourage the production of iron sulphide, pyrite, and sulphur, and manufactures thereof, in the United States and its possessions. The measure provides for a duty of 15c. per unit of the sulphur content on pyrites and all crude iron sulphide minerals, ores, and concentrates, when imported from any foreign country into the United States or its possessions.

Tungsten Ore—It appears that the ore offered at around $7 has now been sold, but buyers do not seem to want to bid more than $7.50. Holders of Bolivian ore are not much disposed to sell, even at $10. Cheap offerings of Chinese ore have also disappeared.

Iron Trade Review

PITTSBURGH—June 17

Production of steel ingots in May, by 30 companies which in 1918 made 84.03% of the total output, was 1,929,024 gross tons, indicating that the industry operated during May at the rate of 26,450,000 tons a year, this being 54% of capacity, taking capacity at 49,000,000 tons, and comparing with 65% in April, 77% in March, 85% in February, and 87% in January. With the heavier buying of steel products that began just before the middle of May, there has since been an increase in production. A rate of as low as 50% was probably approximated at some time in May, though the rate now is between 55 and 60%, probably nearer the latter.

Buying of steel has not increased materially in the last week, but sheet demand shows some further improvement, and the sheet industry will probably be running at between 70 and 75% before the end of the month, against between 60 and 65% at the beginning of the month. Merchant pipe shows a little improvement.

Pig Iron—Pittsburgh Steel Foundry has bought a few hundred tons of basic pig iron and Follansbee Bros. Co. about 3000 tons, both for third quarter. Standard Sanitary has bought 4000 tons of foundry iron, half for its works in Pittsburgh and half for its works at New Brighton, June and July delivery, the bulk of the iron being at full Valley prices, though one lot was from a detached furnace at rather a deep cut, the iron being high in manganese, so that only a limited tonnage of the brand could be used. The Valley furnaces are firm, and there is less disposition on the part of outside furnaces to absorb freights to get into the Pittsburgh market, which can be quoted on the Valley basis except for occasional cutting by detached furnaces, including possibly Ironton and Buffalo. Valley prices are: Bessemer, $27.95; basic, $25.75; foundry, $26.75; forge, $25.75, f.o.b. furnace, with $1.40 freight to Pittsburgh.

Steel—The market continues extremely dull in billets, with a fair movement in sheet bars. Prices remain: Billets, $38.50; sheet bars and 2-inch billets, $42; slabs, $41; rods, $52.

Ferromanganese—No sales of English ferromanganese are announced at the new price of $125, delivered east of the Mississippi River for 80%. Domestic resale continues quotable at $110@115, but with offerings now limited. Producers quote nominally $150, delivered, as for months past. Spiegeleisen is $33@35, delivered, for 18% resale.

Coke—Second-half furnace coke has been more or less under negotiation for some time, and sellers who have been in the market right along have now been surprised to find the first three sales made by a new comer, the Oliver & Snyder Steel Co., whose coke has gone exclusively to the Steel Corporation for years, but is now released because the Steel Corporation has so much new byproduct capacity. The three sales totaled 32,000 or 33,000 tons a month, with a ratio of a little more than six tons of coke to one ton of basic iron, Valley furnace, with a minimum slightly under $4 and a maximum that is not particularly high. The company's output will be 50,000 to 70,000 tons a month, and the remainder is now under negotiation. As Eastern furnaces have stated that they will use Eastern byproduct unless they can buy Connellsville at under $4, the outlook for sales by former merchant producers is not as bright as would be indicated by the high prices they are quoting. Second-half foundry coke has been done at $5 to $5.50. Spot furnace coke is a shade easier. We quote spot coke at $3.75@4 for furnace and at $4.50@5 for foundry per net ton at ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver

	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	107.135	37.940	48.980	52.104
June	76.971	99.500	......	39.065	48.875	......
July	79.010	99.625	......	40.110	48.813	......
Aug.	85.407	100.292	......	43.418	49.077	......
Sept.	100.740	101.125	......	50.920	49.500	......
Oct.	87.332	101.125	......	44.324	49.500	......
Nov.	85.891	101.125	......	43.584	48.969	......
Dec.	85.960	101.125	......	43.052	48.492	......
Year	81.417	96.772	..	40.851	47.516	......

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	16.246	110.000	77.300	125.000	82.200
May	23.500	15.864	110.000	77.787	125.000	81.227
June	23.500	.....	110.000	.....	125.000	....
July	26.904	.....	119.913	.....	134.913	....
Aug.	26.000	.....	122.000	.....	137.000	....
Sept.	26.000	.....	122.000	.....	137.000	....
Oct.	26.000	.....	122.000	.....	137.000	....
Nov.	26.000	.....	122.000	.....	137.000	....
Dec.	(a)	.....	118.447	.....	133.167	....
Year	24.628		116.530		130.507	.. ..

(a) No Market.

Tin

	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.905	225.275
May	(a)	72.600	364.217	234.398
June	(a)	......	331.925	......
July	(a)	......	360.347	......
August	(a)	......	380.900	......
September	(a)	......	343.905	......
October	(a)	......	335.543	......
November	(a)	......	323.550	......
December	(a)	......	267.736	......
Av. year	(a)		330.138	......

(a) No average computed.

Lead

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.962
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818	5.018	6.704	4.773	29.00	23.852
June	7.611	...	7.611	...	29.00	......
July	8.033	....	7.750	....	29.00	......
August	8.050	.....	7.750	.....	29.00	......
September	8.050	.....	7.750	.....	29.00	......
October	8.050	......	7.750	......	29.00	......
November	8.050	......	7.750	......	31.20	......
December	6.564	......	6.324	......	40.00	......
Year	7.413		7.222		30.10	

Zinc

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	7.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314	6.429	7.114	6.079	54.000	35.477
June	8.021		7.791	..	54.000	
July	8.688		8.338	...	54.000	
August	8.985		8.635	...	54.000	....
September	9.442		9.092	...	54.000	....
October	8.801	.	8.451	...	54.000	.
November	8.491		8.141	....	54.100	.
December	8.163		7.813	..	56.050	..
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton.

‡ Pig Iron, Pittsburgh

	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.16	29.36	32.95	27.15	33.95	28.15
May	36.20	29.35	33.00	27.15	34.00	28.15
June	36.30		33.15	......	34.15	..
July	36.60		33.40	..	34.40	..
August	36.60	....	33.40	....	34.40	..
September	36.60	..	33.40	.. ..	34.40	.. ..
October	36.60	.	34.40	..	35.40	.. ..
November	36.60	..	34.40	.. ..	35.40	.. ..
December	36.60	.	34.40	......	35.40	....
Year	$36.67	..	$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. Exch.†	June 17
Alaska Gold M.	3¼
Alaska Juneau	2½
Am.Sm.&Ref.,com.	80½
Am.Sm.&Ref.,pf.	107
Am.Sm.Sec., pf., A	92
Am. Zinc	22½
Am. Zinc, pf.	57
Anaconda	70½
Batopilas Min.	1½
Bethlehem Steel	85
Butte & Superior	27¾
Butte Cop. & Zinc	12½
Cerro de Pasco	55¼
Chile Cop.	25¾
Chino	44½
Colo. Fuel & Iron	47
Crucible Steel	90¼
Crucible Steel, pf.	99½
Dome Mines	13¼
Federal M. & S.	14¼
Federal M. & S., pf.	41¼
Great Nor., ore ctf.	46¾
Greene Cananea	42
Gulf States Steel	58
Homestake	88
Inspiration Con.	58½
International Nickel	29¼
Kennecott	39¾
Lackawanna Steel	81
Mexican Petrol	181
Miami Copper	26¾
Nat'l Lead, com	77
National Lead, pf.	108
Nev. Consol.	19
Ontario Min.	8
Ray Con	23½
Republic I.&S.,com.	87½
Republic I.&S., pf.	102½
St. Joseph Lead	13½
Sloss-Sheffield	62½
Tennessee C. & C.	13
U. S. Steel, com.	106
U. S. Steel, pf.	116½
Utah Copper	87½
Va. Iron C. & C.	66
Worthington Pump	76¾

Boston Curb*	June 17
Boston Ely	1½
Boston & Mont.	78
Butte & Lon'n Dev.	.22
Calaveras	1½
Chief Con.	3½
Contact	‡.05
Cortez	.20
Crown Reserve	.28
Crystal Cop	.13
Eagle & Blue Bell	2¼
First Nat. Cop.	1
Gadsden Cop.	3¼
Houghton Copper	1½
Intermountain	‡.05
Iron Blossom	40
Iron Cap	10½
Majestic	23
Mexican Metals	16
Mines of America	‡.05
Mojave Tungsten	13
Nat. Zinc & Lead	.10
Nevada-Douglas	.16
New Baltic	2
Onecco	.80
Pacific Mines	‡.35
Rex Cons.	.14
Yukon Gold	75

San Fran.*	June 17
Alta	‡.08
Andes	20
Best & Belcher	15
Caledonia	15
Challenge Con.	‡.03
Confidence	‡.25
Con. Virginia	1.70
Gould & Curry	06
Hale & Norcross	‡.25
Jacket-Cr. Pt.	05
Mexican	43
Occidental	‡.40
Ophir	1.17½
Overman	‡.10
Savage	15
Sierra Nevada	10
Union Con.	29
Utah Con.	‡.04
Belmont	‡3.50
Jim Butler	34
MacNamara	70
Midway	40
Mont.-Tonopah	‡.20
North Star	10
Rescue Eula	22
West End Con.	1.62½
Atlanta	04
Booth	09
Comb. Frac.	‡.04
Florence	50
Jumbo Extension	12
Kewanas	03
Nevada Hills	04
Nevada Packard	23
Round Mountain	41
Silver Pick	06
White Caps	17

Colo. Springs*	June 17
Cresson Con.	4.25
Doctor Jack Pot	.04
Elkton Con.	.04½
El Paso	.16
Gold Sovereign	‡.02
Golden Cycle	1.67
Granite	.12
Isabella	.04½
Mary McKinney	.07½
Portland	.96
United Gold M.	.18½
Vindicator	.20

Boston Exch.†	June 17
Adventure	‡1½
Ahmeek	‡79½
Algomah	‡.80
Allouez	40
Ariz. Com.	14
Arnold	‡.20
Bingham Mines	9½
Bonanza	‡.20
Butte-Balaklava	50
Calumet & Ariz.	68
Calumet & Hecla	410
Carson Hill	15
Centennial	16
Copper Range	49½
Daly West	2½
Davis-Daly	7
East Butte	14
Franklin	4½
Granby	‡76½
Hancock	6
Hedley	‡12
Helvetia	5½
Indiana	‡1½
Isle Royale	36
Keweenaw	1½
Lake	5½
La Salle	‡3½
Mason Valley	3½
Mass	6½
Mayflower	10½
Michigan	6
Mohawk	67
New Arcadian	‡4
New Cornelia	24½
New Idria	9½
Nipissing	11½
North Butte	13
North Lake	‡1½
Ojibway	2½
Old Dominion	41½
Osceola	56
Quincy	77
St. Mary's M. L.	58
Santa Fe	‡.35
Seneca	23½
Shannon	4
Shattuck-Ariz.	‡15½
So. Lake	‡3
So. Utah	25
Superior	‡9
Superior & Bost.	3½
Trinity	4½
Tuolumne	1
U. S. Smelting	66
U. S. Smelting, pf.	49½
Utah Apex	3
Utah Con.	10½
Utah Metal	2½
Victoria	3½
Winona	‡1½
Wolverine	23½

N. Y. Curb†	June 17
Alaska Mines	⅛
Big Ledge	⅝
Butte & N. Y.	‡½
Butte Detroit	‡.03
Caledonia	42
Calumet & Jerome	⅝
Can. Cop. Corpo.	1½
Carlisle	‡.12
Cashboy	08
Con. Ariz. Sm.	1½
Con. Coppermines	6½
El Salvador	4
Goldfield Con.	18
Goldfield Merger	.04
Hecla Min.	5½
Howe Sound	4½
Jerome Verde	‡1⅛
Louisiana	‡¼
Magma	‡37½
Marsh	08
McKinley-Dar-Sa.	60
Milford	‡.75
Mother Lode	43
Nixon Nevada	22
Ohio Cop.	‡.50
Rawley	12½
Ray Hercules	2½
Richmond	1.50
Rochester Mines	19
Standard S. L.	½
Stewart	25
Success	04
Tonopah	3½
Tonopah Divide	8
Tonopah Ex.	2⅛
Tribullion	‡.25
Troy Arizona	‡.10
United Eastern	4½
United Verde Ext.	‡40½
United Zinc	‡.25
Utica Mines	‡.08

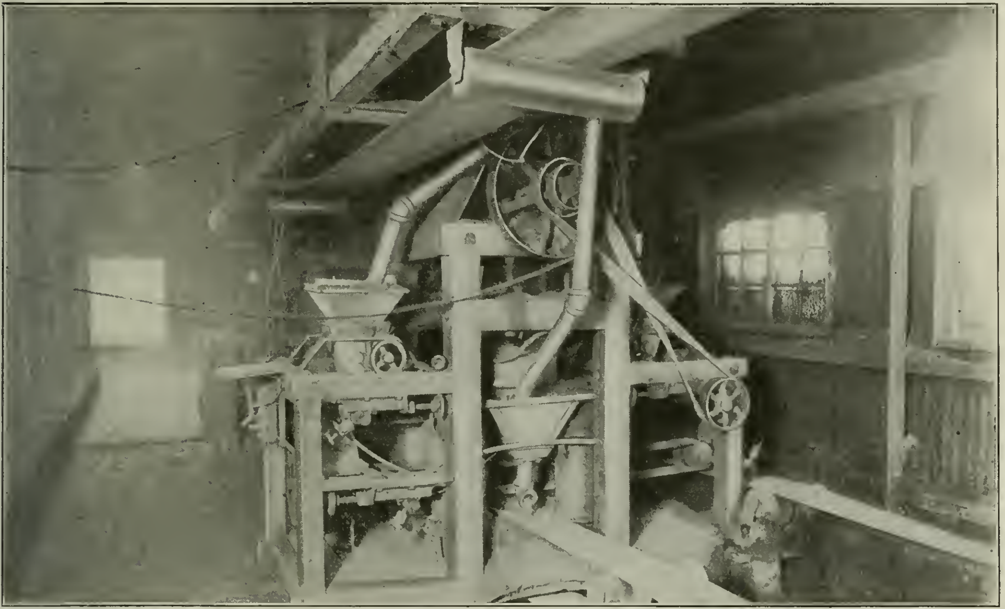
Toronto*	June 17
Adanac	15
Bailey	.03
Beaver Con.	40
Coniagas	2.50
Hargraves	02
Kerr Lake	5.75
La Rose	30
Lake Shore	1.00
Min. Corp. of Can.	1.50
Peterson Lake	.08
Teck-Hughes	.18
Temiskaming	37
Trethewey	37
Wettlaufer-Lor.	03
Davidson	‡.68
Dome Exten.	30
Dome Lake	18
Hollinger	6.50
McIntyre	1.42½
Newray	12½
Porcu. Crown	27
Vipond	20
West Dome	12

*Bid prices † Closing prices ‡ Last quotations

Engineering and Mining Journal

June 28, 1919

Volume 107 MILLING NUMBER *Number* 26



HIGH-INTENSITY MACHINE USED FOR CLEANING ZINC CONCENTRATES

The Roasting and Magnetic Separation Of Wisconsin Zinc Ores

By E. G. DEUTMAN*

The advisability of a thorough cleaning of concentrates or other mill products, with the objective of marketing the concentrates to better advantage, or of reducing freight rates by the elimination of nonvaluable material, merits the attention of the mill operator. A high degree of success has attended the separation of iron compounds from sphalerite or blende by a preliminary roast and the use of magnetic separators. The paper presents a concise description of a plant in the Wisconsin zinc field which is successfully handling zinc concentrates high in iron and which has been developed from practice.

IN THE Wisconsin field, the zinc blende is usually found associated with iron sulphide in the form of marcasite. This ore, after being concentrated at the mines, is sent to separating plants for further treatment by roasting and magnetic separation, inasmuch as the mixed blende and marcasite concentrate, owing to its high iron content, is not suitable for the zinc smelter.

Most of the roasting and magnetic separating are done by three companies, the Mineral Point Zinc Co., at Mineral Point; the National Zinc Separating Co., at Cuba City, and the Wisconsin Zinc Co., at New Diggings. There are other roasting and separating plants in the district—the Linden Zinc Co., at Linden, which company also has a plant at Cuba City; the Benton Roaster, at Benton, and the Mulcahy Roaster, at Shullsburg, operated by the Oliver Iron Mining Co. Each of the largest three plants has a capacity of 275 tons of ore per 24 hours, and their combined capacity can easily take care of the bulk of the Wisconsin zinc-field production.

---

*Superintendent, National Zinc Separating Co., Cuba City, Wisconsin.

The method of roasting ore at all of these plants is practically the same, inasmuch as each has a self-roasting seven-hearth furnace. The National plant uses a Wedge furnace, whereas the plants at Mineral Point and New Diggings have Skinner installations manufactured by the Western Chemical Manufacturing Co., of Denver, Colo. The treatment of the ores at the plants is so similar that the description given here in detail of the method used at the National plant, with which I am most familiar, will answer for all.

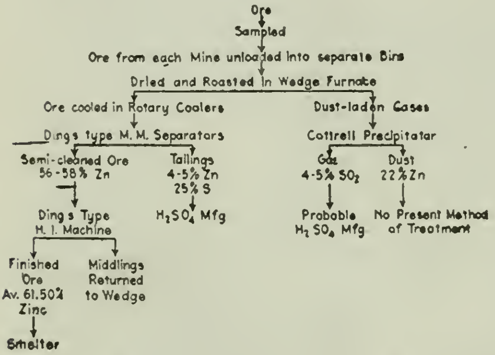

Ore
Sampled
Ore from each Mine unloaded into separate Bins
Dried and Roasted in Wedge Furnace
Ore cooled in Rotary Coolers
Dust-laden Gases
Dings type M. M. Separators
Cottrell Precipitator
Semi-cleaned Ore 56-58% Zn
Tailings 4-5% Zn 25% S
Gas 4-5% SO2
Dust 22% Zn
Dings Type H. I. Machine
H2SO4 Mfg
Probable H2SO4 Mfg
No Present Method of Treatment
Finished Ore Av. 61.50% Zinc
Middlings Returned to Wedge
Smelter

FIG. 1. FLOW-SHEET OF NATIONAL ZINC SEPARATING CO.'S PLANT

The ore as it is received at the roasting and magnetic separating plants from the mines varies greatly in composition, as shown in Table I. The general flow sheet of the National plant is given in Fig. 1.

TABLE I COMPOSITION OF CONCENTRATES SENT TO SEPARATING PLANTS

Mine	Zinc, Per Cent	Iron, Per Cent	Lead, Per Cent.	Lime, Per Cent.	Sulphur Per Cent
Yewdall	21.60	27.40	0.82	2.15	41.60
Martin	39.95	17.12	0.20	1.67	38.30
Jefferson	45.90	12.85	0.22	1.50	35.73

The ore is shipped to the National plant from the various mines of the district, which lie from a few miles to a distance of 25 miles. Shipments are made almost exclusively in box cars, although, in a few instances, where the mines are close to the plant, trucks and teams are used. As the National plant receives all of its ore in box cars, and also ships its finished products out in box cars, efforts are made to insure a maximum unloading and loading tonnage. The box cars are first set out with the side door opposite the green-ore storage elevator. The ore is then dragged out of the cars by means of a Clark single unloading shovel into the underground boot of the elevator, which, in turn, carries the ore to the top of the storage bins, where it is distributed into separate bins by means of a belt conveyor and an automatic tripper. A large tonnage can be handled by this method. Three men can unload at the rate of one ton per minute, which includes the time of weighing the cars in and out. In loading the finished ore, the ore is spouted from the finished-ore bins, which are immediately above the green-ore bins, into the side of the car, where it is stacked in the ends of the car by means of a portable belt conveyor.

The sampling of the cars as they are received is done by means of a green-ore gun, which consists of a 2-in. pipe about 3 ft. long. The roasted ore is sampled with a slotted gun, which consists of a 1-in. pipe 4 ft. long, with 1 x ⅜ in. slots 1 in. apart lengthwise on the pipe. The pipe is covered with a sheath when poked into the bed of ore. The sheath is pulled off when the gun is in position, allowing the ore to fall into the slots. As these methods of sampling are more or less standard in other districts, no further details will be given here.

ROASTING FURNACE

The roasting is done in a Wedge mechanical furnace, which has seven roasting hearths and a top drying hearth and is 22 ft. 6 in. in diameter and 24 ft. above the floor. The furnace consists of a cylindrical steel riveted shell incasing walls of red brick. The hearths are constructed of specially shaped fire brick and are made horizontal, each hearth, however, forming an arch above the one below.

The central shaft is made of riveted steel plate, being 5 ft. in diameter. The outside of the shaft is protected by special insulation and fire brick, which are attached to and revolve with it. The hollow shaft is open at top and bottom, and the natural draft of air through it keeps it sufficiently cool for workmen to enter at any time, thus giving free access to the rabble arms from the inside. The rabble arms are cast in one piece. They weigh 1200 lb. each, and are made hollow with a web horizontally through the center. The rear end is machined and fitted with pipes for air cooling, one pipe leading from the air manifold at the top of the shaft to the upper side of the median web, and the other leading to a manifold at the bottom of the shaft from the lower side of the median web. It is from the lower manifold that the heated air can be either increased into the furnace through the lower hearth, or let out into the furnace space by means of two 3-in. bleeder valves, depending on the condition of the roast. The rabble blades are fitted on the arms with rabble blade holders.

The ore is brought by a belt conveyor and elevator to two feeding hoppers at the top of the kiln, where it is fed to the kiln by two arms revolving at the rate of 90 sec. per revolution. These arms can be lengthened or shortened, depending on the desired tonnage to be fed. As the ore drops on the kiln it is stirred by the rabbles and gradually worked to the central shaft and there falls onto the first hearth; here the rabbles gradually work it outward in a spiral path to the periphery, where it falls onto the second hearth. On the first, third, fifth, and seventh hearths, the ore travels radially outward, and on the second, fourth, and sixth hearths it travels in the opposite direction. The roasted ore is discharged from the periphery of the lowest hearth into two rotary coolers.

With this type of furnace no outside fuel is necessary, as the ore is roasted by its own heat of combustion, the ore being heated up gradually on its downward passage in the furnace until it reaches the seventh hearth, where the maximum heat of about 900 to 1000° F. is reached. By maintaining this temperature with varying feed, 4 to 5% sulphur-dioxide gas, suitable for sulphuric-acid manufacture, is evolved, and tailings averaging 25% sulphur, suitable for further roasting for manufacturing sulphuric acid, are recovered from the magnetic separators. If the temperature becomes too high, the valves on the lower manifold are opened, and the air is allowed to escape into the furnace space, and if more heat is desired these valves are closed.

With this type of roasting furnace, the marcasite (FeS_2) in the ore receives a strong oxidizing roast, though the heat maintained is not sufficient to oxidize any of the blende. The marcasite particles are converted on the outside to the magnetic oxide of iron (Fe_3O_4), the cores of the particles remaining Fe_nS_{n+1} and, to some extent, unaltered FeS_2. During the roasting and separating, the lead and lime (CaO) content will also vary from the green to the finished ore.

The lead increases about 0.015% for every 0.1% contained in the ore. The lime (CaO), on the other hand, decreases about 0.012% for every 0.1% contained therein. This decrease is due to the fact that in the process of roasting partial decrepitation of the ore takes place, and the CaO, being lighter in gravity, has greater tendency to be carried in the flue dust than does the ore itself. Screen analyses before and after roasting are given in Table II.

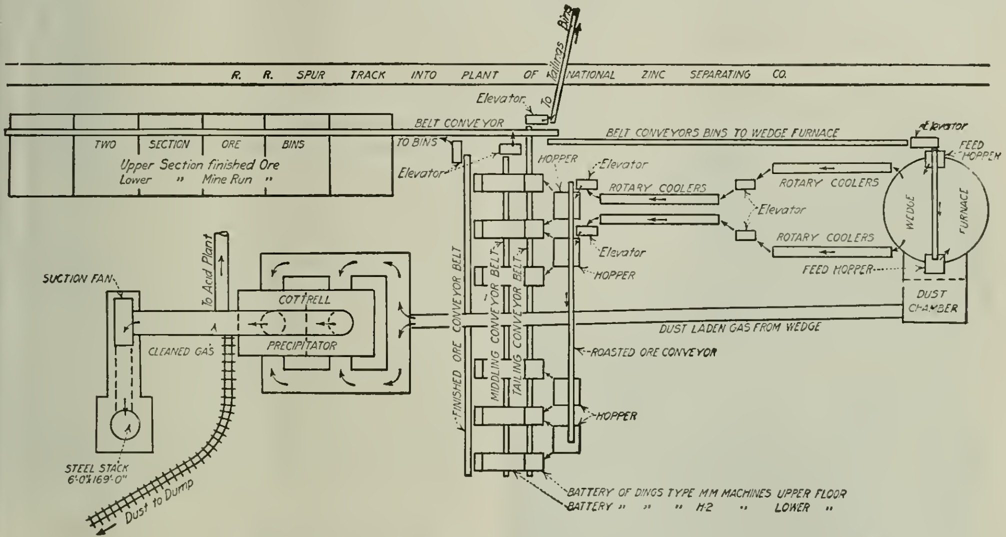


FIG. 2. PLAN OF NATIONAL ZINC SEPARATING CO.'S PLANT AT CUBA CITY, WISCONSIN

TABLE II. SCREEN ANALYSES BEFORE AND AFTER ROAST TREATMENT

Size:	Before, Per Cent.	After, Per Cent
On ½-in. mesh	0.20	0.10
On ¼-in. mesh	21.70	9.70
On 10-in. mesh	17.90	7.80
On 20-in. mesh	28.10	23.30
On 40-in. mesh	22.90	29.10
Through 40-in. mesh	9.20	30.00

The dust-laden gases pass out through the side of the furnace from the first hearth, being first led into a dust chamber, and then through a Cottrell precipitator, and are then discharged to the air through a stack 6 ft. in diameter and 170 ft. high.

The Cottrell precipitator consists of two units which are so arranged that either unit may be operated alone or in parallel with the other. At present each unit is being operated separately and alternately for periods of about two weeks. The precipitator is handling about 9000 cu.ft. of gas per min. at 290° F. and at a velocity of about 6 ft. per sec. The combined capacity is 18,000 cu.ft., per min. for the two units when operated in parallel.

Each unit is 9 ft. by 13 ft. 6 in. from the center line to center line of column supports, and has an over-all height from ground level to base of stack of 34 ft. 8 in. The dust-laden gases enter near the top of the bottom header from opposite sides. The gases flow around the pipes that extend 5 ft. into the bottom header and tend to heat these pipes equally. This causes the pipes to draw equally, and as a result an equal amount of gas tends to pass up through the pipes and is discharged at the top of the precipitator. The fines are collected on the walls of the pipes, or collecting electrodes, whence they drop or are shaken down into the receiving hopper at the bottom. The gases pass on upward into the gas-collecting headers at the top and then down through a suction fan into the steel stack.

The collecting electrodes, of which there are 36 in each unit, are pipes 12 in. inside diameter by 15 ft. long, made of No. 14 sheet steel. The high-tension current used in connection with the Cottrell is converted from 220 to 240 volts a. c. The electrical apparatus consists of a transformer, a switch board, a synchronous motor, and a mechanical rectifier. The rectified current used in connection with the precipitator is about 65,000 each unit, are pipes 12 in. inside diameter by 15 ft. long, made of No. 14 gage sheet steel. The high-tension current is transmitted to the precipitator by a line passing through the top of the electrical building to the caged housing at the top of the precipitator.

The dust recovered is about 95 to 97% of the total amount lost in the gases, and will approximate about 1.6% of the amount of ore roasted.

From the Wedge furnace the ore passes through four rotary cooling drums, revolving at 6 r.p.m. They are each 2 ft. inside diameter and 26 ft. long, and are made of $\frac{5}{16}$-in. riveted plate steel. The drums are water-cooled by means of a spray directly above them. No attempt is made to cool the ore completely, so that it is absolutely cold, as it has been found that roasted ore is not as magnetic when cold as when slightly warm to the hand. Each cooler requires about 30 gal. of water per min. to cool the ore to the proper temperature.

After cooling, the ore is ready for magnetic separation. It first passes over a rougher separator of the Dings Type M. M. machine. This machine occupies a floor space of about 4 x 10 ft. and has an extreme height of 83 in. The ore is received in a hopper at the upper end of the machine, which feeds it in an evenly regulated flow onto a vibrating conveyor or shaking table, actuated by two eccentrics on the driving shaft rotating at 450 r.p.m., causing the ore to travel through the zones of separation. The table is 21 in. wide by 7 ft. 10 in. long, is constructed of a maple framework with a ¼-in. pressed asbestos top, and is inclined at 4 in. per ft. The lower end of the table is 20 in. above the floor.

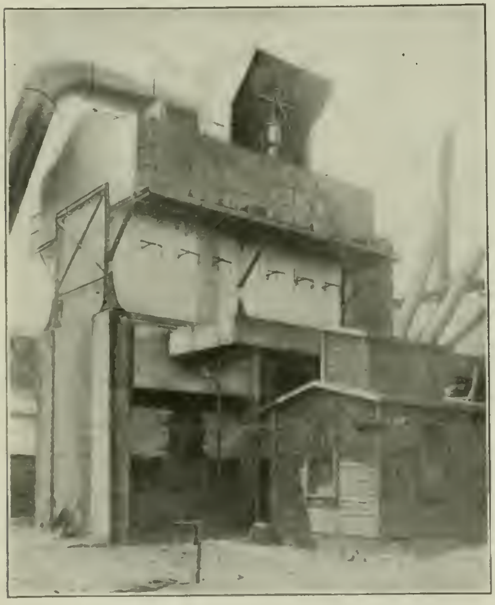


FIG 3 COTTRELL PRECIPITATOR HIGH-INTENSITY SEPARATOR

Above the tables are two sets of magnets placed in the same inclined position as the table. The first set, or rougher pair, are 5½ in. outside diameter by 20½ in. long and have a maximum current strength of about 2 amp. at 225 volts when heated to 100° F. The second pair, or semi-finisher coils, are 8¾ in. outside diameter by 19 in. long, having a maximum current strength of about 3 amp. when heated to 100° F. Under each pair of magnets are revolving bronze spiders 26 in. in diameter with 32 laminated electric steel secondary magnets set in the rims of the spiders about 1½ in. apart and held in place by brass keepers. The upper parts of these secondary magnets are U-shaped and are inductively energized by the lip of the pole pieces of the stationary magnets immediately above, which they embrace while over the conveyor. This close contact presents a large area of surface between the primary and secondary magnets, and reduces the magnetic resistance at this point to a minimum. The lower parts of these secondary magnets are set from ⅜ to ½ in. above the top of the asbestos table.

The magnetic iron sulphide, as it is picked out of the ore traveling down the table, is carried on a circular path out of the magnetic circuit to the neutral positions where the spider rims hang over the conveyor, and is dropped into hoppers made of non-magnetic sheet metal. It is then delivered by belt conveyor and elevator to a storage bin. The tailing or magnetic product thus made averages about 25% sulphur and 4 to 5% Zn. The semi-finished ore passes over the end of the table and down into a Dings separator of higher magnetic intensity, which is used to make the final or finished product. The ore, as it is delivered to the finishing machine, will average 56 to 58% Zn and 3 to 4% Fe. The capacity of this machine is about 60 tons per 24 hours.

The "finisher" magnetic separator is made by the Dings Electro-Magnetic Separator Co., of Milwaukee, and is known as the company's Type H. I. machine. It is 5 ft. 8 in. by 8 ft. 5 in. over all at the base and 7 ft. 4 in. in height. The feed is received at each end of the machine through a feed hopper, which discharges onto two 12-in. endless belts 6 ft. 8 in. long, moving at 70 ft. per min. toward the center of the machine between a magnetic and a revolving armature, which picks out any magnetic material (middlings) and carries it in circular path to the neutral positions, where it is dropped into hoppers at each side of the machine. The non-magnetic material (high-grade zinc blende) drops down into a small hopper under the revolving armature onto a 7-in. belt, which delivers it to the end of the separators. There are four magnetic coils, in series, under the revolving armature, 11½ in. outside diameter by 20 in. long, with 6-in. cores, and having the following current regulation at 225 volts:

	Amperes
Maximum current hot (100° F.)	15
Maximum current cold	19
Minimum current hot (100° F.)	7½
Minimum current cold	9

The armature which completes the magnetic field is made of solid steel, being 24 in. in diameter by 6 in. wide on a vertical shaft setting about ¾ in. to ⅞ in. above the pole pieces of the magnets. The weight of this armature and the downward pull are taken care of by a ball thrust bearing.

The capacity of this machine is from 40 to 45 tons per 24 hours.

POWER

The power is furnished by the Interstate Light and Power Co. of Galena, Ill., which place is 14 miles from Cuba City, Wis. It is transmitted to the National plant from the Cuba City substation by a 4000-volt a. c. service line. It is here transformed to 220- to 240-volt current. The direct current is made with a 100-hp. Westinghouse induction motor direct-connected to a 70-kw. Westinghouse generator. The power consump-

TABLE III KILOWATT-HOURS REQUIRED FOR 24-HOUR SERVICE

	Kilowatt-Hours per 24 Hours
Wedge furnace	315 00
Coolers, elevators, separators	655 00
Cottrell and stack fan	550 00
D.c. generator	855 00
Loading and unloading ore	250 00
Lights	175 00
Water for coolers	150 00
Total daily consumption	2,950 00

tion per 24 hours required for the treatment of 125 tons of ore per day is given in Table III.

COSTS PER TON OF GREEN ORE ROASTED, BASED ON A TONNAGE OF 125 TONS PER 24 HOURS

Roasting and separating:		
Labor	$0.70	
Power	.43	
Repairs and supplies	.15	
Total		$1.28
Ore receiving and shipping:		
Labor	$0.18	
Ore freight	.50	
Power	.05	
Repairs and supplies	.06	
Assaying	.12	
Total		.91
Cottrell electric precipitator:		
Labor	0.06	
Power	.11	
Repairs and supplies	.01	
Total		.18
General:		
Overhead	0.25	
Office expense	.20	
Insurance, taxes, etc	.01	
Workmen's compensation insurance	.01	
Freight and express	.03	
Experimental	.03	
Labor	.06	
Repairs and supplies	.04	
Total		.63
Total cost		$3.00

Costs

The accompanying table gives, in itemized form, the costs per ton of green ore roasted, based on a tonnage of 125 tons per 24 hours.

Accidents in Reduction Works

The following table, taken from Technical Paper 215, Bureau of Mines, shows the number of men employed, umber of days worked, and number of men killed and njured in ore-dressing plants in the United States durng 1917, comparison being made with related statistics or 1916:

ACCIDENT STATISTICS, ORE-DRESSING PLANTS

State	Men Employed	Days of Labor Performed	Average Days Active	Killed	Injured
labama	193	44,715	232	1	7
laska	467	139,960	300	3	141
rizona	2,630	803,567	306	6	578
rkansas	163	38,343	235	..	11
alifornia	755	271,800	360	..	30
olorado	1,715	514,500	300	7	214
eorgia	82	24,769	302	..	1
daho	642	179,238	279	..	62
linois	156	43,008	276	..	9
ansas	206	32,190	156	..	15
aryland	26	5,432	209	..	...
ichigan	2,426	752,874	310	2	88
innesota	337	80,703	239	..	40
issouri	1,523	392,225	258	2	175
ontana	2,051	605,705	295	6	148
evada	1,565	486,255	311	4	117
ew Jersey	537	165,308	308	2	257
ew Mexico	891	290,846	326	1	183
ew York	565	156,601	277	1	77
orth Carolina	46	11,285	245	..	14
klahoma	452	103,933	230	2	208
regon	97	23,637	244	..	6
ennsylvania	24	5,165	215	..	1
outh Dakota	250	87,475	350	..	23
ennessee	425	114,513	269	1	40
exas	100	29,330	293	..	6
tah	4,103	1,459,383	356	5	496
ermont	215	58,308	271	..	13
rginia	709	206,921	292	..	16
ashington	63	11,800	187	..	8
est Virginia	...	....	...	..	...
isconsin	247	64,011	259	3	150
her States	450	107,699	239	1	18
Total, 1917	24,111	7,311,499	303	47	2,952
Total, 1916	22,365	7,041,083	315	33	3,184

The figures relating to California were supplied by e Industrial Accident Commission of the State of alifornia. Those relating to Colorado were supplied Fred Carroll, the Commissioner of Mines, Denver, olorado.

Sorting and Washing Plant for Magnesite Ore*

The plant at the Hemet Magnesite mine, situated seven miles southwest of Hemet, Riverside County, Calif., was one of the few properties operating at full capacity after the almost complete shutdown which occurred recently in the magnesite-mining industry in California and Washington. Operations have been greatly curtailed within the last few weeks. A grade of magnesite is produced which is in great demand for plastic purposes.

Hand sorting is done on a 30 by 50 ft. belt conveyor, the material being evenly distributed on the belt by an 18-in. belt conveyor which runs directly under the sorting belt. The rejections from the sorting belt are run directly to the waste conveyor, which carries the material to the waste dump. The 12-in. conveyor takes the magnesite from the sorting plant to a Gilbert washing screen, where it is washed before going to the ore bin. The water after screening the magnesite is run to a Dorr thickener, where the solids are settled out and the clear water is again used. From the ore bin at the washer the magnesite is carried to the mill by a gravity surface tram.

From the 300-ton mill ore bin, the ore is fed to a Wheeling crusher, set at 1-in. opening. The material after passing the crusher is elevated to the feeder supplying the kiln, which is of the rotary type 6 by 60 ft., making one revolution per minute.

It takes the material about 45 min. to pass through the kiln, and at the end of the calcination the magnesite is a deep cherry red. After calcining, the material is discharged on a steel conveyor, which distributes it on the cooling floor.

Magnesite is hard to grind, and, even when cool, will cause the grinding mills to heat badly; hence the necessity of cooling the material after calcination.

From the cooling floor the material is passed over a magnetic separator to take out any iron before going to the grinders. The grinding is done in two stages. The coarse grinder is a steel plate mill which takes the 1-in. material and crushes it to about eight mesh. The fine crushers used are Sturtevant emery mills, which take the material at eight mesh and make 98% pass 100 mesh in one operation. From the grinders the material is elevated to the bin which supplies the packing department, where the material is all packed in barrels for shipment.

The whole plant is operated by electric power furnished from the lines of the Southern Sierra Power Co. All machinery and electrical equipment were furnished by Collins & Webb, Inc., of Los Angeles.

Zinc Production in Germany, according to the *Deutsche Allgemeine Zeitung* (republished in *Journ. Soc. Chem. Ind.*, Apr. 30, 1919), was approximately 280,000 metric tons during 1918. Imports were about 56,000 metric tons and exports were 105,000 metric tons. In 1913, Germany smelted 260,000 tons of foreign zinc ore and 541,000 tons of home ore, yielding 103,000 and 175,000 tons of zinc, respectively. At present, the home zinc production exceeds the demand, and, although the latter will increase after the signing of peace, there will be no immediate necessity of importing zinc ore or the finished material.

---

*Abstracted from *Mining and Oil Bulletin*, March, 1919.

Notes on Screening Practice

By JOHN BLAND*

A detailed analysis of the factors affecting the passage of grains of certain shapes and sizes through the apertures of a vibratory or stationary screen. Square-mesh and long-mesh screening are discussed, and the various methods of screen sizing in practice are described and classified. Examples of normal practice at a number of plants are also given. A description of cloth screening will be found of value to many engineers who have as yet not recognized the utility of non-metallic material for this purpose. A number of suggestive arguments are advanced in connection with screening practice and equipment.

"DIFFICULT" grains have been defined as those portions of the true undersize of a crushed ore which, in diameter, are nearest in size to the screen opening, but which fail to pass through the sieve. Grains have three diameters and differ from each other in shape rather than in size.

The various shapes of grains may be divided into three classes: (1) Those of three dimensions less than the square-mesh opening—cubical and roundish grains; (2) of two dimensions less and one greater than the square-mesh opening—conical, cylindrical, grains 20% narrower than the opening but 15% (and more) longer than the opening; (3) those of two dimensions greater and one dimension less than the square-mesh opening—tabular grains.

SQUARE-MESH AND LONG-MESH SCREENING

On square-mesh screening, the cubical and long grains are true undersize; on long mesh, all three classes are undersize; on square mesh, long grains only are "difficult"; on long mesh, tabular grains only are "difficult" to pass the aperture. The actual difference in character of undersize from the two meshes is inclusion of all cubical and some of the long grains through square mesh, as contrasted with inclusion of all of the cubical, all of the long, and some of the tabular grains through long mesh. The inclusion of tabular grains in undersize, along with cubical and long grains of far less mass, has a peculiar and an important place in both closed-circuit crushing and screen classification of sands before concentration—practically the whole ore-dressing fields; for there are few important gangue minerals which return a high proportion of tabular grains in crushing, although there are many concentrate grains which do so.

In making the difficult separation of wolframite (magnetic) from cassiterite (non-magnetic), efficiency depends on forming a minimum of grains below 1/3000 in. in size which are practically inseparable. In crushing through, say, 16 mesh, 30 to 60% of the wolframite will break into pieces five times as wide and long as they are thick. The average of the larger particles passing to undersize through long mesh will be five times as long, wide, and thick, or 125 times the mass, as compared to the same grains through the same opening width with square mesh. Quartz is of practically the same mass through either. Of course this represents hardly more than 20% of the total wolframite, and the actual approach in practice to this theoretical condition depends on close or complete screening, which is practically unknown in ore dressing. On a typical Portuguese mixed wolfram and tin ore, the percentage of WO_3 passing 1/2000-in. opening (electroplated 200-mesh screen cloth), after crushing through 1-mm. opening on long mesh, was only 22% of the amount of the same-sized grains that were obtained after crushing through 1-mm. square mesh.

THE CLASSIFICATION OF MICA MINERAL

As to table concentration, middlings are usually made up of a considerable proportion of flat grains, and these grains would have reported with gangue of but 1/20 to 1/125 of the mass had the mill feed been classified through long mesh. This classification enables one to arrive at a solution of the difficult problem of separating wolframite from garnets, detaining the high-grade concentrate required and insuring a high recovery at the same time.

The important exception to this empirical rule of long-mesh classifying of the greater mass of concentrate grain with smaller gangue is found in the recovery of mica. This suggests separation of mica in a clean product by screening only. At the Rare Minerals Co.'s mill at Custer, S. D., this is done in making roofing mica as a byproduct in the production of tin concentrate. Closed-circuit crushing through long mesh (punched plate) 1⅛ x ⅛ in. for preliminary jigging delivers the undersize to square-mesh (wire cloth) ¼ x ¼ in. All quartz, feldspar, and cassiterite passing the 1⅛ x ⅛ in. opening will also pass the ¼ x ¼ in. opening, whereas mica "flakes" greater than ¼ in. in breadth appear as a clean oversize. Undersize passes to long mesh ⅛ x 1/30 in., its undersize again to 1/20 x 1/20 in., from which mica is again taken as clean oversize. Oversize from ⅛ x 1/30 in. includes the true oversize through ⅛ x 1/30 in., for jigging; the undersize from 1/20 x 1/20 in. is further screen classified for tabling. Eighty per cent. of the mica content of the ore, a high percentage, is thus diverted for separate grinding fo roofing mica, which, at the "normal" price of $38 pe ton, is a considerable item.

This method of separation is applicable to graphit and other minerals. It was in working out this flo sheet that the comparative advantages of long mes were suggested. Long mesh makes practicable highe capacity and incomparably more accurate screening i the average operator's hands.

SYSTEMS OF SCREEN SIZING

There are, essentially, two systems of screen arrange ment for grading into multiple divisions. First, super imposed screens, the coarsest, as the top deck, gradin to the finest, at the bottom deck. Here the coarsest size are removed first, as oversize, the undersize droppin to the screen below to feed it. The second method i peculiarly distinct. All screens are in a single plan or deck, the feed reaching the finest screen first, th sizes being removed as undersize, and the oversize pro ucts moving forward to feed the successive screens. The coarsest size is removed last.

---

*Mining engineer, Englewood, South Dakota.

The second method is the one in use, for example, at the Carborundum Co.'s plant at Niagara Falls, N. Y., where accurate grading is essential. The first method has the advantage of slightly less screen-cloth wear, but chiefly in floor-space economy. On the other hand. screening in this system is usually inaccurate or incomplete. Strangely enough, though each system has its supporters, the underlying principle involved remains unascertained.

No attention is paid here to a possible third system, where screens are superimposed but staggered, zigzagged, end to end, forming a high, awkward, inaccessible and mechanically impossible arrangement for an actuated screen. Thomas A. Edison employed this system in his screen, which was, however, inert and not actuated.

THE PROBLEM OF "DIFFICULT" GRAINS

The principle applied in selecting a proper combination of the two systems involves action of the "difficult" grains. The reader is hereby warned. Obviously, minus 200-mesh grains will pass a 16-mesh screen instantly. The extended screen cloth length is used to insure the passage of the "difficult" grains. Where ordinary grains drop to the screen below in the first, or superimposed, system, "difficult" grains pass over but a fraction of the lower screen. If these grains are true oversize on this screen, well and good; but if some of them are true undersize, they have only a part of their screen length to traverse, and they are the grains which must have the full screen length to insure passage. For they were "difficult" grains on the screen above and will be more "difficult" on the screen below, which has smaller apertures.

Under conditions in which the difference in successive screen openings is so small that the "difficult" grains on any screen will be true undersize on the next smaller screen opening, screens may not be superimposed. For example, such differences as between 30 and 60 mesh may be too small on some materials, but great enough on others, depending on the amount of "difficult" (long) grains present. Briefly, screens may be superimposed where the "difficult" grains are true oversize on the next smaller screen opening.

MODERN SCREEN STRATIFIES PULP BED

The second method calls for a screen machine as many times longer than the machine for the first method as there are screen sizes. A combination of the two methods should embody the compactness of the first with the accuracy of the second. This may be done in varying degrees, depending on closeness of sizes and character of material. The presumption that the second method is objectionable because of deep pulp bed on all screens is not important, because the modern vibratory screen stratifies any depth of pulp bed instantly, offering unobstructed opportunity for passage of undersize. In combining the two systems, the "difficult" grains on each screen are selected. This may be done by incomplete screening or by taking those grains passing last and with difficulty, and testing them on the successive screen sizes to determine which contain true undersize.

In classifying with 12, 16, 22, 30, 40, and 80 mesh, for example, if "difficult" grains on 16 mesh contain little undersize on 30 mesh, and 30 and 80 mesh the same, the arrangement shown in Fig. 4 is sound.

If a series such as 10 and 30 and 30 and 80 mesh are too close, then the arrangement shown in Fig. 5 is tested. If the screen feed carries a high proportion of minus 18-mesh grains, the arrangement shown in Fig. 6 is best.

It may be found that "difficult" grains on 22 mesh may contain true undersize on 40 mesh, but this is fully compensated by using a double-length 40-mesh screen. The 80-mesh screen is tripple length, to accommodate the forward movement of "difficult" grains on 40 mesh, and to give opportunity for excess quantity of minus 80-mesh grains.

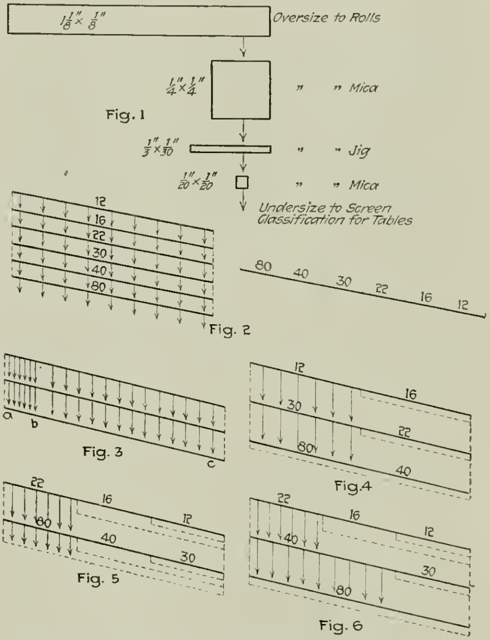


FIG. 1. MICA SCREENING DIAGRAM
Strong vibration used to toss mica, to get endwise engagement with slots

FIG. 2. COMPARISON OF SCREENING METHODS
In the superimposed method, the undersizes drop as shown by arrows. The oversizes report at ends of decks as finished products

FIG. 3. SCREENING DIAGRAM
a—b = non-difficult grains
b—c = difficult grains

FIG. 4. MULTIPLE SCREENING DIAGRAM
Undersizes on 12 and 30 drop to screens below. Undersizes on 16, 22, 40 and 80 are finished products

FIG. 5. MULTIPLE SCREENING DIAGRAM
Undersizes from 22 drop to 80. All other undersizes are finished products

FIG. 6. MULTIPLE SCREENING DIAGRAM
Preferable arrangement when screen feed carries high proportion of 18-mesh grains

In practice, the third method is usually employed, excepting in the few cases where certain grains blind the screen cloth excessively (as with zinc dusts and aloxite), in which a single and accessible deck is used. High-frequency vibration has, however, eliminated blinding to a great extent.

Screen classification before tabling is considered by many metallurgists as being highly desirable in theory, but seldom acceptable in practice. Failure in practice is due chiefly to the mill man's instinctive belief that screening is a simple operation which deserves minor attention, with the result that accurate or efficient screening is seldom or never attained in practical ore-dressing work.

Tests for screening before tabling to determine such factors as increased efficiency, cost of equipment, and mechanical replacement can be readily and inexpensively made. At the Custer Peak Copper Co.'s mine, at Deadwood, S. D., a complete testing plant was built in five days and at a cost of less than $700. A platform, 30 x 30 ft., innocent of roof or sides, a small automobile, an improvised friction drive, a 3 x 4 ft. high-frequency vibratory screen, a 10-in. "coffee pot" grinder, a small crusher, a Wilfley table, and a 4 x 6 ft. tank completed the plant. Mine water was used. The table and crusher were borrowed, and 15 screen-cloth sizes, each 3 x 4 ft., were used. These screens, in metal, would have cost upward of $200, but cotton cloths were used, and only $13.65 was expended. Such cloths are more readily and quickly procurable than is metal cloth, are sufficiently uniformly woven, and will outlast the most protracted test. Supporting screens of light-wire 6-mesh cloth are used, and the cotton cloth is fastened on with tacks and is readily removable. Damp ore (as mined) was screened through the 1/200-in. opening cloth at a rate of 1½ tons per hour. Let me guide the inexperienced shopper so that he may not become discouraged by calling on a merchandise salesman to give him so many "meshes" instead of "price per yard" and so many "yards wide."

TYPES OF CLOTH SCREENING

For 8 to 30 mesh call for "scrim" (curtain cloth); 16 to 40 mesh, "tarlatan" (cheesecloth?); 30 to 50 mesh, "marquisette" (I pass here); 40 to 100 mesh, "voile" (waist material); 60 to 150 mesh, "batiste" (for nightgowns—I pray I may be right); for opening 1/200 to 1/450 in., gingham. The foregoing are cotton cloths. For openings from 1/400 to 1/700 in., taffeta or china silks, irregular, but often serviceable, weaves. Use a linen counting glass (procurable at merchandise stores) to count the meshes and compare width of thread with width of opening to compute the size of the opening. The accuracy of results and ease of manipulation by adopting this method are surprising. In general, the higher the price, the smaller and more even the weave in each class. This shopping guide should transform a terrifying ordeal into a recreation—perhaps a delightful one if the right salesperson is encountered, and particularly so if one has just interviewed a few of the gentry who sell serviceable sand pumps!

That the statement may be heeded that screen classification has lost in competition with hydraulic classification because screens actually will not classify closely when ordinary methods are adopted, a report of efficiency in screening abrasives is given. At the Carborundum Co.'s plant, aloxite which had been screened on regular machines through 32 mesh and on 24 mesh was tested with laboratory screening and found to contain 45% through 30 mesh, and 10% through 40 mesh. And this occurred at a plant where accurate screening is religion! The vibratory screen in use in the majority of modern ore-dressing mills screens so inaccurately in this plant that it will not serve even as a closed-circuit screen, but is acceptable to these masters of screening only as a rougher preceding a closed-circuit trommel.

Couple these facts and realize how inaccurate is screening practice in ore-dressing mills. May it not be that screen classification is unpopular not because so much less satisfactory from the mechanical point of view than hydraulic classification, but because it is less accurate?

PRINCIPLES OF THE VIBRATORY SCREEN

The vibratory screen must be adjustable as to inclination and vibration amplitude; and its screen surface should be easily replaceable. That decreasing amplitude may be obtained as the discharged end is approached, vibration must be true-wire vibration, so that the amplitude varies according to screen-cloth tension.

The all-important factor is adjustability of vibration amplitude. The report of inaccuracy at the Carborundum plant is well founded, but the difficulty is not inherent in the vibratory screen. Amplitude must be controlled so that undersize does not "jump" at any point on the screen. The type of screen referred to has no means of controlling the vibration amplitude—a principle that was discovered accidentally. A hand screen (30 mesh) bearing unscreened aloxite was held against a strongly vibrating upright hickory spring, with the result that "jumping" of the grains, from 1 in. to 3 in., occurred. This was continued until no more undersize passed—until screening was complete. The screen was then removed and shaken quietly. A cloud of undersize dropped. There is no explanation other than that "difficult" grains do not pass when "jumped." Additional tests proved this assumption.

VIBRATORY SCREEN CLASSIFICATION

Herein lies the true explanation of why certain inclined vibrating screens will deliver a 40-mesh product from a 20-mesh screen. Screening is incomplete, and "difficult" grains are not passed; for it will be found that, whereas the oversize does contain 40-mesh grains, the undersize, unfortunately, includes 20-mesh grains! The belief that an inclined screen offers the horizontal projection of its opening, and not the actual opening, has been found true to the limited extent that an angle of 35° effects a decrease of less than 10% of the opening.

At the Carborundum plant the tests were made with a vibratory machine, which, luckily, could be controlled to any degree of vibration amplitude. The following tests show the importance of this control. "Contamination" refers to the percentage of oversize found to pass a 30-mesh screen with an opening of 0.0230 in. The vibratory screen was 2 ft. 6 in. long; the trommel was 8 ft. long.

TABLE I. TESTS MADE WITH TROMMEL AND VIBRATORY SCREEN WITH ALOXITE ON 24-MESH, OPENING 0.0287 INCH

	Contamination, Per Cent.
(1) Trommel	13
(2) Vibratory screen at 32° inclination	
With heavy vibration	34
With light vibration	6
(3) At 20° inclination	
With heavy vibration	26
With light vibration	3

Sand remained on the screen longer at 20° inclination and with a heavy vibration than at 32° inclination with a light vibration, thus demonstrating that increased efficiency is due to the grains "hugging" the screen, and not to the fact that a longer time was allowed with a comparatively greater number of chances to pass through.

The percentage of "contamination" is less in this instance than referred to in regard to screening "through 22 on 24 mesh." "Contamination" varies with the quantity of "difficult" grains in the feed. Material which passes 22 and rests on 24 has obviously a high percentage of "difficult" grains. Screening efficiency cannot be properly expressed in terms of percentage with differing feeds. Equally good work may give 10% "contamination" with one feed and 60% with another. It is for this reason that the mixing of different grades of sands for the purpose of making comparison runs must be done carefully and completely.

Many know that the stationary inclined screen is more accurate that the vibrated screen. This is explained by the fact that "jumping" occurs with the latter type. The vibratory screen must be controlled so that the advantages of freedom from blinding and increased range of vibration are secured, and at the same time the accuracy of the stationary screen is retained.

It must be understood that true oversize, but not undersize, may be "jumped." In screening fireclay through 80 mesh, the oversize will "jump" vigorously and traverse the screen in one-tenth the time required by the undersize, which "hugs" it. The screening action of the high-efficiency vibratory screen on fine materials such as damp quartz through 1/250-in. opening, zinc dust through 1/450-in. opening, and fireclay through 1/125-in. opening may be hundreds of times better than with a stationary inclined screen, but the capacity may be no greater on dry materials through three mesh and coarser. With coarse sands, the blinding action is reduced by the adoption of vibratory screens.

The accompanying table gives rough approximations of tonnage, conditions for screening, and other factors:

TABLE II. SCREENING FACTORS

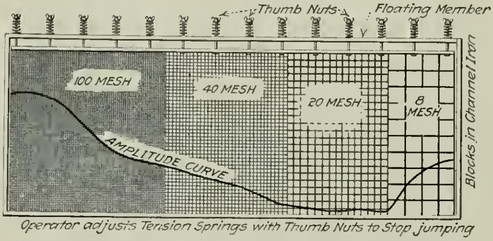
	Dry Quartz Mesh					Damp Quartz Mesh				
	8	20	40	100	200	8	20	40	100	200
Vibration amplitude (per cent. of normal maximum)....	20	5	10	30	40	30	15	40	80	100
Inclination ratio (fall to advance).......	2:1	2:1	1.8:1	1.6:1	1.4:1	2:1	2:1	2:1	1.8:1	1.6:1
Screen cloth length (inches)..........	14	20	24	30	36	20	24	30	38	50
Capacity, lb. undersize per hour per square foot screen area.............	500	350	250	120	60	400	300	200	80	20?

Control of vibration involves (1) control of screen-cloth tension, and (2) control of vibration amplitude through the control of the actuating mechanism.

THE "JUMPING" OF PARTICLES

Where multiple sizes are produced in a single machine, each size will require a different vibration length. Again, where a single size is produced, the heavy bed at the feed end of the screen will require heavy vibration, so heavy, in fact, that the light bed nearing the discharge end will be "jumped," thus preventing the passage of "difficult" grains. Therefore, although the actuating motion may be under control, the vibration amplitude delivered will be the same at all screen areas, as each area requires a different amplitude. This apparently difficult problem is solved by the use of tension springs, which hold the screen cloth under the required tension, the vibration amplitude varying with the screen tension. Once adjusted, the adjustment stays. This type of control is applicable to true vibration only; the impact screen, hammer-action vibrated screens, and similar apparatus do not respond.

In the vibratory screen vibratory amplitude must not only be controllable, but easily and unchangeably controllable. Where high capacity and freedom from blinding are not important, a shaking screen, if properly designed to run smoothly, will take little head-room. On materials which are dry, but which tend to form into aggregations of small particles on screenings on 80 mesh and finer, the trommel has its place. However, a vibratory screen, with a simple brush arrangement, will doubtless be developed to meet this difficult problem. These aggregations are formed only when grains smaller than 1/2000 in. are present. For example: aloxite, crushed 72 hours in a ball mill without discharge, is all but unscreenable on 1/200-in. opening, whereas the same material, with but 20% removed—as sands in suspension—will screen rapidly. In fact the high-frequency vibratory screen will screen even damp sand through 1/200-in. opening at a rate comparable with, say, 16-mesh screening. The forces responsible for formation of these aggregations of small particles have not been identified. Moisture plays but an unimportant part.



AMPLITUDE CURVE WITH DIFFERENT SCREENINGS

HYDRAULIC VS. SCREEN CLASSIFICATION

With regard to screen vs. water classification, it would appear as if too much theory had beclouded the discussion. The obvious advantages of classifying large pieces of gangue with smaller concentrate grain have led speculative thought far from the true issue involved —the separation of minerals of little difference in specific gravity. For, where there is little difference in specific gravity, water classification will not result in the inclusion of larger gangue particles with the smaller concentrate grains. Water classification is a direct competitor with screening, and the choice will fall to the one which will effect the sizing the most accurately.

If grains differ widely in specific gravity, their separation on a modern table occurs regardless of classification. However, Richards gives as his latest report on tests of efficiency of hydraulic and screen sizing grains, differing widely in specific gravity, the following:

TABLE III. DISTRIBUTION OF VALUABLE MATERIAL IN CONCENTRATES, MIDDLINGS, AND TAILINGS

Feed	Per Cent. of Valuable Material in Concentrates	Per Cent. of Valuable Material in Middlings	Per Cent. of Valuable Material in Tailings
Sized..............	95	4.5	0.5
Classified...........	83	9.0	7.0
Natural............	39	54.0	7.0

These data are taken from the *Journal* of May 18, 1918, p. 910, "Dry Sizing as a Means of Preparing Feed for Concentration," by George V. Bland.

Stripped of theory, the question is as to which system of classification is the best for the separation of minerals of little difference in specific gravity. These fall into two classes: those of free minerals, as fluorspar and quartz; and those of included grain, as cassiterite (sp.gr. 7.0) and cassiterite attached to quartz (sp.gr., say, 3.9). The separation of true middling from tailing makes separate grinding and treatment of middling products possible, and in many cases permits the rejection of the tailing without regrinding.

A recent type of vibratory screen is capable of an output of 10 tons per hour per machine, which makes four products, 24, 30, 40, and 50 mesh. The finest screening—to prepare slime table feed as 1/200-in. undersize—is done at the rate of 4 tons per hour on a single machine with sands dampened to prevent dusting.

BOULDER COUNTY TUNGSTEN MILLING PRACTICE

Screen sizing of ore before concentration is common, but screen sizing after concentration is not. At the Crescent, Colorado, mill of the Primos Exploration Co., a high-frequency vibratory screen was devised, and has been used continuously to screen canvas-table concentrates on 1/700-in. opening. The concentrate before screening assayed 18% WO_3; and, after screening, the undersize through 1/700 in. assayed 40%, the oversize (8% WO_3) being re-tabled without loss, fines not being present in that material. The fines could not be re-tabled, as the grains were too small to settle from suspension on the reciprocating table. This operation increased the net value of the concentrate from $175 to $325 per ton.

Boulder County tungsten practice has been reported as the highest development of the ore-dresser's art. Certainly no expense or complication as to equipment has been omitted. The high value of the crude ore and concentrate and, more particularly, the high penalty for imperfect concentrate, justified a great effort to achieve perfection.

I had the good fortune to become familiar with practice in all the important mills—at research work for the Primos Co. in its two mills, and, later, at screen-machine installations in three other important mills. Crushing methods are uniform in all the mills, but nothing else is. A notable innovation was jigging, to recover true middling in large sizes for separate treatment. This was treated with the coarse-sand table middling, and the procedure consisted of multiple-stage reduction, with intermediate tabling after close-screen sizing.

Slimes-recovery equipment was varied. The account of a system of screen analysis which was used to determine the comparative efficiency of the recovery of slime will serve to indicate the methods in use. With a given ore, the comparative efficiency of a slime-recovery method varies as the fineness of the grains recovered. A quick and wholly satisfactory method of determining the percentage of extremely small grains recovered is by means of the use of electroplated 200-mesh screen cloth (using a special combination of two metals) to obtain a screen of opening of 1/2000 in. and smaller. The procedure is to take a sample of definite weight of dry concentrate, which is screened with a sieve with 1/2000-in. openings. The screen should be "knocked" against a firm wooden member 500 times, with frequent brushing.

The comparative efficiency can be calculated from the weight of the undersize. For example: in one mill no concentrate was produced which would pass this aperture. No concentrating device was found which would report more than 20% through this opening, excepting canvas tables, which recovered 60% of the concentrate as grains smaller than the opening. Later, using thick pulp, on No. 3 Deister slimer and Deister Simplex slimer, grains as small as those from canvas tables were recovered in the form of a low-grade (20% WO_3) middling. This middling was made up of small ferberite and larger quartz, and responded to the same treatment as canvas concentrate—screening through 1/700-in. opening, sacking of undersize, and re-tabling of oversize.

With the modern slime table, fine concentrate grains are found associated with larger gangue grains. The largest concentrate grains ride the highest on the table. If this were true in the case of the riffled coarse-sand table (and it is not), how absurd would be the theory that large grains should be classified with small concentrate grains! If screen classification of sands be used for table preparation, special riffling and cross-wash conditions should be used to approach the action on slime tables.

Screen analyses on 1/2000-in. aperture were used to determine optimum pulp dilution as shown in Table IV.

TABLE IV. DATA OF OPERATION OF NO 3 DEISTER SLIME TABLE WITH MINUS 200-MESH FEED

Pulp Dilution (H_2O to Sand by Weight)	Per Cent. of Concentrate Passing 1/2000" Opening	Grade Concentrate Per Cent. WO_3	Feed Rate (Lb. per Hour)
2.5:1	40.2	61	200
3:1	34 0	59	325
4:1	21 0	62	425
5:1	18 0	58	600
6:1	6.4	63	800
8:1	7.0	64	400
10:1	4.5	61	800
12:1	0.00	63	400
15:1	0.00	59	1000

The recovery of smaller grains in using a thick pulp has been explained by assuming that grains will stratify in a pulp which is thicker than may be required to pass them into suspension. Once on the deck, where agitation is far less than in the shear zone above, the smaller grains will progress into the concentrate (or middling). A future line of progress in gravity concentration may be suggested. Slime-table feed should be thicker than is obtainable with continuous thickeners. The manager of one of the New Jersey Zinc Company plants tells me that it is impossible to make a separation of slime unless it is fed dry to the table.

If dry preparation is found desirable, elephantine thickeners, which are utilized to get rid of water (which should never have been admitted to the flow), will not be used. True middlings will be separable from tailings, thus reducing the amount of coarse sands to be reground when fed dry. With the amount of water added under strict control, constant conditions of pulp are possible. With other conditions unvarying, a constant degree of pulp dilution will enable a clean cut to be made between minerals or middlings of little difference in specific gravity. As is well known, the difficulty of this separation lies chiefly in making this cut sufficiently close in maintaining a concentrate delivery at a given point.

Thick pulp on the slime table decreases capacity. A compensating factor is that only one-quarter of the deck is used, making the use of a light, compact deck possible, and multiple superimposed decks practicable. A major objection to dry preparation is that no efficient dry grinder is available. Again, fine screens are not durable. However, electroplating of fine-mesh screens serves to increase wire size and surface resistance to abrasion. Such screens are brittle and are not practicable for use on most types of screen machines.

The Arizona Hercules Copper Company's Plant

THE Arizona Hercules power plant and mill are at Hercules, Ariz., about half a mile from the Gila River and Kelvin, and 5½ miles from Ray, where the mine is situated. The water supply for Hercules townsite, power plant, and mill is obtained from shallow wells along the south banks of the Gila River. It is pumped to supply tanks through a 12-in. redwood pipe line by means of one 500 to 1000 gal. per min., two-speed, Scranton quintuplex pump.

The power plant was installed by the McIntosh & Seymour Corporation, and consists of three of that company's 1045-hp., 164-r.p.m., 6-cylinder, 4-cycle, Diesel engines, burning 14-gravity fuel oil in summer months and 24-gravity oil in winter. These engines are direct-connected to General Electric Co. 720-kw., 0.8 power factor, 2200-volt, 3-phase, 60-cycle generators, with direct-connected exciters. The first Diesel was started in April, 1918, the second in June, 1918, and the third in August, 1918. The fourth engine foundation is in place.

Power at 2200 volts is transmitted to the mill and pumping plant over a steel pole line. The power for the mine at Ray is stepped up in the power house to 44,000 volts through Wagner transformers, and transmitted over a steel pole line to the mine, where it is stepped down to the required distributing voltages. The load at the mine averages approximately 500 kw., with a hoisting peak of approximately 900 kw. The mill load is steady, amounting to approximately 460 kw. for each of the three mill sections installed.

GENERAL VIEW OF MINE PLANT

LACK OF POWER HAS HAMPERED OUTPUT

The output of the mine and mill to date has been considerably hampered because of lack of power, caused by the experimentation necessary with this size of Diesel engine. One of the principal difficulties encountered has been in connection with the governor and camshaft gear, due to heating and cutting, caused by endeavoring to run the engines to their rated speed of 164 r.p.m., which speed it has not been practicable to maintain, the critical point averaging approximately 158 r.p.m. The air compressors are three stage, direct-connected to each engine; and some difficulty has been experienced by failure of the rings in the high-pressure cylinders, owing to valve troubles and improper lubrication.

Incorrect temperature of cooling water in the main cylinders has resulted in several scored pistons, that have resulted through uneven expansion of piston and liner. This trouble has been overcome to a great extent by increasing the cooling water temperature with the increase of the load. The original pistons have recently been replaced, by the manufacturer, with a new type having a heavier head, which was found necessary on account of the old heads cracking. The fuel consumption averages approximately 1 gal. of fuel oil per 13 kw.-hr. at full load.

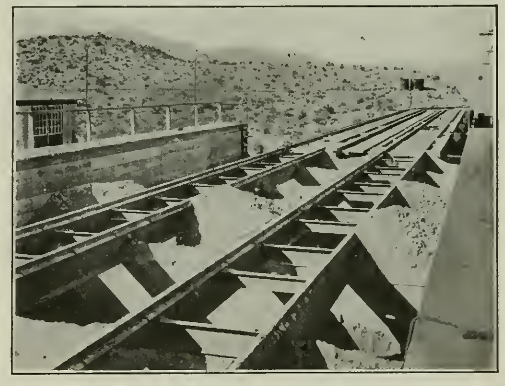


FIG. 1. TOP OF MILL ORE BIN

Auxiliary equipment in the power plant consists of four centrifugal cooling-water pumps, two for the Diesel engines and two for the cooling pond; and one 23-cu.ft., 1200-lb. air compressor, belted to a gasoline engine, for emergency purposes, in case the starting air is lost in the starting bottles. No water-softening apparatus is used, as the cooling water contains only a small amount of solids. The switchboard, which was installed by the

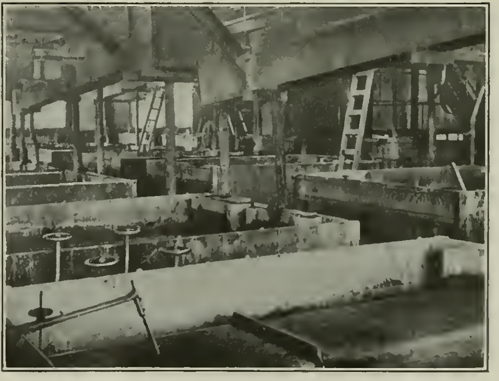


FIG. 2. PORTION OF FLOTATION FLOOR, SHOWING CALLOW CELLS

General Electric Co., consists of four exciter panels, four generator panels, and five distributing panels, equipped with Terrill regulators, and is in every way up to date.

With the installation of another generating unit, the present power shortage may be overcome. With only two Diesels in operation, full operating power demand cannot be met. C. V. Ross is chief engineer.

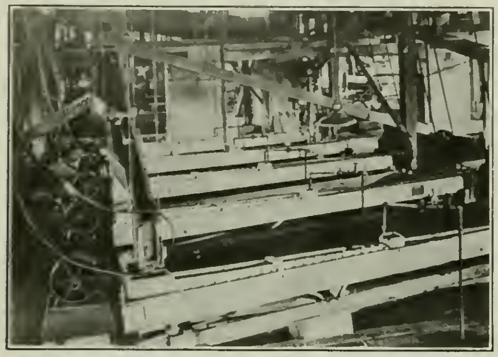


FIG. 3. PORTION OF THE TABLE FLOOR

The mill, consisting of three individual units of rated capacity of 400 tons each, was designed and built by Bradley, Bruff & Labarthe, engineers, of San Francisco, according to the flow sheet developed and drawn up by J. M. Callow, who was metallurgical engineer. The original flow sheet was that shown in Fig. 7.

The coarse-crushing plant and crude-ore sampling mill are at Ray, and consist of the following equipment: One Gates No. 8 gyratory crusher; one 54 x 20 in. Type AA Traylor roll: one rotary feeder, with Reeves speed changer, all of which are operated with a 150-hp. electric motor. The ore is taken from the mine ore pocket with a 5-ton skip, dumping into a 300-ton ore bin, and then fed to the crusher by an 8-ft. diameter rotary feeder, driven with a worm gear and controlled with a Reeves speed changer, Size 0, Style D. The ore leaving the feeder passes over grizzlies, which take the fine ore and leave the coarse to go through the crusher, which crushes to 3-in. mesh. The ore from the crusher passes over another set of grizzlies. The fines pass to the conveyor and the coarse passes to the rolls, the ore leaving the rolls direct to the conveyor being at an average of 1½-in. mesh.

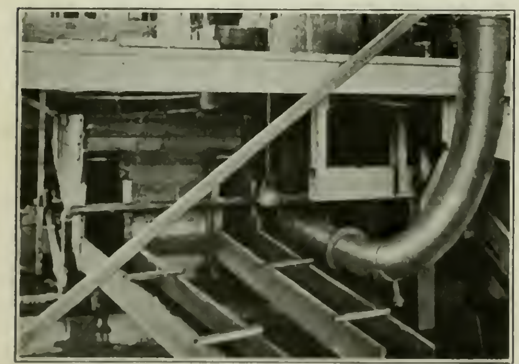


FIG 4 BELOW FLOTATION CELL FLOOR, SHOWING LOWERED CLEANER CELLS. THESE CELLS ARE EQUIPPED WITH CONCRETE FILTER BOTTOMS

The plant is able to handle 1200 tons in eight hours. A 30-in. belt conveyor, 300 ft. long, carries the ore from the rough-crushing plant to the sampling mill. The discharge from the conveyor is cut by an automatic, three-speed cutting device. Cuts can be made every 24, 32, or 48 seconds, making a full cut across the face of the discharge. The full discharge of the cut passes through a 10 x 7 in. Blake crusher; from there through a 16 x 10 in. Sturtevant roll, and then to the cutter, which cuts 4 to 1. The cutter rejects back to the ore bin, the remainder going to the finishing rolls, from which it again passes through the cutters, cutting 4 to 1, leaving the sample an average size of ¼ in. The full discharge from the conveyor empties onto the ore-bin conveyor, a 36-in. belt running the full length of the bin, 125 ft., and distributing through a self-propelling, reversing tipper into a 5000-ton capacity ore bin.

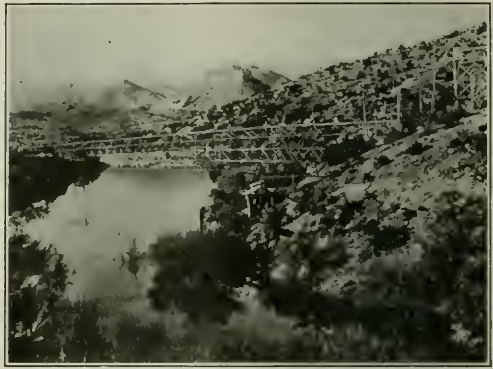


FIG. 5. TAILINGS POND

The ore is transported to the mill, a distance of 5½ miles, via the Ray & Gila Valley R.R., for 3¼ miles to Hercules Junction and thence over the tracks of the Arizona Hercules Copper Co. for 2¼ miles, in cars of 60-ton capacity, and dumped into the mill bin of 2000-ton capacity, for three mill sections.

During the first few months the mill was in operation, the character of ore treated was practically constant, the mineral being mainly in the form of chalcopyrite, with a small amount of chalcocite and a trace of native copper in a gangue composed principally of heavy green diabase. As the orebodies in the mine were opened up, the total copper content gradually increased, until at present the mill heads contain between 2.0 and 2.5% total copper, the greater proportion being in the chalcopyrite and chalcocite, with some native copper and copper oxide, the gangue consisting of granite porphyry, diabase schist, and talc.

The first section of the mill was placed in operation on Aug. 12, 1918; the second section soon thereafter, and the third section about the middle of September, 1918. The original flow sheet was as follows: For each section the ore was drawn from the mill bin by means of six roll-type feeders and conveyed over a Merrick automatic conveyor scale to one 8 x 6 ft. Marcy ball mill, which is operated in closed circuit with one 6 x 22 ft. duplex Dorr classifier and is crushed approximately 90% through 48 mesh. The head sample was cut there with an Anaconda-type sampler, cutting every two minutes. This product was elevated by means of a 16-in. bucket elevator to eight 2 x 8 ft. standard Callow flotation cells operated in parallel. The tailings from these sells flowed by gravity to one 4 ft. 6 in. x 14 ft. 8 in. standard duplex Dorr classifier. The slime overflow from this classifier was returned by means of a 4-in. Krogh sand pump to four standard Callow cells in parallel. The tailings from these secondary cells went to a 10 x 40 ft. Dorr thickener, where clear overflow water was recovered and returned to the mill-water supply tank. The tailing discharge from this tank was sampled with an Anaconda-type sampler, cutting every two minutes.

The concentrates from all 12 Callow cells were elevated with two 10-in. bucket elevators to two standard cleaner cells, making a finished flotation concentrate. The cleaner tailings were returned to the main-feed elevator. The sand product from the 4 ft. 6 in. x 14 ft. 8 in. Duplex classifier was distributed to four primary Deister-Overstrom sand tables, from which a rougher concentrate was made and elevated by means of a 6-in. bucket elevator to one Diester-Overstrom finishing table, producing a finished copper concentrate and a middling tailing, which flowed to a simplex Dorr classifier, operated in closed circuit with a 6 ft. x 22 in. Hardinge ball mill. The reground overflow product was returned to the main feed elevator. The tailings from the primary tables joined the flotation tailings ahead of the 10 x 40 ft. Dorr thickener.

The concentrates from the finishing table were elevated by means of two 6-in. bucket elevators, accommodating three sections, and were combined with the flotation concentrates. The combined concentrates passed through an Anaconda-type sampler, cutting every two minutes, to size 24 x 16 ft. intermittent-type settling tanks, accommodating three units. The thickened product from these tanks flowed to one 24 x 12-ft. storage tank equipped with rabbles, and was elevated from this tank by means of a 10-in. bucket elevator to three 12 x 8 ft. standard Oliver vacuum filters. The filtered product was conveyed direct to railroad cars by means of three 16-in. belt conveyors.

To improve the operating efficiency of the plant, the flow sheet is being changed to conform to Fig. 6, as follows: The Anaconda-type sampler at the discharge of the primary Dorr classifiers was abandoned and the original product of all three sections was combined and redistributed to the main-feed elevators in order to make the operation more flexible. The size of the main-feed elevators was increased to 20-in. belts, equipped with 18-in. "AA" buckets. The eight primary Callow cells are being changed so that the initial feed will flow to four cells in parellel, the tailings from these passing direct to a second set of four cells in parallel. The tailings from the second set of parallel cells flow, as formerly, to the secondary Dorr classifier, the slimes from this classifier being pumped to four Callow cells, making the final tailings, 90% of which will pass a standard 80-mesh screen.

The rougher concentrates from all twelve flotation cells flow by gravity to two Callow cleaning cells on each section. The concentrates from these cells are pumped by means of tandem 4-in. diaphragm pumps to two 2 x 8 ft. pneumatic recleaning cells. The tailings product from all cleaning cells returns to the discharge from the Marcy mill, where it is used to control the density of the pulp in the primary Dorr classifiers, and replaces the fresh water used for this purpose.

The sand product from the secondary Dorr classifiers is distributed equally to the former four roughing tables and to one finishing table, making a finished and mixed native- and sulphide-copper concentrate, as well as a sulphide-copper concentrate. The total sand tailing is returned to the simplex Dorr classifier, which is operated in closed circuit with a 6-ft. x 22 in. Hardinge mill. The classifier overflow, of reground material, is returned to the main-feed elevators. With this flow sheet, there will be no tailings rejected other than those from the flotation machines.

The sulphide-table concentrates are combined with the finished flotation concentrates and treated as formerly. The mixed native- and sulphide-copper concentrates will be elevated to an Anaconda-type sampler, and

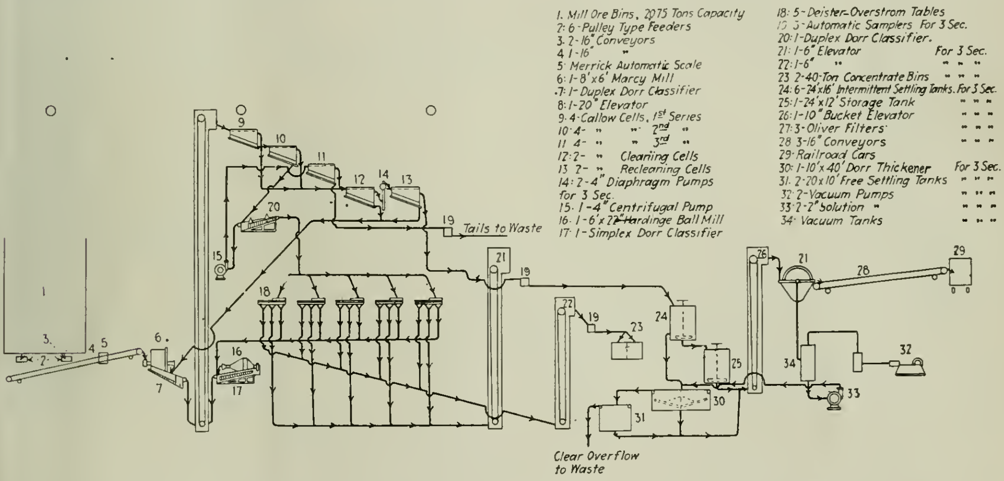

1. Mill Ore Bins, 2075 Tons Capacity
2: 6-Pulley Type Feeders
3. 2-16" Conveyors
4 1-16" "
5 Merrick Automatic Scale
6: 1-8'x6' Marcy Mill
7: 1-Duplex Dorr Classifier
8: 1-20" Elevator
9. 4-Callow Cells, 1st Series
10. 4- " " 2nd "
11 4- " " 3rd "
12: 2- " Cleaning Cells
13 2- " Recleaning Cells
14: 2-4" Diaphragm Pumps for 3 Sec.
15. 1-4" Centrifugal Pump
16. 1-6'x22" Hardinge Ball Mill
17. 1-Simplex Dorr Classifier
18: 5-Deister-Overstrom Tables
19 3-Automatic Samplers For 3 Sec.
20: 1-Duplex Dorr Classifier.
21: 1-6" Elevator For 3 Sec.
22: 1-6" " " " "
23 2-40-Ton Concentrate Bins " " "
24: 6-24'x16' Intermittent Settling Tanks. For 3 Sec.
25: 1-24'x12' Storage Tank " " "
26: 1-10" Bucket Elevator " " "
27: 3-Oliver Filters " " "
28 3-16" Conveyors " " "
29. Railroad Cars
30: 1-10'x40' Dorr Thickener For 3 Sec.
31. 2-20x10' Free Settling Tanks " " "
32. 2-Vacuum Pumps " " "
33. 2-2" Solution " " " "
34. Vacuum Tanks " " "
Tails to Waste
Clear Overflow to Waste
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
28
29
30
31
32
33
34

FIG. 6. FLOW SHEET OF ONE SECTION OF ARIZONA HERCULES COPPER CO.'S MILL

will flow to two 40-ton free-settling concrete bins. The 10 x 40 ft. Dorr thickener formerly used for reclaiming water from the tailings will be used for final settling of the decanted water from the intermittent-type concentrate-settling tanks. A pump has been installed for reclaiming clear water from the tailings pond, for general milling purposes. The tailings are flumed from the mill to the tailings dam at sufficient elevation to provide storage for at least two years without further expense. The tailings dam is maintained by means of a "V" distributing launder at the face of the dam.

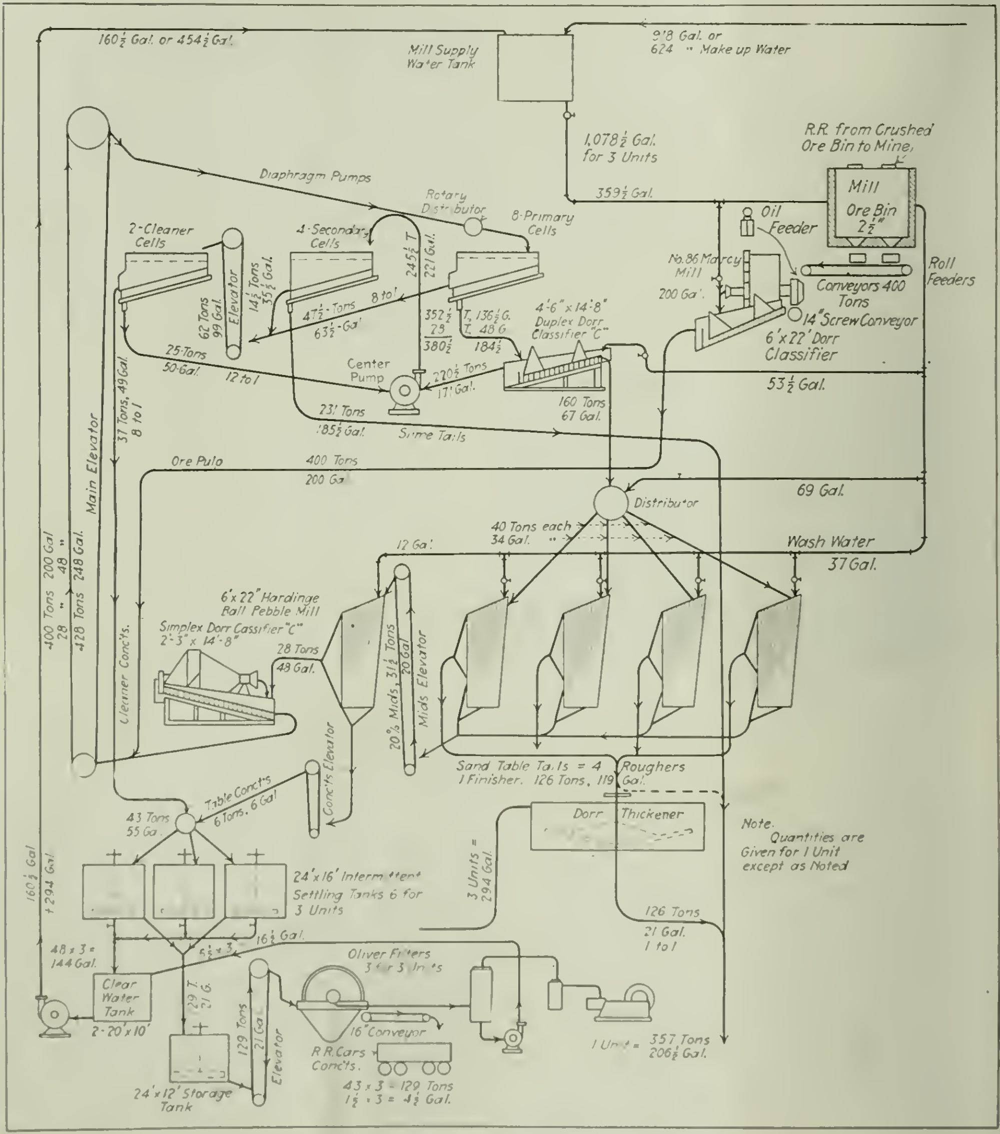


FIG. 7 ORIGINAL FLOW SHEET OF MILL

In order to improve the recovery of the native copper, an experimental concrete jig has been installed in one section, operating in the Marcy mill circuit, treating the return feed to the mill, and encouraging recoveries are being obtained. A research laboratory has been installed at the plant to conduct flotation experimental work in an endeavor to recover the metallic copper, together with the sulphides. The presence of metallic copper is an unusual feature of such ores. J. T. Shimmin, formerly mill superintendent for the Butte & Superior Co., is mill superintendent.

Selection of the Power Plant for the Mill

BY GEORGE J. YOUNG

Power is required in modern milling practice and constitutes an important item in the operating costs. Efficient selection of the power plant demands a careful comparison of first cost of plant as well as of operating costs. Many appliances of excellent design and proved operating efficiency from which to select are available. A knowledge of what the machinery market offers and thorough acquaintance of the operating conditions are necessary for a wise selection of the type of plant and the individual units of which it is to be composed.

IF A CONCENTRATING plant is not within convenient distance of a central power plant with electrical distribution, the selection of a suitable power agent and a plant for the generation of power and its distribution through the mill is the next most important problem after determination of the milling method and the design of the mill plan. Indeed, the form in which the power is to be applied will influence the mill plan to a considerable degree.

The most satisfactory form of power for use in a mill, as far as the distribution of the separate machines is concerned, is electricity. Electrical motors can be placed wherever convenient, and by the use of idler pulleys short-belt runs are practicable. Long shafts and heavy main-driving shafts can be avoided; and where there are a number of machines, such as concentrating tables, they can be driven as a group from a comparatively light shaft and by the use of light belting. Such shafts are so light and convenient that they can be placed in positions above the tables.

Motors can also be placed in positions that can be supported by the roof members of the mill, as the types of motors suitable for the operation of individual machinery or of small groups are relatively light and do not require excessively heavy supports. On account of convenience and adaptability of the driving machinery, electricity is therefore to be preferred to any other form of power agent in the mill. It is rare to find conditions that will require the use of a single driving unit and power distribution throughout the mill by shafting and belts.

PRINCIPLES UNDERLYING POWER-PLANT SELECTION

It is the purpose of this article to point out some of the features of the power plant and the principles underlying the selection of the parts that compose its makeup. At the outset it will be assumed that the mill is to be electrically driven by induction motors, and that the problem concerns itself with delivery to the switchboard of the mill of the necessary amount of power in the form of a three-phase current of 220- or 440-volt potential.

The power agents that are to be considered are water, coal, wood, gas, gasoline, distillate, and crude oil. The availability of water power, either close by or limited to distances of considerable magnitude, as, for example, 20 to 30 miles, will determine largely whether this agent may wisely be considered. The cost of the power plant, together with its appurtenances, as well as of the power line and transformers required, is one consideration. Another no less important is the probable length of the operating life of the mill. If the available ore supply is such as to insure a reasonably expected length of operation of only two years or less, it is evident that the first cost of the power plant and its operating expenses over this short period will have to be apportioned over the tonnage treated during the two years of life, and will constitute a proportionally large charge. An operating life of five or ten years, on the other hand, will entail a much less unit charge for power. These are elementary considerations, but they are just as important in the planning of a small mill as in the installation of a large plant.

REQUIREMENTS FOR WATER-POWER PLANTS

A water-power plant requires a dam, headgates, ditch, flume, penstock, turbine, generator, regulating apparatus, switchboard and building. Conditions may be such as to make it possible to utilize simple and cheap structures, or the power development may entail a large expenditure. Here again the operating life enters as a determining factor. If it is relatively long, substantial construction may be permissible; but if it is short, the least expenditure consistent with fairly reliable operating conditions will rule.

Another important consideration is continuity of water supply. If water storage is necessary to insure continuous operation, it must be provided in those instances in which the normal stream flow is insufficient during the dry months of the year. Water storage may be cheaply provided under some conditions, whereas in others it may entail prohibitive expense.

The use of power agents such as coal, wood, crude oil, or special kinds of fuel—sage brush or other native material—depends upon availability. Facts as to quantity, cost, and reliability of supply require investigation before selection of any one of these fuels should be made. Conditions may be such as to restrict the selection to only one fuel; and this will determine, often decisively, the main details of the power installation. For example, if coal delivered at the nearest railroad point at a cost of $10 per ton be the only fuel that it is practicable to obtain, this fuel and a form of power plant that will permit of its use will necessarily be selected. If the power plant be situated twenty miles from the railroad-delivery point, a road and haulage facilities must be provided for the movement of an equivalent of about six tons of coal per day for every 100 hp. required (assuming a coal consumption of 5 lb. per hp.hr.).

COAL-HANDLING FACILITIES

At the railroad point of delivery, unloading facilities for handling at least a carload of coal at a time must be provided, as well as facilities for loading haulage wagons or motor trucks. At the power plant, facilities for cheaply discharging the coal are also necessary. The labor involved will depend on the care taken in designing both unloading and handling details. It is evident that for a small power installation the cost of this equipment must be kept down, and the handling charges due to labor will be large.

If fuel oil is to be used, tank storage must be provided both at the unloading point and at the power plant. At the unloading point the tank must be of sufficient size (10,000 gal.) to hold at least a tank car of oil (8000 gal.). At the mill the same or double the storage is preferable. For transportation, a tank wagon or truck is indispensable. For transferring from car to tank, a pump must also be provided. This will preferably be steam operated, as steam may be necessary to heat the oil in the car during the cold winter months. A steam boiler, pump, and building will be found essential, although sometimes a site that permits of gravity handling from the tank car to storage and from storage to tank truck may be available.

The problem of fuel transport is often such that it is preferable to place the power plant at the most convenient railroad point, and transmit power by high-tension current over the intervening distance, rather than to move the fuel to a power plant at the mill. Here again the engineer must work out comparative costs. One important objection to the last-described plan is the splitting of the plant into two widely separated units, entailing great difficulties in overseeing and in control.

USE OF WOOD FOR FUEL

Wood as a fuel, where it is brought in by the railroad at a contiguous point, must be removed from the cars and piled conveniently close to the unloading spur. It must then be loaded upon wagons and trucks and hauled. A much simpler plant is required than if coal is to be used, although the handling of the wood involves high expense for labor. If wood is cut in the vicinity of the milling plant, a separate organization for logging and cutting must be maintained for a part of the year, or until the annual wood supply has been cut and hauled. The gathering of wood from a wide area, as is sometimes necessary, is not without its peculiar difficulties, and may require the construction of roads and skid paths.

Distillate, gasoline, or crude oil, when these are used for power purposes in some form of oil engine, are transported in drums. They are unloaded upon a platform at the rail point and transferred to wagons or trucks. From two to three drums of 100 gal. each are required per 100 hp. per 24 hours. The haulage of this amount involves little difficulty and comparatively small expense, even when the distances are considerable. Of all of the power agents excepting water, the oils or gasoline which are used in oil engines are of the least bulk and weight and of least cost, per unit of power developed, for their transportation to the mill. The labor or handling is obviously lighter than for the fuels which are used in a steam-power plant.

SIMPLICITY AND RELIABILITY IMPORTANT FACTORS

Having decided upon the form of power agent, the next important point is the selection of the kind of power plant. The principles that determine the selection are relatively simple—simplicity and reliability. Continuity of power service requires that a plant should be as nearly fool-proof as possible. To meet this condition, machinery must be selected that can be handled by the average operating skill and knowledge available. If complicated and delicate machinery is to be installed, a commensurate degree of mechanical ability and knowledge must be provided, by the securing of operators who can meet these requirements.

Third is the cost of power generated. Closely related to this is the first cost. First cost will depend upon the kind of machinery and the degree of complexity. An elaborate steam-power plant, with all of the auxiliaries necessary to utilize the fuel in the most efficient manner, will cost several times as much as a simple steam engine and boiler. Here again enters the factor of the length of life of the plant. A relatively large first cost is permissible where the plant is to be operated for ten years, but for two years' operation a low first cost would be highly desirable.

ACCESSIBILITY MUST BE CONSIDERED

The accessibility of the plant site and the cost of freight are other factors of no small importance. Obviously, the more elaborate the plant the greater the difficulty of transporting its component parts and the greater the cost per unit of power installed. In some localities, the transporting in of the simplest kind of plant may be all that is possible. In addition, the engineer must consider the question of erection difficulties. The erection of a complicated plant often requires the services of highly skilled mechanics, and such mechanics may have to be brought to the mill site at considerable expense. In addition, the kind of water available for steam boilers is an important consideration. This may be of sufficient importance to be a deciding factor.

In the foregoing I have laid down some general principles, and there remain to be considered some of the more particular details of steam and internal-combustion power plants. These will be divided into four groups—the steam plant, the distillate-engine plant, the gas-producer plant, and the Diesel-engine plant.

THE STEAM PLANT

There is a comparatively wide range in the selection of the essential parts of the steam plant. In the following grouping I have placed together a number of standard arrangements:

A—Boiler
  Steam engine
  Feed-water pump

B—Boiler
  Steam engine
  Feed pump
  Feed-water heater

C—Boiler
  Compound engine
  Feed pump
  Feed-water heater

D—Boiler
  Compound engine
  Condenser
  Feed pump
  Feed-water heater
  Oil filter

E—Boiler
  Stoker—automatic
  Compound engine
  Condenser
  Feed pump
  Feed-water heater
  Oil filter
  Superheater

F—Boiler
  Turbine
  Feed pump

G—Boiler
  Turbine
  Condenser
  Feed-water heater
  Oil filter
  Feed pump

H—Boiler
  Superheater
  Turbine
  Condenser
  Feed-water heater
  Feed-water pump
  Oil filter

I—Boiler
  Superheater
  Stoker—automatic
  Turbine
  Condenser
  Feed-water heater
  Feed-water pump
  Oil filter

The groups range from the simplest to the most complex. They also range from the least economical in fuel requirement to the most economical. Probably it can also be said that they range from the plant in the installation and operation of which the least amount of mechanical ability is demanded to that which requires the most. It will be noted that there are two main groups, A to E inclusive and F to I inclusive, the first group being characterized by the reciprocating steam engine as the prime mover and the second group by the steam turbine.

What has been said applies to either group within itself. As between the two groups, the second group represents the more modern and also the simpler mechanically, although perhaps a higher order of mechanical ability is required to keep the turbine in good operating condition than is demanded in the operation of the steam engine. Each has its individual peculiarities. Progressively in each group there is a decrease in cost per unit of power obtainable from the plants indicated, as well as an increase of weight per unit of power generated, and also an increase in cost per unit of power installed. The unit weight per power unit is less in the second main group.

An increase of economy in operation is invariably accompanied by a considerable increase in the first cost of the plant. It is also obvious that as the number of parts are increased there must also be an increase in the amount of care and attention demanded of the men who are to operate the plant.

To continue the generalization, it may be pointed out that where the fewest parts and the least weight are desirable, groups A and F meet the requirements, but they would necessitate the greatest amount of fuel for operation. If fuel were obtainable at low cost, the use of plants of this kind might be justifiable. Also, where first cost is the dominating essential, both plants would meet the requirement, with A as the least-cost plant. On the other hand, if economy of operation be the first essential, groups E and I would meet this requirement, with preference given to Group I. The intermediate groups in each main group would show progressively greater and greater economy. The limits of this paper do not permit going into the detail of the selection of the particular type of boiler or engine or other parts of the plant, but it is evident that correct judgment and a knowledge of the operating conditions are necessary before these can be selected from the great variety offered by the machinery market.

THE DISTILLATE-ENGINE PLANT

The unit of this plant is the single- or double-cylinder, horizontal type of oil or distillate engine. In weight per unit of power generated, this plant is comparable to Group A (steam plant). In complexity of arrangement and number of parts, there is much in favor of this plant as compared with the steam plant. In economy of fuel, there is also a materially greater saving over any one of the steam plants. Hence, where fuel is expensive and difficult to obtain, the distillate plant has the decided advantage of requiring the least weight of fuel in the form of a liquid, which is more easily handled than solid fuel. From an operating standpoint, the distillate engine presents rather more difficulty than the steam-engine plant, although with experienced men this is more apparent than real. The labor required in operating is measurably less than for any steam plant requiring solid fuel. In compactness of plant, less housing space, the distillate plant has the advantage. The first cost of the distillate plant is less than that of the more economical steam plants, and is probably about equal to the first cost of the steam plants in groups A and F.

THE GAS-PRODUCER PLANT

The essential features of the gas-producer plant are the gas producer, the scrubber or purifier, and the gas engine. All are simple, and the arrangement is somewhat more compact than that in the steam plant. The advantage of the plant is that suitable solid fuel, as, for example, clean anthracite coal or charcoal, can be used, and an economy of the same order of magnitude as that obtainable with the distillate engine obtained under ordinary operating conditions. With clean gas, little trouble is experienced with the gas engine. The labor of operation is less than for a steam plant of corresponding size. The operating skill required is not any greater than that required for a steam plant.

The weight per unit of power installed is somewhat more for the producer plant than for a steam-power plant of equivalent power. In portability the producer plant does not present much more difficulty than the steam plant. Probably the greatest difficulty experienced is in the obtaining of suitable fuel. Theoretically, many fuels can be gasified in the producer, but the problem is to clean the resulting gas without too elaborate scrubbing appliances. The competition of the crude-oil engine as well as the Diesel type has been an indirect factor in the lack of interest shown in the gas-producer plant, and it is likely that this form of power plant will be used only under conditions that particularly favor it.

THE DIESEL-ENGINE PLANT

The Diesel internal-combustion type of engine and its modification, the hot-bulb engine, are, from a weight standpoint, heavier per unit of power installed than the simple steam-engine plant and about equal to the more complicated steam plant. In economy of fuel per unit of power generated, these types have an advantage over all of the forms of power plant mentioned. C. G. Sprado says, in the May 20, 1919, issue of *Power*:

"Although the Diesel engine operates with an economy which is unequaled, its reputation has been damaged in some instances from its being used under unsuitable conditions, but more especially by unskillful handling. Over-enthusiastic advocates of the Diesel engine have injured its reputation by leading purchasers to believe that the machine was 'fool-proof,' and required no operating skill; but, as a matter of fact, in return for its high economy the Diesel engine demands a certain amount of attention (such as in connection with grinding valves) at the right time; and there are instances where the machines in duplicate installations have either been highly successful or failures, dependent entirely on the degree of skill of the operating crew.

"The Diesel engine is practically a 'maximum-rated' machine, for its power is limited by the volume of air compressed in the main cylinders, the amount of oxygen present determining the quantity of oil that can be given perfect combustion. It can readily be seen that on this account Diesel engines are limited to small overload capacity, for comparatively short periods, but they will operate with relatively high economy on lighter-than-maximum loads.

"In common with all moderate-speed internal-combustion engines, the Diesel has a relatively high first cost per brake horsepower; and to offset this there has been a tendency among builders to over-rate their engines both as to capacity and speed. Although this may do no harm on fluctuating loads, it is sure to give unsatisfactory operating results on continuous heavy loads such as are encountered in marine work, pumping and flour mills, owing to overheating, carbon from incomplete combustion, and other causes."

The fact that the Diesel-engine type of power plant has found extensive application in marine service is sufficient testimony of its reliability. In the mining industry the principal difficulty attending its use has been lack of skilled operators. Steam-engine operators have been comparatively numerous, but there has not been sufficient time to develop a relatively large number of operators who have sufficient experience to keep the Diesel in running condition. Manufacturers of this type of oil engine have had to train the men for operating service. This is a condition that is rapidly passing, and with it will come a more extensive use of this form of power plant in mining districts where fuel is expensive and where it has to be brought in from long distances.

The extensive development of petroleum districts in many parts of the world insures a supply of suitable fuel for the Diesel type of prime mover. The relative amounts of fuel oil required in the more economical steam plant as compared with the Diesel plant and its modifications are as 3 or 2.5 to 1. On a 500-hp. unit operating 20 hours per day and 350 days per year, or 3,500,000 hp.-hr., the approximate weights of fuel oil would be 3500 tons to 1050 tons, the lower figure being the crude-oil requirement of the Diesel.

GENERAL CONCLUSIONS

The choice of the power plant from the standpoint of operating economy may be made from one of the following three types—the water-power plant, the steam-power plant of either group H or I, and the Diesel-engine plant or one of its modifications.

If water power is available, there is little question as to the wisdom of selecting this form of power plant. Similarly, where fuel cost is high, and fuel must be transported in, and fuel oil is reasonably available, the last-mentioned form of power plant will be selected. Where oil cannot be obtained, and wood or coal is available, the steam-power plant remains as the solution of the power problem. In any one case where a number of possibilities are present, the selection of the power plant rests primarily upon the determination of the comparative first costs and the comparative unit-power costs by the different systems.

Flotation and Retorting of Sulphur

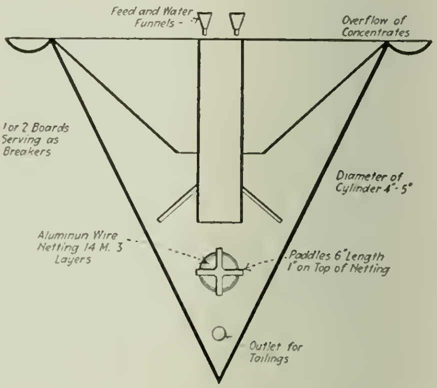
By P. F. JUNEHOMME

The following notes and results, obtained by experimental flotation tests on samples of gypsum containing free sulphur, may be of interest, although prices have dropped, and the stimulus for the development of low-grade sulphur minerals no longer exists.

The gypsum rock in question contained free sulphur, varying in amount from 37 to 6%. The colors of the earthly substances and the hard rock were white, yellowish, brown to green, and even purple. The extraction of sulphur has been carried on in retorts, and the results have been sometimes successful, but often with considerable losses in the residue. A practical retort system has not yet been devised. The size of retorts necessary to bring the sulphur to the melting point, and the time of maintaining the heat at a sufficient temperature and under efficient pressure to exhaust the mineral of all the sulphur, have not yet been determined. Often the retorts have been built so large that radiation of heat is too great and the extraction of sulphur in low-grade ores is impossible. In high-grade ores considerable losses occur in the residue.

Flotation experiments on sulphur rocks have proved successful. A combination treatment involving flotation, and the retorting of the sulphur in the concentrates produced has been tried and has given excellent results. The tests were made on rocks and on fines containing up to 36% sulphur. A sketch of the spitzbox machine used to make the experiments is shown herewith.

The high-grade ore assayed 35%, and 20 lb. was taken for treatment. After 20 minutes' treatment in the machine, the concentrate, which overflowed into a canvas bag, was collected, squeezed dry, then dried in the sun. The sulphur contents assayed 76%. The tailing assayed 1.4% S, so the extraction was about 96%. The concentrate was re-treated in the machine and the percentage of gangue still further reduced. The usual rules as with treatment by flotation of ordinary copper and silver sulphide ores were observed. The ore was first crushed to about 20 mesh; then mixed with water in the ratio of one to one, and introduced into the receiving funnel through a hose or pipe, with a continuous stream of water from another ½-in. pipe. From 0.05 to 0.10% of gasoline was used in the first treatment in the machine, and half this amount for the subsequent treatment. Some foaming took place, due to the fine dust present.


Feed and Water Funnels
Overflow of Concentrates
1 or 2 Boards Serving as Breakers
Diameter of Cylinder 4"-5"
Aluminun Wire Netting 14 M. 3 Layers
Paddles 6" Length 1" on Top of Netting
Outlet for Tailings

SULPHUR FLOTATION EXPERIMENTAL MACHINE

An attempt was made to retort the sulphur, without success. It was found that it must be either briquetted with some binding material, and then broken up in pieces not larger than 1 to 1½ in., or charged with hard stone pebbles, of 1 to 1½ in., or hardwood blocks or cubes. The temperature of the steam should be at least 300 to 350° F. The perforated cage which holds the charge in the retort should be made of sheet aluminum, as the melting sulphur will soon destroy one made of sheet iron or steel.

Ferromanganese, Ferrosilicon and Ferrochrome will be manufactured by the Tennessee Manganese Co., Knoxville, Tenn., by the electric-furnace method, according to plans now under consideration. The first 10-ton furnace will be situated at Cleveland. Manganese deposits in Tennessee are controlled by the company. Its highest-grade chromium ore is 50 per cent.

Report on Economies in Mill Parts in South African Gold Mills*

During the year 1916, the tightening up of restrictions in England on the export of supplies for the mines made it imperative that concerted action should be taken regarding economies to be practiced at the South African mines, and, where possible, that substitutes for imported articles should be made locally. Previous to that year the large local stocks of necessary engineering supplies had not made the matter so urgent, but certain economies and useful ideas were being developed at individual mines, and it was evident that, if a free circulation of this information could be accomplished, the mines of the group would be greatly benefited. Many interesting and unique devices in connection with mine machinery were evolved by various engineers, and it was felt desirable to summarize the many economies which had been effected. The following is a list of the principal items:

Stems—Stems are made at many mines from old camshafts or by faggoting up three old stems, at a cost averaging about £3. Stems are also repaired by welding on any suitable scrap material. Many mines report that one or other of these ideas has long been practiced.

Cams—New Modderfontein—Worn cams are brought up to shape by welding on pieces of rail or drill steel, at a cost of about £2 10s. per cam. The Knight Central fullers up the cams and, when necessary, welds in a piece of drill steel. The cost is stated to be £1 per cam. Ferreira Deep, Ltd., draws out old worn cams from root to standard size. This was the practice prior to the war. Crown Mines, Ltd., have made up a few cams by quasi-arc; first results not good; could be improved.

Heads—Ferreira Deep, Ltd.—When badly worn in socket, are heated up, compressed, re-bored, and put again into use.

Shoes—Several methods are being tried for replacing broken shanks on shoes. New Modderfontein welds a worn-out shoe on to the broken one. This is economical if the weld holds, but definite information on this point is not yet available. A more usual method is to draw a new shank out of the shoe under hammer, which makes a satisfactory job, not, however, invariably successful, variation in quality of steel sometimes causing the shoe to split. It is stated that two hours are required to form a new shank like this, so the cost would be about 10s. Rose Deep bores out shoe and shrinks in a mild-steel shank at a cost of about £1. Another mine converts old tappets into shoes by welding on a shank.

Dies—It is now the general practice to make dies by cutting an old head in two and filling holes with shoe shanks. This costs about 15s. for two dies.

Camshafts—Witwatersrand Deep, Ltd., makes camshafts of five stems faggoted up together. Other mines weld up broken camshafts, with varying success.

Blanton Gibs—Crown Mines, Ltd., has found a gib with feather on key much superior to the gib with two pins. The holes for pins are frequently drilled too deep and become a source of weakness in camshafts. The keyway would appear to add 50% to life of camshafts. At Ferreira Deep, Ltd., all pin-holes in camshafts are drilled in fitting shop to gage ¼-in. deep, by using flat-faced drill with sleeve on to prevent possibility of drilling too deep. Considers cutting keyways and fitting key an unwarranted expense.

Mortar-Box Liners—At the Crown Mines, Ltd., mortar-box liners are made from old camshafts, at a cost 50% under imported ones. Similar liners are being made at some of the mines from old dies.

Wood Guides—In connection with the practice of reboring wood stem guides, the Knight Central, Ltd., finds it pays to buy extra-thick timber for the outside guides. In this mill the inside guide against the girt cannot be more than 4 in. thick, but the outer one can be 4½ in. This extra ½ in. gives a much longer life to half the guides. At the Ferreira Deep, Ltd., it is the practice to start guide with ¾-in. liner between halves, and as holes wear the liner is reduced until they come face to face; ¾ in. is then cut away from the face of each half of guide block and restarted with a ¾-in. liner. The same procedure is carried out until blocks are completely worn out. Any odd hole worn out of proportion is lined with rawhide liner. By this method an average life of seven years is attained. Other mines adopt similar methods for economies in guide blocks. At the Crown Mines, Ltd., economy is achieved by lining guides with discarded leather ("Hendry") belting. Leather lining is not a new idea, but tacking on strips is novel, having the advantage of enabling the shape of the box to be maintained. Still further improvement is effected by battery screening.

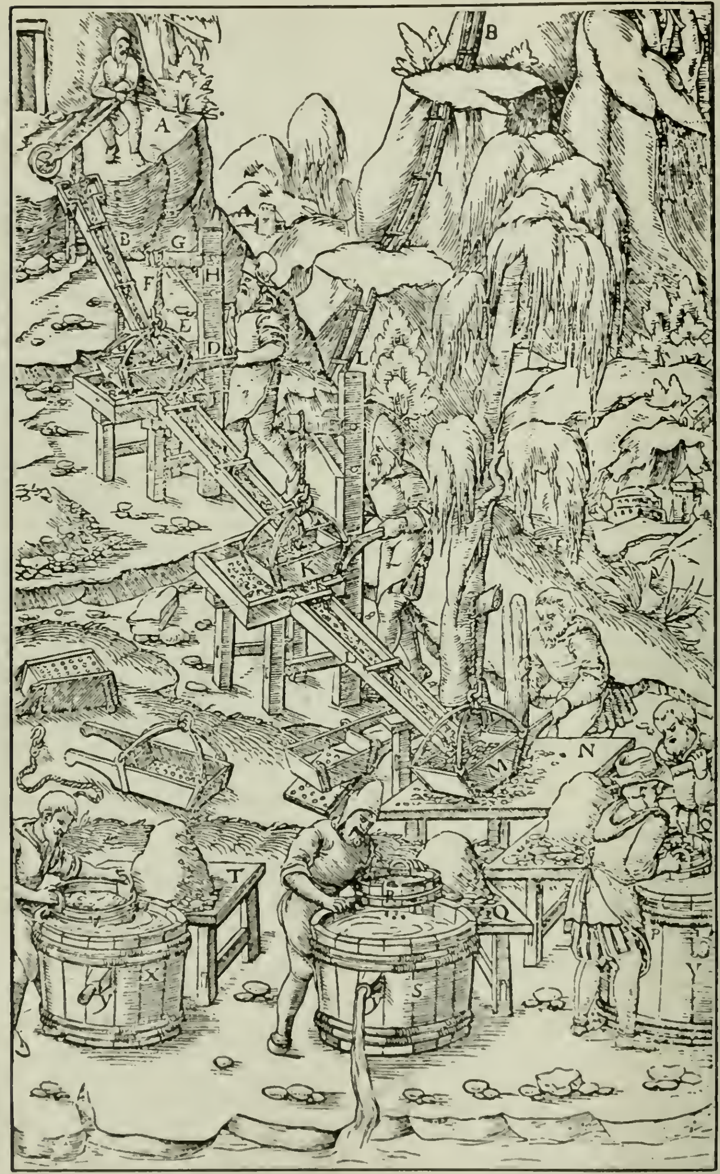
Boilers—An interesting boiler repair job, which saved the company an expenditure of £300 on the boiler tubes, was carried out at the New Heriot Gold Mining Co., Ltd. Through removal for cleaning, the tubes of an F. & C. boiler, 104 in number, had worn out at the ends. By cutting 2 in. off each end of these tubes and 4 in. off the boiler shell, all the tubes could be used again. The entire job cost £60. East Rand Proprietary Mines, Ltd., reported that the method was new to that mine. It is the practice to cut and weld tubes to suit the boiler, and the management considers this the better method. Welding tubes has been the practice at this mine since the war started. At the Crown Mines, Ltd., shortening of boilers has been in practice with Sterling boilers in order to make further use of tubes; it is also being done to facilitate transport.

Crushers—The Bantjes Consolidated Mines, Ltd., carried out an economical repair job on a 30 x 12 in. Hadfield crusher. The engineer made a pair of case-hardened toggles from camshaft at a cost for labor of £3 5s., which allows an ample margin for power costs and similar charges, compared with the imported price of £9 10s. From similar material a wedge block toggle seat for 30 by 12 in. Hadfield crusher has been made. The Ferreira Deep, Ltd., uses F. & C. of Hadfield's 10 by 20 in. and 12 by 30 in. crushers. All toggles when worn badly are re-formed at a cost of 8s. each. Broken toggle blocks are re-plated by mild-steel ones made at mine; also back wedges for fixed jaw faces. The East Rand Proprietary Mines, Ltd., have made wedge blocks and toggle seats from this material. Making crusher parts from old camshafts or suitable scrap has proved to be a valuable economy.

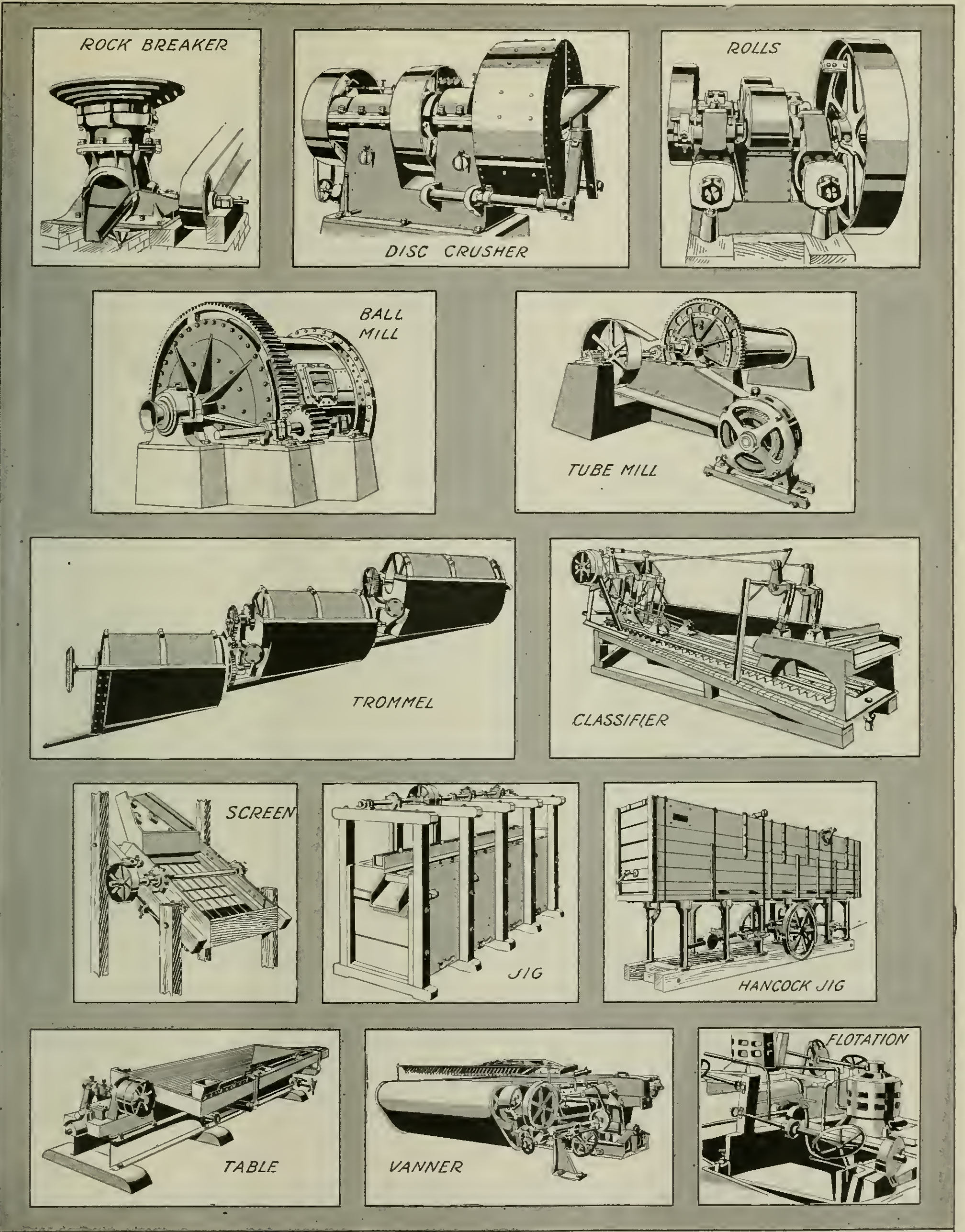
Claims Filed With the War-Minerals Commission by Utah producers of such minerals show a total of $20,000 to have been asked by companies producing manganese, five in number; $2500 by one company producing pyrites; and $7000 by one company producing tungsten.

---

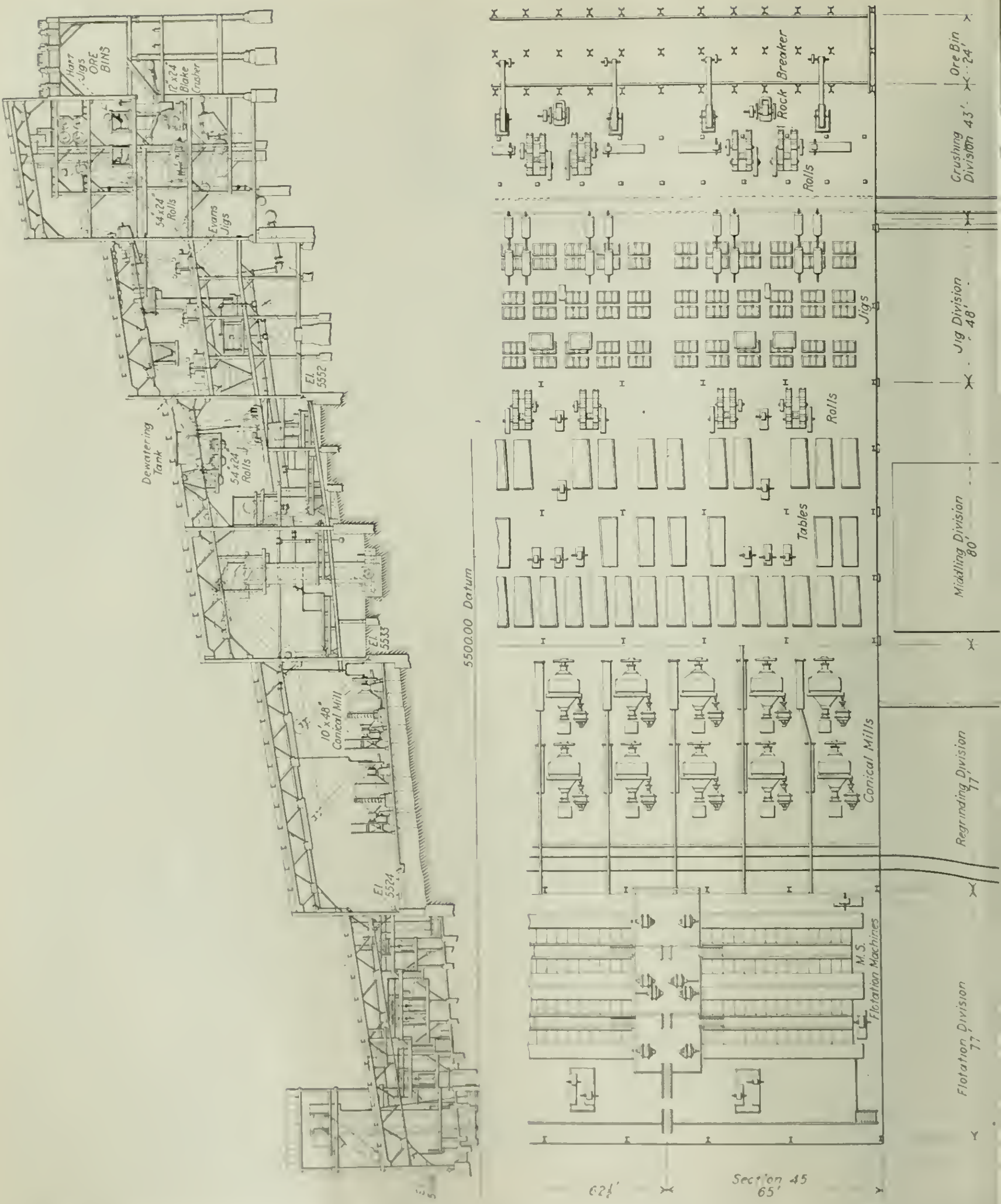
*Excerpt from an article in *Journ. Chem. Met. & Min. Soc. of S. A.*, Dec., 1918. p. 89.



In Agricola's time milling was accomplished by crude appliances and human muscle, and the result was small tonnages, low recoveries, and indifferent work. Considerable ingenuity was displayed by the early "mill men" in inventing appliances



In modern time, all milling machinery is power-driven. There is an appliance for every step. Methods of separation have multiplied. Tonnages are large. Recoveries reach high percentages, and milling work is done under exact control



In sharp contrast to the Agricola picture is the arrangement of a modern milling plant. On this page is shown a plan of a section of the copper-concentrating mill of the Anaconda Copper Mining Co., at Anaconda, with a vertical section

Milling in the San Juan, Colorado

By CLIFFORD R. WILFLEY*

The San Juan region in Colorado has always been an interesting milling center, for the ores are, as a rule, complex and require much preliminary experimentation before a suitable flow sheet can be determined. Flotation has simplified the treatment to a considerable degree. The account which follows reviews both mining and ore-treatment conditions and operating mills of the principal districts.

UNDER the term "San Juan" are grouped the Lake City, Ouray, Silverton, Telluride, Rico, and the Telluride mining districts, including the lower San Miguel River and Naturita vanadium developments. In the last year the San Juan, in common with other districts, has been hampered by high operating costs, scarcity and inefficiency of labor, and the epidemic of influenza. In addition, some plants were shut down and others run at half capacity because of power shortage due to lack of water at the generating stations of the Western Colorado Power Co. This shortage occurs every winter, but last winter it was more severe than usual, some plants being shut down for a month or more. At present, power is sufficient and labor is somewhat more plentiful and efficient, though still not what it used to be. Wages have been reduced slightly—not as much as in other Colorado districts—without strikes. Costs remain about as high as during the war, though a reduction is making itself felt to a moderate extent.

The prospects for the near future are fair, with strong probability for substantial improvement later. Compared with a few years ago, much less ore has been milled during the last year, but the faith of the average operator in the district is unshaken. Many smaller mills will resume in the coming season, and several new plants are about to start operations now. The advance in the price of silver is proving a stimulus which will soon be felt.

TELLURIDE DISTRICT

The Tomboy, the Smuggler, and the Liberty Bell have been practically the only steady mill operators in the Telluride district. Good ore reserves and efficient management have made it possible for them to run continuously. Some small intermittent operations have also been conducted. The Tomboy mill is operating at 450 tons per day, with practically the same flow sheet as formerly—stamps, amalgamation, concentration, and cyanidation. Much interest is taken in the plans of this company for a new mill. It is the intention to use flotation instead of cyanidation. Construction has already started, and the new plant is expected to be running by next autumn.

MOUNTAIN TOP MINE, PORTAL OF ADIT. MILL IS INSIDE ADIT UNDER RIDGE AT LEFT. ALTITUDE, 12,000 FEET

The Smuggler Union Mining Co. is operating its mill at Pandora, as usual, and making the customary experiments and continual improvements. The plant receives ores from three mines—the Smuggler, Humbolt, and Black Bear. These ores require separate mill units and railroad cars. The valuable metals are gold, silver, and lead in the case of the Smuggler and Humbolt, and gold, silver, lead, copper, and zinc in the ore from the Black Bear. The ores are all sulphides.

The methods employed are reduction by stamps and in ball mills, with straight flotation on some ores, or concentration on tables followed by flotation on other ores. Experiments, consisting of passing flotation froth over tables, are being made, with good results. In other instances the froth is handled by thickeners, pumps, and filters. The flotation machines used are the Callow and Janney, and a Ruth machine is also being put in, from which good results are expected. A new ball mill is now being installed, and it is thought that the tonnage will be increased this summer, by other additions, from the present 450 tons to 700 or 800 tons per day.

---

*Mining engineer, Ouray, Colorado.

The Liberty Bell mill continues to operate at its usual high efficiency, but no great changes are in prospect, the operators asserting that they anticipate a final shutdown soon. This plant has been a training place for a number of well-known metallurgists and mill men of today, and has handled a large quantity of ore. There have been a number of changes, and low-cost records have been made. The ore is gold and silver, associated with pyrite. It is handled by 80 stamps, with Wilfley tables, thickeners, agitators, Moore filters, and zinc-shaving precipitation, the process being concentration followed by the cyanidation of concentrates and mill pulp separately. Despite the cyanidation of concentrate, the extraction is well over 90%. The concentrates are ground to pass 300 mesh for cyaniding, and the mill pulp is ground to 100 mesh. The mill treats 400 to 500 tons daily.

The Belmont-Wagner Co. developed the Alta mine last year and was equipping the mine and finishing the mill when the epidemic of influenza caused the plant to be shut down. Before it resumed operations, the snow forced a delay until this spring. The old mill building was equipped with new machinery, and a first-class mill of 300-ton capacity is now about ready to operate. The ore contains gold, silver, lead, and copper sulphides. The process will be essentially flotation in Jones-Belmont machines, the middling from cleaner cells being treated on tables, which will make a concentrate, the concentrate being reground and sent back into the mill system, and the tailings sent to waste. The ore contains considerable barite, which causes trouble on the tables, but not in the flotation section. This plant will add materially to the output as well as the prestige of the Telluride district, which has always been the busiest part of the San Juan.

The Primos Chemical Co. is building a new plant at Vanadium, on the San Miguel River, a few miles below Telluride, to replace the old plant which burned recently. A steel structure is being erected, and the plant will probably be operating by Aug. 1. The company has never given much information about its plant or method, but it is understood that the process involves roasting and chemical treatment, a chemical product being produced. The ore is vanadium, principally roscoelite, and is obtained largely from the company's own mines near by and to a small extent from small independent producers.

The Colorado Chemical Co., it is understood, will build a plant on the San Miguel River at Sawpit. The company had been shipping vanadium ore to the Primos plant, some of its ore now being stored at that company's mill site, awaiting treatment in the new mill. The Standard Chemical Co. is operating a vanadium plant at Naturita, some distance down the San Miguel River, but no information is available as to its plant or process.

The Ouray district was unusually quiet last year, but is beginning to improve. The former great producer, the Camp Bird, has been developing its mine through the new crosscut adit, and has not operated the mill since September, 1916. No announcement has been made as to resumption of milling, but it is generally expected that milling will be resumed eventually.

The Atlas M. and M. Co., at Sneffels, continues to operate its mill, though at reduced capacity. It is expected that the mill will soon return to its former capacity of 140 tons per day, with possibly an increase in capacity later. This mill, one of the pioneers in flotation in the United States, has been an interesting establishment, and has a record of high recoveries for a period of years. The ore is a low-grade silver and lead, with a small amount of gold and not enough copper to pay for its recovery. Zinc usually accompanies the ore, but has never been a commercial product. It is the intention of the management to experiment with selective flotation. The present treatment is sorting out waste at the head of the mill, followed by breaker, stamps, tables, ball mill, and an eight-cell Minerals Separation machine, followed by a three-cell Hebbard. The first cells make concentrate. From the next cells froth is sent to tables for cleaning, and from the last cells, including the Hebbard, a froth is returned to the head of machine. The flotation feed is practically all through 60 mesh. The lead recovery is high, being approximately 95%. From a mill head of 2.5% lead, a tailing of 0.16 to 0.20% lead is made. The silver recovery is usually slightly over 90%. Variations in the ore cause variations in recoveries.

The Mountain Top Mining Co. is operating its mill at somewhat reduced capacity, but expects soon to resume three shifts. The ore is a good-grade silver-lead, and from it a recovery of 80 to 95% of the silver and a high percentage of the lead, at 48-mesh grinding, is obtained. Mill heads average about 17 oz. silver per ton and 1.5% lead, with a small amount of pyrite, but no zinc or copper. Concentrates vary in grade, but average about 130 oz. silver per ton, 17% lead, 15% silica, and 25 to 30% iron. The mill has a capacity of 50 tons per day. The equipment consists of a crusher, a ball mill and a flotation machine. The froth is cleaned on a table and the tailing passed over a pilot table.

The mill is interesting because of the fact that it is underground. It is situated at about 1500 ft. from the portal of the adit through which the mine is operated. The arrangement is a series of rooms staggered on either side of a central incline, a separate room being provided for each machine. The mill operator in one room can see the machine in the opposite room on the next lower level. The ore is raised from the tunnel level through a vertical raise by an automatic elevator to a bin which is simply a chamber in the rock.

The mill operated all winter, despite the fact that it is situated at 12,000 ft. altitude, in a region of heavy snowfall. No heating is required. Tailing is run to the portal of the adit by means of a 2-in. centrifuga pump and 2-in. pipe line, which never clogs. As an interesting example of hit-or-miss trials in flotation it is reported that the flotation machine at times failed to make a froth, and no reason could be found. Various reagents were tried, with varying success, until someone tried a small amount of spent carbide from the miners' lamps. This is said to have been an unfailing remedy causing the froth to form quickly.

These two are the only mills that are operating steadily in this district. The Barstow mill, as usual, will opera this summer, when water from the gulch becomes available from melting snow. High-grade gold ore will be handled during the summer. The Red Mountain Mines Co. will probably operate a small mill later in the year at the old Genessee mine. The Gold Crown mill, at Ouray, which was remodeled and put in good condition last autumn, for the purpose of treating a variety of ores as a custom plant, may be started this summer, as well as the mill of the Vernon Mining Co. at Ironton, under the same management.

The Ouray Con. M. and R. Co. is finishing a new mill at Ironton. This is the only mill so situated that it can serve the Ironton district, and it is expected that its operation, as a custom plant, will stimulate mining in that region. The plant is well designed, as a one-mineral mill, including classification, coarse tables, and flotation, with regrinding and further concentration if necessary. The same company plans to operate the old Treasury mill, at Red Mountain, late in the year, on ore from the National Belle.

SILVERTON DISTRICT

The Silverton district has been retarded more than any of the others because of general conditions, especially the epidemic of influenza, but seems to be "coming back" as well as the other districts. Practically all milling operations have been in the mills close to Silverton. A year ago the A. S. and R. Co. operated a flotation plant at the company's Durango smeltery, in an experimental way, principally on San Juan concentrates, but has not continued this work recently.

At present the Iowa-Tiger mill is operating; the Gold King is making extensive improvements and practically building a new mill; the North Star mill will probably be in operation later, and the Contention property has been taken over by new interests, with the expectation of doing considerable mill improvement, as well as of operating the mill. Flotation in combination with table concentration is generally practiced.

The most interesting mill operation in the district, if not in the whole San Juan, is the mill of the Sunnyside M. and M. Co. This company bought the famous Sunnyside mine some time ago and spent a large sum of money in equipping both mine and mill. The plant was put in operation, but great difficulty was experienced on account of the labor supply. Last March, when conditions were improving, the entire mine plant burned. Construction of new plant has begun, and it is expected that the mill will resume in three or four months.

The ore is the usual San Juan sulphides, intimately mixed with a quartz and rhodonite gangue. The rhodonite is abundant, the ore having the average content of 7% manganese. The process is straight flotation, with selection into lead and zinc concentrates, most of the pyrite going into the lead concentrate. The success of selective flotation at this plant has attracted much interest. The capacity of the mill is 500 tons, with the following flowsheet:

No. 6 Gates gyratory crushers at mine to 3 in.; Trenton cable tram 16,000 ft. to mill; Merrick weightometers to three 30-ft. cylindrical steel bins, 4000-ton capacity; 8 by -ft. Marcy mills, closed circuit 6-ft. Dorr classifiers to 28 mesh, with 40% through 200 mesh; 5 by 14-ft. tube mills and a 5 by 8-ft. ball mill, closed circuit with classifiers, to 8 mesh, with 65 to 70% through 200 mesh; lead flotation in 14-cell M. S. machine, eight standard and six Hebbard sub-aërated cells—producing final lead. Zinc flotation in 9-cell standard M. S. machine (both M. S. machines 24 in.); the lead concentrate, zinc concentrate, and tailing pass to six tables, which make no cuts, but are used simply as pilots, though not used continuously. Final tailing to two 40-ft. Dorr thickeners for water recovery in winter; the two concentrates to separate Dorr thickeners; thence to Portland filters; thence to steel bins, and by gravity to railroad cars.

The gross recovery, figured on the value of all metals recovered, is 90 to 92%. The Marcy mill requires 2¼ lb. of chrome-steel balls and 0.7 lb. manganese-steel liners per ton ground, and 200 hp. when one mill is grinding 350 tons per day. In the tube mills selected rhodonite from the mine is used in an amount equal to twice as much as would be required if imported pebbles were used. The 5 by 8-ft. ball mill uses 2-in. manganoid balls and grinds 50% more, with 35% more power, than the tube mills using rhodonite, but the tube mills are favored on account of costs. The first head sample is taken automatically from the tube-mill overflow. The concentrate plant is built large enough to handle all the concentrate on one shift, thus allowing longer settling and thickening in the Dorr apparatus, with the result of lower moisture content. The lead concentrate is discharged from the thickeners at 35% moisture and from the filters at 6½%; the zinc concentrate at 40% and 7½% respectively. These moistures are so satisfactory that the drier bought for the concentrates is not used.

The total power used, including the crushing plant, when handling 550 tons per day, is 900 hp. The lead concentrate assays 50% lead and 13% zinc; the zinc concentrate, 50% zinc and 6% lead. The normal mill crew, excluding the crushing and concentrate handling plants, is five men per shift, including a shifter.

Fine Crushing in Idaho

According to a preliminary report recently issued by the Bureau of Mines on the mining districts of Idaho, in order to crush material such as middlings and tailings from jigs and tables to a size suitable for table concentration and for flotation, some type of pebble or ball mill is generally used. Both cylindrical and conical types are used in the mills of the district, and both types are found in some mills.

The ore in the ball mills is crushed wet, the mixture varying from about two parts of ore to one part of water to one part of ore to two parts of water. It is believed that the lower water content would result in more efficient crushing in the long run, depending, of course, upon the amount of slimes the mill man desires to produce. In general, more water is required for a granular product than for the production of a slime. Also, the proportion of water used has considerable effect on the capacity of the ball or tube mill.

However, each individual problem must be worked out to obtain the greatest crushing efficiency in the ball mills, according to the conditions of operation and the kind of product desired.

Ball or tube mills, when used for fine crushing, are usually in closed circuit with classifiers, the oversize being returned to the tube mill and the overflow either passing to Dorr thickening tanks for flotation or to cones or hydraulic classifiers for subsequent treatment on tables. The sizes of cylindrical ball mills commonly used are 5 by 5, 5 by 10, and 6 by 14 ft.; the conical type of Hardinge mills are usually 6 ft. by 22 in., although smaller and larger sizes are found in some of the mills.

Shafting and Belting

BY ROBERT S. LEWIS*

Associated with data relating to the design of belts and shafting to be used in ore-dressing and milling plants there is a confusing superabundance of formulas, charts, and rules, from the use of which widely divergent results may be obtained. In this article the author has attempted to select the smallest number of reliable formulas and charts that would solve the problems ordinarily encountered. The mathematical analysis of the design of shafting is entirely satisfactory. However, the mathematical analysis of the action of belting is impossible without making assumptions regarding the value of certain quantities, and these conclusions must rest on experimental data if the formulas derived are to be of practical application. The data on belting that are included in the following paper seem to be the most reasonable combination of theory and practice that is warranted by the present knowledge of the subject.

THE numerous and long lines of shafting, all driven by a single prime mover, which were so common in milling plants of earlier design, have been greatly reduced in number in modern installations by the introduction of the individual motor drive for machines. However, the proper diameter of shafts and the spacing of bearings are still important questions, as is shown by the excessive vibration and not infrequent breakage of shafting in mills of comparatively recent design

Few shafts are subjected only to simple twisting. Pulleys and gears exert a lateral pressure on shafts and often cause severe bending stresses. As the direction of the line of action of these forces remains fixed, it is plain that during one revolution of a shaft the stress at any point will change from maximum compression to maximum tension. Moreover, the operation of such machines as crushers, ball mills, and rolls, which, of necessity, make irregular demands on the power supply, throws a rapidly fluctuating intensity of load upon the power-transmission machinery. For these reasons, shafting should be made of tough and ductile material, well adapted to withstand shock and severe service.

Wrought iron was formerly often used for shafting in mill operation, especially in the manufacture of the camshafts for stamp mills, but its tendency to crystallize and break, the high cost of manufacture, and its lesser strength have led to its replacement by steel. Bessemer steel, of the so-called "mild grades," is sufficiently tough and ductile to be suitable for use as shafting. It is now the most widely used material for this purpose. Openhearth steel is more uniform and reliable than bessemer steel, and is often specified for important parts of certain machines, such as spindles for machine tools and armature and engine shafts. In the case of automobiles and marine engines, where great strength and toughness are desired, special alloy steels, such as those containing nickel, tungsten, manganese, chromium or vanadium, are used. These alloys are more expensive than common grades of steel, and, though stronger, they have no greater rigidity.

Classified according to the method of manufacture, shafting is known either as cold-rolled or turned. Turned shafting is made by rolling the hot steel ingot to a diameter about $\frac{1}{16}$ in. larger than that of the finished shaft. It is then placed in a lathe, turned down and polished to exact size. Large shafts are forged from an ingot and then finished by turning. Turned shafting is used for high-grade machinery, where great accuracy of size is required. In the cold-rolling process, the hot ingot is first rolled in the manner just described, after which it is treated with acid to remove the adhering scale. It is then passed cold through special rolls under heavy pressure. No scale is formed by this cold rolling. The finished shaft has a bright, smooth, and hard surface and is accurate in diameter. The elastic limit and ultimate strength of the steel are increased, but its ductility is decreased. Most of the shafting used for power-transmitting purposes is made by this process. The sizes carried in stock by manufacturers range from $\frac{3}{16}$-in. to 5-in. diameter by increments of $\frac{1}{16}$ in., and in lengths from 1 to 24 ft., the larger sizes being made to order.

The weight of steel shafting may be calculated with sufficient exactness for all practical purposes by the formula:

$$W = 2.67\ d^2\ L \qquad (1)$$

Where, W = weight in pounds.
d = diameter in inches.
L = length in feet.

Wrought-iron shafting averages in weight about 2% lighter than steel.

Shafting may be subjected, depending upon its use to simple bending, simple twisting, combined bending and twisting, or combined twisting and compression. In instances of simple bending (without twisting) the shaf may revolve, as in the case of a car axle; or it may be stationary, as when used as the shaft for a crane or hoisting drum. If the external and internal bending moments are equated and reduced to the lowest terms the following formula for simple bending is obtained

$$d^3 = \frac{10.2\ M}{S} \qquad (2$$

Where, d = diameter in inches.
M = external bending moment in inch-pounds
S = safe unit bending stress in pounds per square inch.

Mild steel used for shafting has an elastic limit o approximately 35,000 lb. per sq.in. Using a factor o safety of from 5 to 10, the value of S would range from 7000 to 3500 lb. per sq.in. For calculating the deflec tion of such a shaft, the coefficient of elasticity, E, i taken as 29,000,000, and the deflections are determined in the same manner as for round beams.

A long shaft carrying a pulley at each end, or with several pulleys close to bearings, is often considered a being subjected to simple twisting only. Though thi assumption may be safe enough for light loads, shaft transmitting large amounts of power and carrying larg pulleys should be designed to withstand both twisting nd bending stresses. For round shafts, considering wisting only, the following formula applies:

---

*Professor of Mining, University of Utah, Salt Lake City

$$T = P \times R = M_t = \frac{3.1416\, d^3\, S_t}{16} \text{ or } d^3 = \frac{5.1\, T}{S_t} \qquad (3)$$

Where, T = applied twisting moment in inch-pounds.
P = load in pounds applied at end of arm R.
R = length of lever arm in inches.
M_t = internal torsional or twisting moment in inch-pounds.
S_t = safe unit shearing stress in pounds per square inch.
d = diameter of shaft in inches.

xpressing T in terms of horsepower, hp., and revolu ions per minute, n,

$$T = \frac{63{,}030\, hp.}{n} \qquad (4)$$

nd substituting in (3),

$$d^3 = \frac{321{,}000\, hp.}{n\, S_t} \qquad (5)$$

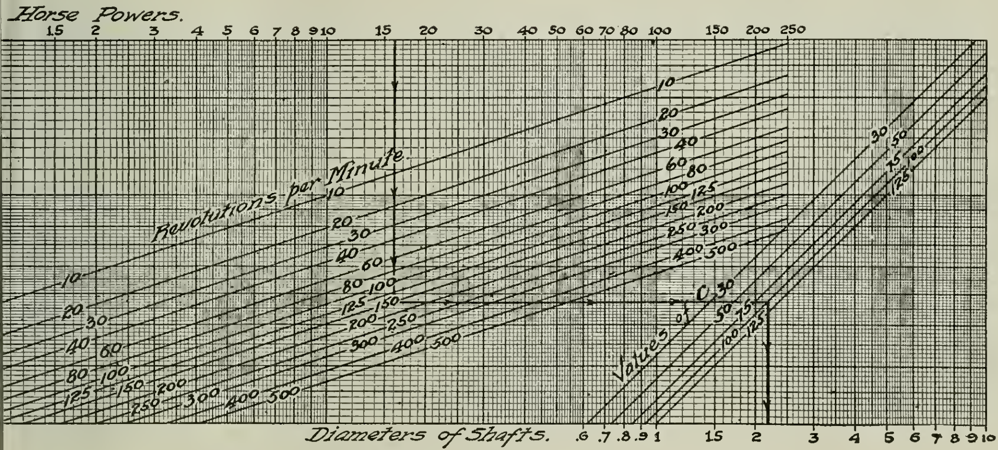


CHART 1. SHAFT DIAMETERS FOR GIVEN HORSEPOWERS AND SPEEDS

Practical experience has indicated how this formula ay be modified to apply to shafting that is working nder different conditions of operation. Several manu cturers recommend the values of S_t given below.

For well-supported head shafts, carrying main driv g pulleys, sheaves, or gears, and transmitting heavy ads, $S_t = 2600$ and

$$d^3 = \frac{125\, hp.}{n} \qquad (6)$$

For regular line shafts, supported on bearings every ft., $S_t = 4300$ and

$$d^3 = \frac{75\, hp.}{n} \qquad (7)$$

For light-duty line shafts supported on bearings every to 10 ft., $S_t = 6400$ and

$$d^3 = \frac{50\, hp.}{n} \qquad (8)$$

Different designers will use other values of S_t than ose given above, in accord with the refinement of cal lation that they wish to make, but the values stated e conservative rather than otherwise. Chart 1, taken m the catalog of the Robins Conveying Belt Co., ves a quick graphic solution of the problem for a number of values of C, corresponding to 125, 75, and 50 in the equations stated. The solution given is for 16 hp. at 150 r.p.m., and shows that for $C = 100$, a $2\frac{3}{16}$-in. shaft would be required. The diameter of shafting is always given in the nearest sixteenth of an inch.

Though shafts may be strong enough for the work they are to do, they may not have sufficient torsional stiffness to prevent considerable twisting or winding up of the shafts around their own axes. This is of no practical importance for the common conditions of power transmission, but it is of importance in the case of machine tools which are doing careful work, as there must be no lagging in the operation of the machine. Several authorities state that the angular deflection should not be permitted to exceed 0.08° per ft. of length of shaft. The requisite stiffness is obtained by using the following formula to design the shaft diameter.

$$d = 4.6 \sqrt[4]{\frac{hp.}{n}} \qquad (9)$$

The torsional deflection of any shaft may be found by the formula:

$$\theta = \frac{584\, T\, L}{d^4\, E_t} \qquad (9a)$$

Where
L = length in inches of shaft.
d = diameter of shaft in inches.
T = twisting moment in inch-pounds.
θ = angle of deflection in degrees.
E_t = torsional coefficient of elasticity, commonly taken as 12,000,000.

In case a shaft carries large pulleys or gears, its strength in regard to bending should be investigated. Formula (6) will give a diameter that is sufficiently safe for nearly all cases, but for extra heavy loads it is necessary to take both twisting and bending moments into consideration. There are several formulas in use which combine these two moments. A convenient one, especially in the graphic form shown in Chart 2, is given by J. H. Barr[1]. The bending and twisting moments are combined into a single moment called the equivalent twisting moment. This moment is considered as causing the same unit stress in the shaft as would be set up by the separate bending and twisting moments acting together.

---

[1] *American Machinist,* June 11, 1908.

$$M_e = M + \sqrt{M^2 + M_t^2} \qquad (10)$$

Where

M_e = equivalent twisting moment.
M. = applied bending moment.
M_t = applied twisting moment.

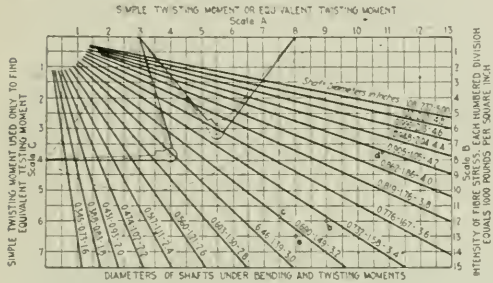


CHART 2. DIAMETERS OF SHAFTS UNDER BENDING AND TWISTING MOMENTS

The equivalent twisting moment, M_e, can now be substituted for either M_t or T in one of the forms of Equation (3), and, assuming a value for S_t, the equation can be solved for the value of d. As T and M_t have the same numerical value, Equation (4) gives the value of M_t, and the applied bending moment, M, must be found by calculations to be explained later. Chart 2 may be utilized in several ways, as follows:

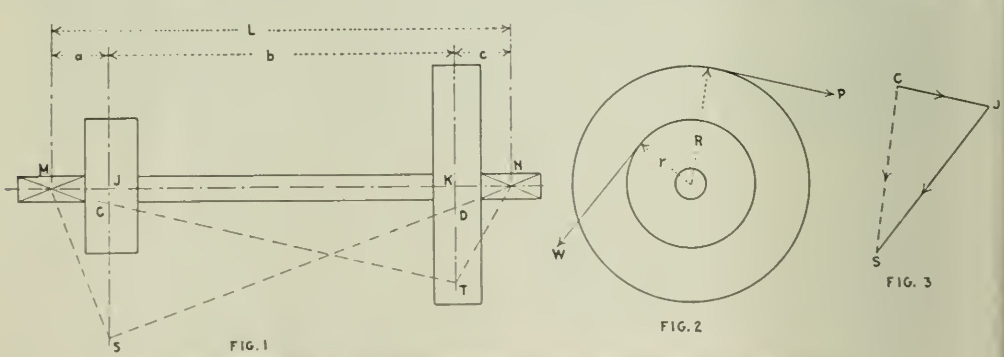


FIG. 1 FIG. 2 FIG. 3

DIAGRAMMATIC METHOD OF DETERMINING BENDING MOMENTS OF SHAFTING

Scale B always has the same value for each division. namely 1000 lb. per sq.in. Scales A and C must each have the same value per division, but this value may vary with conditions, being 100, 1000, or 10,000, as the case demands. Thus, the readings on scales A and C for the first position of the compasses may be 300 and 400, 3000 and 4000, or 30,000 and 40,000 respectively. The three sets of shaft diameters given on the diagonal lines correspond with the low, medium, or high values taken for the scale divisions. The range of the chart may be increased by taking the divisions as equal to 100,000 or 1,000,000 inch-pounds. Then the lowest and intermediate values of shaft diameters should be multiplied by 10 to give corresponding results.

1. To find the required diameter of a shaft for a given twisting moment and fiber stress: Erect perpendiculars from scales A and B at the points corresponding to the given values and find their intersection. If this comes on a diagonal, the required shaft diameter is given at once. If the point does not fall on a diagonal, the required diameter may be found by interpolation.

2. To find the intensity of stress for a given shaft and twisting moment: From the given twisting moment on Scale A, drop a perpendicular to the diagonal or interpolated point for the given size of shaft. Then pass horizontally to cut Scale B. This point gives the desired intensity of fiber stress.

3. To find the twisting moment that will produce a given fiber stress in a shaft of a given diameter: From the fiber stress on Scale B pass horizontally to the diagonal, or interpolated point, of the given shaft diameter. Then go vertically to cut Scale A. This point gives the desired twisting moment. Use the proper value of scale divisions according to the size of shaft given.

4. To find the required diameter of a shaft for a given bending moment and intensity of fiber stress: Multiply the bending moment by 2, use this result to enter Scale A, and proceed as under 1.

5. To find the intensity of fiber stress in a shaft of given diameter under a given bending moment: Multiply the bending moment by 2 and proceed as under 2, above.

6. To find the bending moment in a shaft of given diameter when the fiber stress is known: Proceed as under 3, above. Divide the moment thus found by 2 and the result gives the desired bending moment.

7. To find the diameter of a shaft for combined bending and twisting moments: Lay out the bending moment on Scale A as outlined for the twisting moment under 1. Lay out the twisting moment on Scale C, using the same value per division. Set compasses or dividers to the length between these points (3-4 on the chart) and pivot the dividers on Scale A to cut a new point further out on this scale, as at 8. This gives the value of the combined moments. Then proceed as under 1.

8. To find the fiber stress for a given shaft acted upon by combined bending and twisting moments: Find the equivalent moment as under 7. Then find the fiber stress as outlined under 2.

A method of determining the bending moment for a shaft is as follows:

In Fig. 1 a shaft is supported by bearings at M and

N and carries two pulleys. The directions of the pull of the belting are shown in Fig. 2. The horsepower and number of revolutions per minute for each pulley being known, it appears that from (4) $T = 63{,}030 \frac{hp.}{n}$ and from (3) $T = M_t = P \times R = W \times r$, ($W \times r$ will be less than $P \times R$ if all the power applied at P is not taken off at W, but, in any case, the actual horsepower transmitted by the smaller pulley is known), from which the values of P and W are easily found. But P and W are the net belt pulls. If T_1 is the total tension in the tight side of a belt, and T_2 is the total tension in the slack side of the belt, the net pull is $T_1 - T_2$. Now, the total pull exerted on the shaft by the belt is obviously $T_1 + T_2$ and this is much greater than the net pull. Without discussing here the question of belts, the average relation between the tensions in usual cases of power transmission has been given as $T_1 = 2T_2$, which makes $T_1 + T_2 = 3$ times the net pull. Therefore P and W should be multiplied by 3 to get the total pull causing deflection of the shaft. The relation between tensions is meant to be an average figure, and it is not intended that this value should be considered as a fixed and invariable one. However, it will give a more reasonable diameter of shaft than if the net pull is used in the designing.

The bending moments caused by these forces should be calculated by the formulas for the bending moments for beams which are to be found in nearly all engineering handbooks. The most complete set of tables is published in *Machinery's* Handbook and deserves special mention because of its completeness. The general expression for the maximum bending moment caused by a single load is $M = \frac{W a b}{L}$, where W is the load in pounds, a and b are the distances from load to supports, and L is the span, expressed in inches. For the two pulleys, then, $\frac{W \times a \times (b + c)}{L}$ and $\frac{P \times c \times (a + b)}{L}$ represent the maximum bending moments. Construct the moment diagram for each pulley by laying off *J-S* and *K-T* perpendicular to the axis of the shaft and representing the value of the bending moments to some convenient scale. Connect the points S and T with the bearings M and N. The span of the shaft is measured to the center of the bearings. Then, *M-S-N* is the moment diagram for the smaller pulley due to W, and *N-T-M* is the moment diagram for the larger pulley due to P. Also, *J-C* and *K-D* are the moments caused at the center of one pulley by the force acting upon the other pulley, and the total moment at each pulley is the sum of its own moment and the moment caused by the other pulley. It is evident that the greater combined moment is at the smaller pulley, but these moments cannot be directly added, as their lines of action differ in direction. They must be combined by vector addition. In Fig. 3, *J-C* and *J-S* are the two moments, drawn to scale and parallel to the forces P and W. Their geometrical sum in magnitude and direction is *C-S*. (To avoid possible confusion, it should be noted that this *C-S* is not the same as the distance *C-S* in Fig. 1.) This bending moment is now combined with the applied twisting moment due to P in the manner explained under 7 for Chart 2.

To prevent excessive vibration, the limit of lateral deflection is often placed at 0.01 in. per ft. of shaft. The handbooks, referred to above, give formulas for calculating deflections. For shafting, the value of the coefficient of elasticity for bending should be taken at 29,000,000 and the moment of inertia, I, is $0.0491\ d^4$. The deflection curve for each pulley should be plotted, and the two deflections should then be combined by vector addition in the same manner as explained for bending moments. If the total calculated deflection is greater than 0.01 in. per ft. of shaft, the diameter must be increased. To minimize bending stresses, pulleys should be placed as close as possible to the bearings.

The effect of keyseats in a shaft has been studied by Prof. H. F. Moore[2], who found that the ultimate strength of a shaft with keyseats is practically the same as for a solid shaft, irrespective of the length of the keyseats, but the elastic strength of a shaft with keyseats is noticeably affected. He proposes the following formula:

$$k = 1.0 + 0.4w + 0.7h. \qquad (11)$$

Where

k = ratio of angle of twist of a shaft with keyways to angle of twist of a similar shaft without keyways.

w = width of keyway divided by diameter of shaft.

h = depth of keyway divided by diameter of shaft.

In general, keyways are about one-quarter of the diameter of the shaft in width, and their depth is from five-eighths to three-quarters of the width.

Keyseating tends to spring a shaft out of line, and this is especially true for cold-rolled shafting, which has a tough outer skin. Manufacturers usually straighten all shafts up to 6-in. diameter after keyseating. Larger sizes are keyseated and then turned to size. Shafting can be straightened by bending slightly, over a support, in a direction opposite to that in which the shaft is sprung, and then striking with a sledge on the upper part of the shaft. This stretches the metal and straightens the shaft. The striking must be carefully controlled, as it can easily be overdone. To protect the surface of the shaft from injury, the blows of the sledge may be made to fall on a piece of metal, of proper curvature, placed on the shaft.

The power lost through friction in bearings cannot be satisfactorily estimated by any formula. Kent[3] states that the friction loss in line shafts ranges from 3.3 to 11.4%, with 5% as an average. Published data from tests show losses ranging from 40 to 75%. These large losses occur in factories having long lines of shafting driven by a single prime mover. Tight belts throw an undue strain on bearings, and the settling of hangers throws a shaft out of alignment. Such conditions are doubtless the cause of a large part of the losses just mentioned. The use of individual drives has greatly reduced the length of shafting driven by a single prime mover, and for shafting that is kept in good alignment and making use of ring oiling bearings, the frictional losses should not exceed the figures given by Kent. Practically no data have been published on the subject of friction loss in shafting in milling plants, but this would seem to be an interesting question.

NOTES ON BELTING

In Fig. 4, let the belt be running in the direction indicated, and let T_1 be the total tension in the tight or driving side and T_2 be the tension in the slack side of the belt. Then the net effective tension for transmitting power is

---

[2] *Bulletin* 42, University of Illinois Experiment Station.

[3] "Mechanical Engineer's Pocket Book."

$$T = T_1 - T_2 \tag{12}$$

For a belt at rest the tension is considered to be uniform throughout the length of the belt and is called the initial tension, T_0.

The early conception of the operation of belts was that the sum of the tensions T_1 and T_2 remained constant at all speeds, and the following formula for the relation of these tensions was derived,

$$T_1/T_2 = 10^{0.00758 f a} \tag{13}$$

where,

f = the coëfficient of friction.

a = angle of contact in degrees of belt on smaller pulley.

It was found by sliding a leather belt over stationary pulleys that the coefficient of leather on iron was approximately 0.42. Under these conditions the problem of belt design appeared to be simple. The horsepower to be transmitted being known, the net or effective pull could be found from equations (3) and (4). The values of f and a were calculated and substituted in Equation (13). Then from Equation (12) the values of T_1 and T_2 could be found. The breaking strength of belt material was known, and by using a reasonable factor of safety it was possible to determine the maximum tension, T_1, to which a belt should be subjected. However, experiments by Lewis and Bancroft upset all previously accepted ideas in regard to belting by proving that the sum of the tensions, T_1 and T_2, did not remain constant, but changed with the condition of the belt and pulley surfaces, the speed and slip of the belt, until, as one writer stated, the coefficient of friction f might as well be considered as ∞, because it was such a variable quantity.

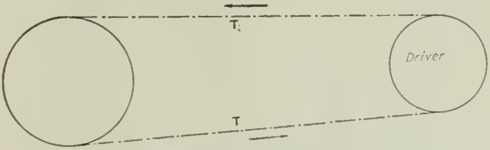


FIG. 4. DIAGRAM SHOWING DIRECTION OF BELT DRIVE AND TENSIONS

F. W. Taylor[5] carried on a series of experiments with belts in machine shops. His work covered a period of about nine years, and had for its object the securing of the longest economic service from belts by running them under carefully regulated tensions and standardizing conditions of upkeep and repair. Belts were put on pulleys under definite initial tension by means of spring balance clamps, and were retightened to the original tension whenever they stretched so that they began to wave or flap or showed signs of slipping.

Consider a belt under an initial tension T_0. As soon as the belt moves and power is transmitted, the tension in the tight side of the belt increases while that in the slack side decreases, until the difference—the net or effective pull—is sufficient to transmit the desired horsepower. It is evident that the tension in the tight side of the belt may be much greater than the initial tension, T_0, and that T_1 is greater than the effective pull by T_2. Depending upon the value of T_1 the unit stress in the tight side of the belt may become dangerously great, if the belt is designed only for withstanding the net or effective pull. Obviously, a formula for computing the horsepower of belting of the form

$$hp. = \frac{\text{effective pull in lb.} \times \text{speed of belt in ft. per min.}}{33{,}000}$$

gives no information about the maximum stress to which a belt may be subjected. If modified to the form

$$hp. = \frac{\text{width of belt in in.} \times \text{thickness in in.} \times \text{safe pull per sq. in. of belt} \times \text{speed of belt}}{33{,}000}$$

there is still no way of showing to what value T_1 might attain. The only certain point is that a belt so designed will be under more than a safe stress. A number of formulas of this kind are in use. They are almost entirely empirical in nature and some give widely divergent answers.

Taylor used the records of initial tension, power transmitted, and life of belts as data for calculating the approximate working tensions to which the belts had been subjected, and he then formulated certain recommendations for installing leather belts. He suggests from 4000 to 4500 ft. per min. as the best speeds for belts. The distance between shafts should be from 20 to 25 ft. Not less than a 12-in. pulley should be used for double belts. The minimum pulley diameters for triple and quadruple belts should be 20 and 30 in., respectively. A double leather belt should be under an initial tension of 71 lb. per in. of width. With an arc of contact of 180°, this tension will give an effective pull of about 35 lb. per in. of width of belt. As a general rule, a double belt 1 in. wide should run at a speed of 950 ft. per min. to transmit 1 hp. Such a rule required the use of heavier and, therefore, more expensive belts than would be used under the old empirical formulas. Whether a belt is to give the longest possible life with the minimum of repairs, or is to be operated under the maximum stress that it can bear, is a problem that the designer must solve in accordance with the conditions imposed. The first condition involves high first cost but minimum cost for repairs and renewals; the second, least first cost for belting, but high cost for repairs and renewals.

C. G. Barth[6] has made a careful study of the work of former writers on belting, and has proposed formulas and rules for designing leather belts. He gives an extensive mathematical analysis of the question, starting with Formula 13 as a basis for calculations. However, he has to make several assumptions in order to reach his conclusions. The coefficient of friction is considered to vary with the belt speed, or

$$f = 0.54 - \frac{140}{500 - V} \tag{14}$$

where V is the belt speed in ft. per min. He states that leather is an elastic material, and recognizes the modifying effect on the tensions that centrifugal force exerts in a belt traveling at high speed. Thus

$$T_c = \frac{w}{300\,g} V^2 \tag{15}$$

where

T_c = loss in effective tension per sq.in. of belt cross-section.

w = weight in lb. of 1 cu.in. of leather.

g = 32.2, acceleration due to gravity.

V = velocity of belt in feet per minute.

---

[4] Rankine's "Machinery and Mill Works," p. 351

[5] "Notes on Belting." *Trans.* Am. Soc. Mech. Engs., Vol. 15, p 201

[6] "The Transmission of Power by Leather Belting," *Trans.* Am Soc Mech. Engs Vol 31, p 29

The effect of centrifugal force is to lessen the effective tension in a belt: consequently, no advantage is to be gained from running belts at speeds greater than about 4500 ft. per minute.

Equation 13 now becomes

$$\frac{T_1 - T_c}{T_2 - T_c} = 10^{0.000758fa} \qquad (16)$$

His further assumptions are that, for a belt driving a machine, the minimum initial tension must be such that, when a belt is doing its maximum amount of work, the sum of the tension in the tight side of the belt and one-half that in the slack side should equal 240 lb. per sq.in. of cross-section for all speeds. For countershafts, where it is not convenient to retighten belts often, the sum of the tensions should be 160 lb. Also, the maximum initial tension to which a belt should be retightened as often as it drops to a minimum, as defined above, should be 320 lb. for a machine belt and 240 lb. for a countershaft belt.

Mr. Barth has constructed an elaborate chart for the solution of belt problems, from which the following table is derived.

TABLE I. BELT FUNCTIONS DERIVED FROM CHART

	Machine Belts $T_1 + \frac{1}{2} T_2$ = 240 Pounds						Countershaft Belts $T_1 + \frac{1}{2} T_2$ = 160 Pounds					
V	500	1000	2000	3000	4000	5000	500	1000	2000	3000	4000	5000
T_0	124	120	121	128	136	144	82	81	83	89	96	102
T_c	....	3	13	31	56	86	....	....	....	....	....	....
T_1	210	212	211	207	198	187	140	141	140	134	125	114
T_2	60	54	57	68	84	107	40	38	41	53	69	92
$T_1 - T_2$	150	158	154	139	114	80	100	103	99	81	56	22
$T_1 + T_2$	270	268	269	274	282	294	180	179	181	187	194	206
Horsepower per sq.in. of section	2.27	4.79	9.33	12.64	13.8	12.1	1.51	3.12	6.04	7.36	6.79	3.33

As the data are for 1 sq.in. of belting, the total cross-sectional area of a belt is found by dividing the required horsepower of the belt by the horsepower transmitted per square inch of section, as stated in the table. The thickness of the belt is decided upon, and the width is then computed from the sectional area.

A mathematical analysis of the power of belting cannot be made without the aid of some such assumptions as have been given. These assumptions are reasonable averages based upon recorded experience with belts, and the rules derived go far toward placing the question of belt circulations on a more rational footing than when purely empirical formulas are used for designing belts.

C. J. Morrison[7] states that experience with thousands of leather belts over a period of several years in different factories indicates that the simple formula given below is entirely satisfactory for designing belts. Two constants must be known: the square feet of belting passing over the pulley in a minute and the speed of the belt in feet per minute. These constants are 80 and 3000, respectively, for double belts, and 160 and 3000 for single belts. Then

$$W = \frac{F \times hp. \times 180}{V \times \theta} \qquad (17)$$

where

W = width of belt in feet.

$hp.$ = horsepower transmitted.

F = square feet of belt passing over pulley per minute.

V = speed of belt in feet per minute.

θ = arc of contact in degrees of belt on smaller pulley.

The assumption that the formula makes regarding the angle of contact is not strictly correct, but it has less variation from correct results than there is variation in the manufacture of belts. The best belt speed is 3000 ft. per min. The following formula may be used to find the arc of contact on the smaller pulley, when the pulley diameters and distance between centers are known:

$$\theta = 180 - 115\,\frac{(r_1 - r_2)}{c} \qquad (18)$$

where

θ = arc of contact in degrees.

r_1 = radius of larger pulley in inches.

r_2 = radius of smaller pulley in inches.

c = distance between centers in inches.

The proper initial tension for belts is obtained by shortening the exact measured length by 1 in. for each 10 ft. of length. The width of pulleys for straight belts up to 16 in. wide should be 25% greater than that of the belt, for wider belts from 15 to 25% greater, and for crossed belts 30 to 35% greater. However, these widths will be considered extreme by those who have been accustomed to use pulleys only one or two inches wider than belts and have found such pulleys to give satisfactory service. Pulleys should be crowned uniformly with a well-rounded top, to prevent shifting of the belt across the pulley face. The usual crowning is from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. per ft. of width.

The best leather for belts is cut from the central part of the hide. Pieces should not be more than 4½ ft. long, as a greater length would include the neck of the hide, a part that stretches easily and does not make good belts. The strips are sewed, cemented, or riveted together to make a belt of requisite thickness and width. Hides are tanned in different ways, the two most common being the oak-tan and the chrome-tan processes. Chrome-tanned leather is to be recommended where there is danger of the belt coming in contact with steam or moisture. Oak-tanned leather is for indoor use, where the belt is protected from both water and steam. The chrome-tan process is more or less secret, but produces a leather that is very durable, because the fibrous structure of the leather is preserved in unweakened condition. Leutwiler[8] states that the ultimate strength of oak-tanned leather ranges from 3000 to 6000 lb. per sq.in., according to grade, but that the ultimate strength of chrome-tanned leather varies from 7500 to 12,000 lb. per square inch.

The average weight of leather belting is about 0.035 lb. per sq.in. First-class leather belts should show a tensile strength of not less than 4200 lb. per sq.in. of leather or at splice. The elongation should not be more than 12.5% in 2 inches, 1 in. on each side of break, or less than 8% elongation at breaking strain. When at full length a leather belt should lie flat on the floor with practically no curvature; otherwise the belt will not run true on the pulleys. Belts should be well stretched before using, so that they will not require taking up every few days after they are first put on the pulleys.

---

[7] "Belts, Their Selection and Care," *Engineering Magazine*, July 1916.

[8] O. A. Leutwiler, "Machine Design."

Leather belts are classified as single, double, triple, and quadruple, according to their variation in thickness as compared with that of a single hide. There are graduations in each class, as is shown in Table II, which gives the thickness and weight of the different grades.

TABLE II. THICKNESS AND WEIGHTS OF DIFFERENT GRADES OF BELTS.

Weight, oz. per Sq. Ft.	Thickness in Inches.	Weight, oz. per Sq. Ft.	Thickness in Inches
Single		Triple	
9	1/8	35	15/32
12	5/32	37	1/2
14(a)	3/16	40(a)	17/32
16(a)	7/32	42(a)	9/16
19	1/4	44(a)	19/32
		47	5/8
Double		Quadruple	
21	9/32	49	21/32
23	5/16	51	11/16
26(a)	11/32	54(a)	23/32
28(a)	3/8	56(a)	3/4
30(a)	13/32	58(a)	25/32
33	7/16	61	13/16
		63	27/32

(a) Common commercial sizes.

A common formula for the horsepower of belts is

$$hp. = \frac{P \times n \times d \times w}{130{,}000 \times K} \tag{19}$$

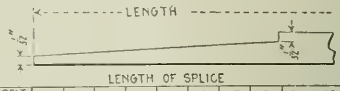
where

$P =$ effective pull per inch of width of belt.
$n =$ r.p.m. of pulley.
$d =$ diameter of smaller pulley in inches.
$w =$ width of belt in inches.
$K =$ constant depending upon arc of contact on smaller pulley.

Arc of contact	90°	112.5°	120°	135°	150°	157.5°	180°
Value of K	2.21	1.72	1.6	1.4	1.24	1.17	1

The weakness of Formula (19) lies in its disregard of the value of the maximum tension, T_1, to which a belt is subjected. In order to use the rule and then not have the belt under a dangerously high stress, some approximation of the ratio $\frac{T_1}{T_2}$ must be had. Several writers give an average value of 2 to the ratio, where small pulleys, say 12-in. diameter, are used, and an average value of 3 where pulleys 24 in. or more in diameter are used. In all cases the two pulleys should be nearly of the same diameter. A wet belt, a very loose belt, or one that is oily will have a ratio entirely different from these values. After calculating the effective pull, P, the maximum tension, T_1, can be obtained by assigning a definite value to the ratio $\frac{L_2}{T_1}$, and the belt should be designed to safely carry the maximum tension.

Various methods of splicing leather belts are in use, such as cementing, copper rivets, rawhide lacing, wire lacing, and metallic belt hooks. When properly done, cementing gives the most satisfactory and strongest splice; in fact, the splice should be as strong as the belt itself. The laps of the splice should be beveled, as shown in an accompanying sketch (Fig. 5). The taper should be regular and is best made with a plane. Dress the belt to a feather edge, and then square the ends. Clean the laps well with gasoline before splicing. After joining, any projecting points are scraped smooth. A good cement is made by adding one pint of high-grade gasoline, 72° Bé. (poor gasoline containing kerosene will spoil the glue) to 1 gal. of melted fish or cabinet glue. Another cement is made by soaking equal weights of common glue and isinglass in water for 10 hours. Bring to a boil and add pure tannin until the mixture has the appearance of white of egg. Both cements should be applied hot, at about 212° F., or the temperature of boiling water. Place the belt over pulleys and bring the ends together by means of belt clamps. For small belts, the laps, after coating them with cement, can be pressed together between two boards lined with paper to keep the belt from sticking. For wide belts the laps are generally hammered together. Leave for three or four hours between the boards, and do not put belt under tension for at least five hours after cementing. If the belt is spliced and then run onto pulleys, as is sometimes done, undue strain is brought on the joint, and it may break. Belts should be run with the hair or dressed side next to the pulleys.



WIDTH OF BELT IN INCHES	1	2	3	4	5	6	7	8	9 to 18	Over 18
LAP IN INCHES	5	5	6	6	7	8	8	9	Width	18

FIG. 5. RATIOS USED IN BEVELING BELTS

Wire lacing, either hand or machine, makes a satisfactory joint, but this method of splicing is prohibited in some states. Rawhide lacing should be started at the middle of the belt. The two ends should be kept in line and the same tension used on both sides. The lacing should not be crossed on the pulley side. The holes should be punched in the belt. A No. 6 punch is commonly used for this work. Two rows of holes are punched, and the holes of one row are placed back of the spaces between the holes of the other row.

TABLE III. SPACING DATA FOR PUNCHING HOLES IN BELTS
(In Inches)

Belt Width	Diameter of Hole	Size of Lace	Distance From End to First Row; Also Between Rows	Distance From Side to First Hole	Space Between Holes
3	5/32	1/4	1/2	3/8	3/4
3 to 6	3/16	3/8	3/4	3/8	1 to 1 1/4
6 to 12	1/4	3/8	1	1/2	1 1/2
Over 12	5/16	1/2	1 1/4	1	1 3/4

Leather belts should be cleaned and dressed every five or six months to keep them in good condition. An excellent dressing is a mixture of equal parts by weight of good fish oil (cod liver) and melted tallow. Apply to pulley side of belt, after cleaning, and wipe well with a soft cloth.

Rubber belting is made by placing together several layers or plies of duck which have been coated with rubber composition or "friction," and then running the whole through a vulcanizing press, the heat and pressure forming a solid belt. The best grade of belt is made from 32-oz. duck. Cheaper grades are made from 30-oz. and 28-oz. duck. The weight of rubber belting is about 0.045 lb. per cu.in. Standard widths range from 1 to 60 in. A 12-in. belt weighs about 1⅜ lb. per sq.ft. Standard thicknesses are from 2 to 8 plies. Thicker belts are made to order. For 30-oz. duck the thickness of belts is approximately as follows:

Plies	3	4	5	6	7	8
Thickness of belt, in inches	3/16	15/64	19/64	11/32	13/32	29/64

As a rough rule, belt thickness is $\frac{1}{16}$ in. per ply. A 3- or 4-ply rubber belt is equivalent to single leather belt; a 5- or 6-ply rubber belt to a double leather belt, and a 7- or 8-ply rubber belt to a triple leather belt.

A number of formulas for proportioning rubber belts are in use, and they give markedly divergent results. Only two will be stated here. They are proposed by the B. F. Goodrich Co. The first is based upon the assumption that a 4-ply rubber belt 1 in. wide and traveling at a speed of 800 ft. per min. will transmit 1 hp. For a ratio of tensions of $\frac{T_1}{T_2} = 2$, the maximum tension in such a belt is 82.5 lb. Dividing by 4, the number of plies in the belt, the tension is found to be 20.6 lb. per ply. As the duck generally used in these belts has a tensile strength of from 300 to 350 lb. per ply per inch of width, the rule gives a factor of safety of from 12 to 15. In more general terms the formula becomes

$$hp. = \frac{V \times w \times p}{3200} \qquad (20)$$

where

$hp.$ = horsepower transmitted.
V = speed in feet per minute.
w = width of belt in inches.
p = number of plies.

The second formula, shown in the form of a chart (Chart 3), indicates results that are less conservative than those found by the first formula. Belts designed by the chart will have, in general, one or two fewer plies than the number given by Formula (20). When all points are considered, the first formula gives the more economical belt for the mill man to use. To solve a problem by the chart: Begin at the left margin with the width of belt, pass horizontally to the curved line of horsepower, then either up or down to intersect the diagonal line corresponding to the desired speed, then again to the right. On the margin is the scale giving the proper number of plies. Select the next larger whole number of plies whenever a fractional number of plies is indicated.

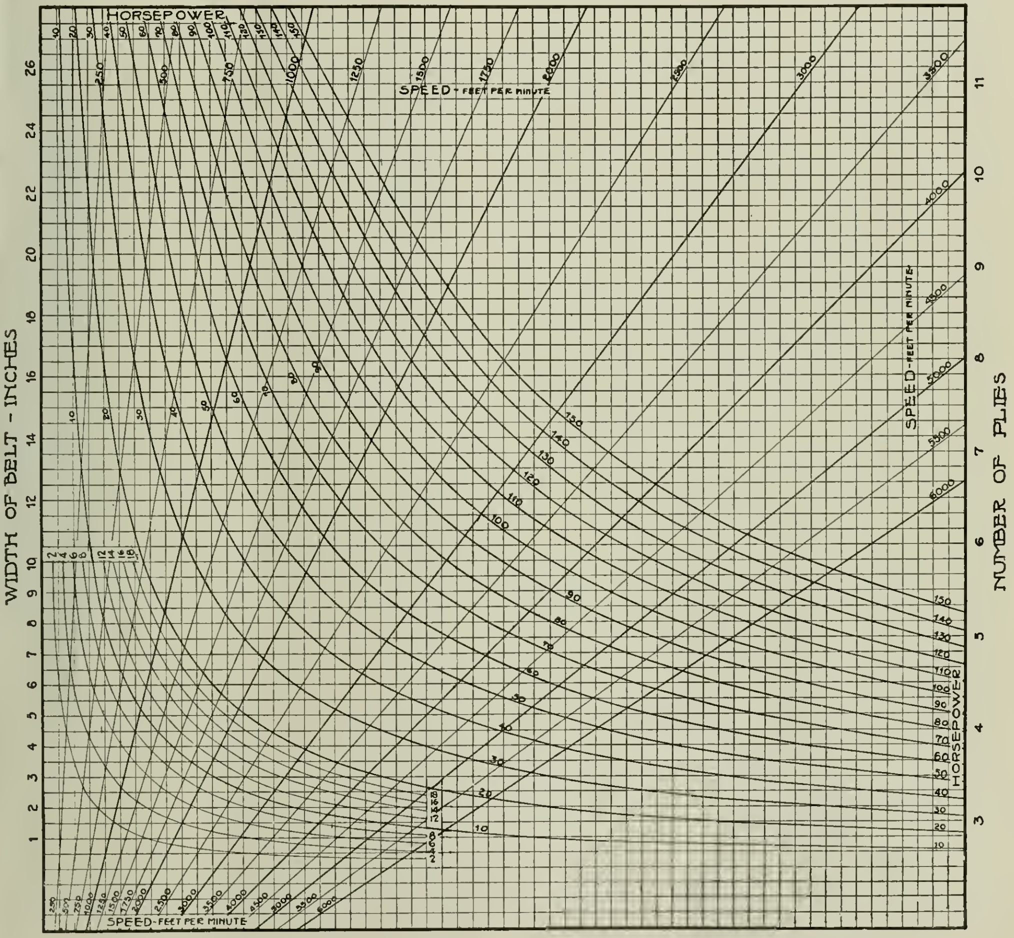


CHART 3. HORSEPOWERS, SPEEDS, WIDTHS, AND NUMBER OF PLIES OB BELTS

Rubber belting stretches less than other kinds of belting. To get the proper initial tension for a belt, shorten the exact measured length as follows:

For 3-, 4-, and 5-ply belts, shorten measured length by $\frac{5}{32}$ in. per ft. of length.

For 6-, 7-, and 8-ply belts, shorten measured length by $\frac{1}{8}$ in. per ft of length.

For 9- and 10-ply belts, shorten measured length by $\frac{3}{32}$ in. per ft. of length.

The most common method of splicing rubber belts is by means of rawhide lacing or metal belt hooks. A well-made joint should be from four to six times as strong as the working load carried by the belt. The sharp bending of a belt over small pulleys tends to separate the plies and shortens the life of the belt. A reasonable minimum diameter of pulleys for belts of different plies is given herewith.

Plies of belt........	3	4	5	6	7	8	10
Diameter in Inches..	6	12	18	24	30	36	48

Some rubber belts are operated at a speed of 5000 ft. per min. However, a speed of 4000 ft. per min. will give better service, and a speed of 3000 ft. per min. insures a long life for a belt.

Rubber belts require a certain amount of filler to give body to the rubber. This filler is dry and powdery, and, if the belt is run perfectly dry, the face of the belt will become more or less polished and is likely to slip on the pulleys. Whenever this occurs, the belt should be moistened with a little boiled linseed oil. Trade catalogs recommend a dressing made of a mixture of equal parts of red lead, black lead, French yellow, and litharge, mixed with boiled linseed oil and enough japan to make it dry quickly. Should belts require cleaning before the dressing is applied, scrub the belt with soap and water only. Never use gasoline or benzene, as these liquids dissolve rubber. The use of dressings containing rosin, as one manufacturer states, "offers one of the quickest and surest routes to belt destruction." These dressings form lumps on the pulleys, keeping some of the belt surface from touching the pulley, and their stickiness tends to pull apart the plies of the belt. It is not unusual to see a belt so treated become practically a piece of hose.

The evil effects of tight belts cannot be over-emphasized. The great strain on the bearings and pulleys often causes hot boxes, burned belt surfaces, and broken pulleys, in addition to greatly increasing the friction loss of shafting. If a belt is kept in proper condition, is suitably designed for the work it is to do, and is not overloaded, there should be no trouble from slipping.

From Formula (16) it is evident that the effective pull of a belt may be increased in three ways: by direct tightening of the belt, by increasing the angle of contact, or by increasing the coefficient of friction. The first is the method generally used by the practical mill man. Its evil effects have been discussed. The angle of contact can be increased by using idler pulleys. This method is successful, and is employed in many cases with good results, as for instance in the numerous installations of the Lenix short-center belt drive. By the use of two pulleys, the angle of contact on conveyor belt drives is sometimes made as great at 360 degrees.

Statements have been made that an allowance of from 5 to 15% should be made for belt slip in calculating the power transmitted by belting. Prof. W. W. Bird* states that slip should be negligible in a properly designed belt, but that an allowance should be made for belt creep. This is entirely different from slip, and is due to the elasticity of the belt. The belt stretches and shortens in passing from pulley to pulley, owing to the difference in tensions, and moves or creeps on the pulleys in such a way that the driven pulley revolves somewhat more slowly than the driving pulley. The difference in peripheral speed of the pulleys varies. Under ordinary conditions the loss due to creep will not exceed 1%, and a maximum value of 2% is found only in belts that are fairly elastic and operate at a low speed. It should be noted that this loss in speed due to creep is also a loss of power, and is unavoidable as long as the material of the belt possesses elasticity.

Milling and Amalgamation at the Homestake

During 1918, a total of 1,628,630 tons of ore was treated at the plants of the Homestake Mining Co., of an average gold content of $3.63305 per ton. Milling and amalgamation cost $0.3141 per ton, the total amounts being distributed as follows:

Assaying.......	$5,858.47	Quicksilver....	$13,990.92
Coal...........	9,304.84	Refining......	5,624.40
Labor..........	203,390.18	Silver plating	15,021.29
Lumber........	2,218.40	Sundries......	38,896.77
Machinery......	117,188.32	Surveying.....	3,770.08
Oil...........	865.72	Teaming.... .	2,086.00
Electric power..	62,041.99	Water.........	30,306.09
Total.......			$510,563.47

Expenses for repairs and renewals are, doubtless, included under "Machinery," and superintendence and other general expenses under "sundries." The expenditure of $3770.08 for "surveying" is inexplicable.

Use of the Microscope*

For some years the microscope has been the chief means of determining the exact nature of different kinds of ores and rocks. Thin sections, when viewed in polarized light, not only show the mineralogical composition of the ores or rocks but also the order of formation of the different crystals and their relations to each other. Many valuable geological deductions have been made from such information. Strange to say, the value of the application of the microscope to ore dressing has not, until recently, been generally recognized. Even in unskilled hands much can be learned by means of the instrument. The measurement of the size of mineral grains, the size of aperture and diameter of the wire in screens, the degree to which crushing must be carried in order to free the grains of valuable minerals in an ore, the amount and condition of the middling product made by any machine, and the efficiency of sulphide filming for flotation treatment are easy possibilities for the uninitiated.

With a little practice minerals of similar appearance can be differentiated, using the Becke method of finding the refractive index of grains in mineral powders. The examination of polished opaque sections in reflected light may show the presence in the ore of unsuspected minerals. Through the study of the shape of grains after an ore has been crushed the behavior of the ore under the usual conditions of concentration can be predicted with a fair degree of accuracy. A complete mineralogical analysis of the crushed ore or concentrate produced can be made by the use of the microscope combined with a separation of the grains in heavy solutions of different specific gravities.

Time spent in investigation will be well repaid by the increased efficiency of operation that will result from such a study. The advantages of this method of mill control cannot be too strongly urged.

---

*Private communication

*Excerpt, "Milling Calculations," by Robert S. Lewis, *Chemical and Metallurgical Engineering*, Mar. 1, 1919.

Design of Small Metallurgical Mills

BY HERBERT A. MEGRAW*

The design of large and important metallurgical plants has received a maximum amount of study and care, with the object of securing the greatest economy in operation; but smaller mills are usually allowed to take care of themselves, and design has often been a consideration of decidedly secondary importance, in spite of the fact that economy is just as important in the small plant as in the larger one. There are two reasons for this unfortunate condition. First, the small mill is likely to be considered less important because its total cost, both of installation and operation, is small; and, second, because the resources of the small-mill operator are often too slender to permit the employment of capable designers. The equipment of small plants is often bought on a purely price basis, the certain result being high operation and maintenance costs and rapid deterioration.

THE design of a small mill ought to receive just as much study and care as that of a large one. Every detail should be studied with reference to the particular ore to be treated, the local advantages and disadvantages, and the systems of metallurgy selected. If this is done, it will often be found that much of the equipment installed is superfluous; that the flow sheet can be much simplified, and that the resulting plant can be operated with much less labor than when less study is devoted to the problem. Of course, there are instances in which proper care has been given to design of the small mill, but these are so rare as to be exceptions, and they stand out as shining examples of efficiency.

DUPLICATION OF EXISTING PRACTICE OFTEN UNDESIRABLE

Too often the small mill is built to follow a system of ore treatment that has proved successful at some other plant, without due regard to the peculiarities of the ore to be handled. It is so seldom that one ore can be treated in exactly the same manner employed in the treatment of a different one that such a course should never be followed without the most careful consideration. Not only should previous practice be regarded as not necessarily a course to be followed, but each step in any proposed process should be carefully studied with the view of improving upon it, even where the change or improvement means the breaking of an absolutely new trail.

Nobody with ripe experience and sane judgment should hesitate to do something that has not been done before. Of course, experience and judgment are necessary to justify a step that involves a radical departure from established practice, and the advantages and disadvantages ought to be considered from all points of view, metallurgical and mechanical, so that no violations of chemical or physical laws shall be attempted. Every possible simplification should be incorporated in plant design, with the idea of economizing on labor.

Labor costs have reached a point at which they may easily determine the success or failure of a metallurgical enterprise, which, of course, is nothing more than a commercial venture. There is little hope for a lowering of labor costs in the near future, and it is therefore imperative to reduce the labor requirements to the lowest possible point. This applies not only to plant operation, but also to the durability of the equipment employed. Repairs consist largely of labor, whether at the plant or at the factory, so that well-designed and well-constructed machinery will much more than earn its slight additional cost. This applies to every kind of machine and device entering into the equipment of a mill, and should be so considered. Consequently, it will apply to all equipment for any purpose mentioned in this paper, without further specific attention being drawn to that feature.

ROCK BREAKING IN SMALL MILLS

To consider the equipment of a small metallurgical plant in logical sequence, one must begin with the primary rock breaker. All mills require this equipment, but most of the smaller plants purchase almost any breaker that is offered at a low price. The result is excessive power consumption, low capacity, because of faulty design, and high maintenance cost, due to the poor material which must inevitably be used in a cheap machine.

There are, basically, just two types of machine that can be used for rock breaking. One is the Blake or Dodge or jaw type; the other is the gyratory. Both are well known. There are many variations of each, usually known under trade names, but they all depend, basically, upon the principles of one or the other. Each of these has its field. Each is useful where the other cannot economically be employed, but some care is required to select the one most serviceable for the work at hand. To use one where the other is indicated would be a mistake that would lead to excessive cost and low efficiency. Consequently, the factors that lead to the selection of either of the types should receive careful consideration.

The jaw crusher, as is well known, performs its work by compressing and breaking rock between a stationary wall and a moving jaw. In the Dodge type the moving jaw is pivoted at the bottom and has its maximum movement at the top. This gives a constant-discharge opening, with uniform product and small capacity. In the Blake type, the pivot is at the top, or opening, and maximum movement at the bottom, or discharge point. Consequently, the capacity is comparatively large and the product by no means uniform. Another feature of importance is the angle of nip. In the Dodge type of breaker this angle decreases as compression is applied, thus increasing the efficiency. In the Blake type, the angle increases with compression, having a tendency to push the rock out of the machine, and consequently decreasing its efficiency. Dodge-type breakers are rarely used, the larger capacity of machines of the Blake type making them preferred, with or without real reason.

The gyratory crusher breaks rock by the gyrations of a conical crushing head against a stationary wall, forming the outside of an inverted cone. The conical crushing head is fixed on a vertical shaft which has its fixed point at the top and its point of greatest movement at the bottom. The length of the shaft is sufficient to provide a proper leverage for performing the work of rock breaking. The gyratory movement is attained by placing the lower end of the vertical shaft in an eccentric bearing. With this type of machine, the eccentricity is not great; consequently, the angle of nip is practically constant, and the discharged product is much more uniform than with the Blake-type breaker. As the breaker opening is circular, crushing is continuous, not intermittent, and beam action comes into play, preventing the discharge of wide, flat slabs of rock, such as are constantly discharged through the rectangular opening of a jaw crusher. The product of a gyratory is much more uniform and more cubiform than that of either type of jaw crushers.

---

*Metallurgical engineer, 120 Broadway, New York.

Gyratory rock breakers require no more head-room than machines of equivalent output of the jaw type. The vertical shaft must be long enough to provide a crushing head of proper length and to allow for proper leverage, below the head, to apply pressure upon the rock. Disregard of the latter feature, in an effort to lessen the head-room requirements of gyratory breaking machines, has led to the designing of breakers with short shafts, where the power for crushing is applied almost directly to the bearing of the eccentric. Any rock crusher, whether jaw or gyratory, which takes the crushing pressure directly upon a bearing is mechanically wrong and has not taken advantage of the features inherent to the type of the machine.

Selection of Primary Crushing Machine

The selection of a suitable primary crushing machine is important, and its type must depend upon the character of work to be done. The gyratory machine has greater capacity for its weight and power consumption than either of the jaw types. This superiority reaches its maximum with some of the large machines. The accompanying table shows a comparison of some standard sizes of Blake-jaw and gyratory machines having the same opening width.

The selection of a primary crusher, however, will not depend altogether upon the efficiency of the machine, but rather upon the width of opening of the crusher, because, to avoid the expense of sledging, the crusher opening should be large enough to take the largest piece of rock coming from the mine. If the pieces of rock are large, 10 to 13 in., or more, a jaw crusher would be indicated, because a gyratory large enough to take these pieces would have greatly excessive capacity, would be much heavier, consequently costing more, and would require much greater power. In plants where the full capacity of the gyratory can be used, it is a much more economical machine, but in the small mill it is necessary to employ a Blake-jaw breaker for primary reduction.

Following the primary breaker a screening device should be used to remove the material of fineness below that of the product of the secondary crusher. A grizzly is often employed for this service, but is not as effective as a revolving screen, or trommel, and requires continuous attendance. The automatic machine is much cheaper in the long run. It should be used to minimize the work of the secondary crusher.

For the secondary crusher there is no question as to the utility of the gyratory type. The rock has been reduced in size so as to be appropriate for a high-speed gyratory with small opening. This machine can be so selected as to make use of its maximum capacity, keeping it at work continuously. Its product should be appropriate for the succeeding reduction equipment. The great advantage of this step in reduction lies in its ability to deliver a fine product appropriate for, say, ball-tube mill finishing, and doing it at crusher cost, rather than at tube-mill cost. This is economy, because a smaller tube mill, with lower installation and operation cost, will suffice. Ball-tube mill feed should be at least 1-in. cube in size for best results, and if it is delivered at ½-in. size the tube mill will have less work to do and will do it with greater economy. This is a point at which careful study will be repaid in low maintenance costs. Though large-diameter tube mills of great length often have to be used, and may be the most economical equipment for plants of great capacity, they had better be avoided in the small plant, on account of their great cost and large power requirements. In the small plant the desideratum should be to do as much breaking as possible in rock-breaking machines and at rock-breaking cost. Let the fine-grinding machine do as little of this work as can be arranged.

COMPARISON BETWEEN GYRATORY AND JAW CRUSHERS

	Gyratory	Jaw	Gyratory	Jaw	Gyratory	Jaw
Crusher opening, in.	7x52	7x10	15x112	15x30	30x230	30x48
Size of product, in.	2½	2½	2½	4	5	6
Weight of crusher, lb.	10,000	6,000	70,000	39,000	225,000	80,000
Capacity, tons per hour	15	8	100	48	750	95
Horsepower	10	7	53	30	150	1.10
Capacity, tons ÷ weight tons.	3	2.66	2.86	2.5	6.7	2.37
Capacity, tons ÷ horsepower.	1.5	1.14	1.89	1.6	5	0.863

Ball-Tube Mill Is Customary Finishing Machine

Placing the burden of work as far as can be done upon the rock-breaking machines allows a smaller installation of finishing equipment. Usually the finishing device is the ball-tube mill. Rolls, Chilean mills, and other machines are employed, but as the ball-tube mill is by far the most popular, only this will be considered in this discussion. There is good reason for the preference shown for the tube mill. It is a simple device, does not require frequent attention, and can be so adjusted as to deliver a product of almost any maximum fineness. The rate of feed governs the fineness of the discharge, so that heavy feeding provides a coarse discharge, whereas light feeding produces finely ground products. If a very finely ground product be desired, it is usual to use a tube of comparatively great length; a short tube is employed to deliver a coarse discharge. In general, it is best to use the shortest possible tube consistent with proper product, thus reducing the power requirements. A ball-tube mill requires approximately 10 hp. per ton of ball charge to move it, and as the short mill carries fewer balls, a large power saving is effected.

That the discharge from the ball mills may contain the smallest possible amount of material greater in size than desired, the product is usually classified and the oversize returned to the mill for further grinding. Thus, for a coarsely granular product, say between 20 and 60 mesh, it is good practice to use a short mill, 5 or 6 ft. long, and return the oversize. The diameter of the mill depends on the size of the feed to it. For large rock 1½- to 2½-in. cube, mills up to 8-ft. diameter are employed. For material ½- to 1-in. cube, the diameter need not be more than 5 ft. Here, again, the value of the secondary crushing machinery is demonstrated, because a great deal of power and installation cost is saved by feeding fine rock to a smaller ball-tube mill.

The classification of the product of the ball-tube mill is usually performed in hydraulic classifiers, although screens have been used. This point should be the subject of particularly careful study. Screen classification has much in its favor, the principal objection having been the high maintenance cost of the screening machines used. If mechanical devices are available for economically screen-classifying the ball-mill product, a good deal of extra work, and consequently expense, will be avoided. Here is a chance for the small-mill designer, as well as for the designer of the larger mill, to take a progressive step in wet metallurgy.

The design of any mill will, of course, depend upon the system of metallurgy to be used. In the accompanying flow sheets, No. 1 shows the outline of a simple all-sliming cyanide plant, and No. 2 shows a concentrating plant with equipment for ore sorting, jigging, table concentration, and flotation. The liberal equipment of screens provides definite particle-size classification and insures the right class for each recovery system. The argument as to when and where any particular device should be used is never-ending, but the outlines here shown may give suggestions to any one having problems of the kind under consideration. No particular type of ore has been considered in their connection. Probably other combinations would be better under some circumstances, but the actual equipment is about what would be required for simple design and construction.

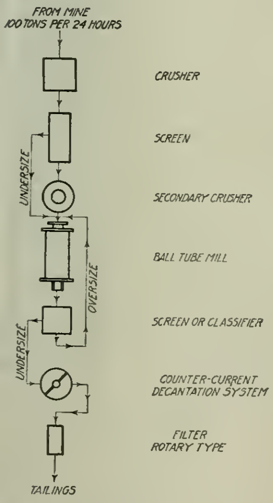


FIG. 1. A 100-TON ALL SLIMING CYANIDE PLANT

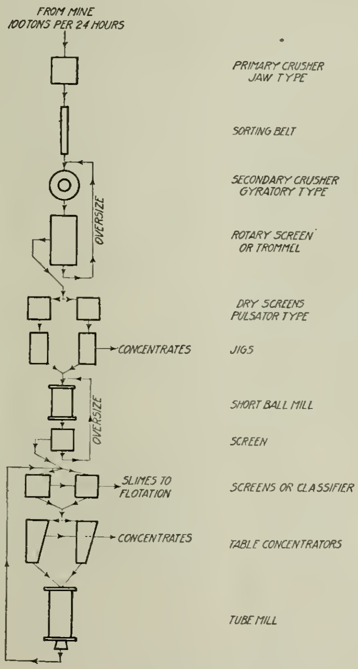


FIG. 2. A 100-TON CONCENTRATION PLANT

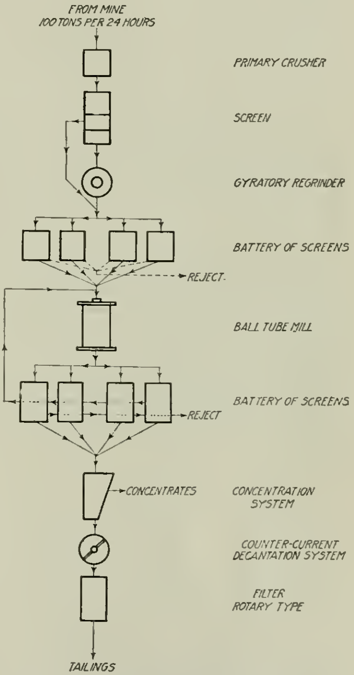


FIG. 3. A 100-TON CYANIDE PLANT —SCREEN-REJECTION SYSTEM

In the design of a metallurgical mill on any scale the crushing and grinding section should receive much more study than is usually accorded to it. The processes of metal recovery—cyanidation, amalgamation, concentration, or flotation—usually get their share of attention, as these details are the subject of more spectacular discussion, but too often the crushing and grinding are merely stereotyped practices following something that has already been done. Nevertheless it is true that successful plants depend quite as much on logical ore-reduction systems as they do on metallurgical processes. An ore may not be ground fine enough, or it may be ground too fine. Or certain parts of it may require separate treatment of a type entirely different from that given to the remainder. The subject requires careful attention if the best, most appropriate, and most economical system of treatment is to be incorporated in the completed plant.

Stage crushing and grinding comprise, I believe, the method embodying the greatest ultimate advantage. Of course I am aware of the fact that this is not invariably true, as there are some ores so formed, either by wide and uniform distribution of metal, or otherwise, that their efficient treatment requires all of the rock to be reduced to a uniformly fine product. In such circumstances stage reduction may be limited to two or three steps. When the metal or mineral is not uniformly disseminated, however, it will often be found better to use perhaps a large number of steps, separating at each step the material already fine enough for treatment. This tends to minimize the subsequent installation, reducing its work in proportion to the product removed from the mill feed before reaching it. A typical example of treatment of this sort is the bypassing of fines around the primary crushing machines by means of a grizzly. This is common practice, but it might well be carried much further. In metallurgy, the jigging of granular material, table treatment of sand, and flotation of slimes all have for their object the same purpose. Flow sheet No. 2 is an example.

SCREENING OUT BARREN MATERIAL FROM THE MILL PULP

It is conceivably possible to take still another step in the search for an efficient treatment method. Most mill operators will admit that in their crushing and grinding stages there is usually a point where a barren or nearly barren product might be separated from the mill flow, either by hydraulic means or by screens. This is particularly true in ores in which the valuable mineral is more or less concentrated in spots or localities in the rock, or where the mineral and rock break to widely different finenesses. Under such conditions, screen separation may take out an economically unprofitable portion or a portion better suited to some other form of treatment. Apparently it would be the part of wisdom to do this. Screening devices cost little to operate, and economize on grinding and subsequent metallurgical treatment—processes that are far more costly. It has been clearly proved that any ore not able to stand treatment changes by itself will not stand them any better when mixed with more valuable material. Why not take advantage of this fact in mill design? If a portion that will not stand the treatment charge can be screened out of the mill run, why not throw it away? The outline in flow sheet No. 3 shows a possible arrangement to accomplish this result.

The discussion in this paper is no more than a suggestion. Each problem must be decided on its merits. The same diet is not good for everyone. The care spent in planning for highest economy in operation will be magnificently repaid, in small mills no less than in large ones. It is better to spend $10,000 or $20,000 more in a properly equipped plant than to spend 10c. or 20c. more for the treatment of each ton of ore that goes through it.

Driers as Applied to Ore Drying

By L. R. CHRISTIE*

The ultimate exhaustion of commercial-grade ores makes consideration of the simplest and most effective way of concentrating and increasing the metallic contents of the lower-grade deposits advisable. Washing plants are being used extensively, but, in many instances, the removal by drying of part of the moisture contained in the mined ore is sufficient to avoid penalties, frequently premiums may be gained, and the plant is simpler and less expensive. Drying after washing can sometimes be practiced to advantage.

Furnace operators generally object to very dry ore, on account of the dust losses from the furnace; but when about 8% moisture is left this objection is overcome, and, as the ore generally contains about 18% moisture when mined, there is room for considerable increase in grade. To illustrate: Assuming ore to contain 56% iron when dried, the iron content when this ore contains 18% moisture would be

$$\frac{56 \times 82}{100} = 45.92\%$$

and when containing 8% would be $\frac{56 \times 92}{100} = 51.52\%$.

The weight of dried ore per ton of 8% material would be

$$2240 \times 92 = 2060.8$$

and the original wet weight $\frac{2060.8}{82\%} = 2513.17$.

The loss of weight being

$$2513.17 - 2240 = 273.17$$

and the weight of water originally contained

$$2513.17 - 2060.8 = 452.37$$

There would then be an increase in metallic ore from 45.92 to 51.52% and a reduction in shipping weight per ton dried ore of $\frac{273.17}{2240} = 12.2\%$.

By these methods the increase in value of ore and saving in freight may be determined for any material, and a gain would be shown almost invariably if proper attention is paid to the efficiency of the drier and ruggedness of construction. Definite laws govern any process of heat transfer. Driers are manufactured to apply these laws to best advantage and utilize over 85% of the heat generated in the furnace. In drying one ton of ore at 8% moisture from an original moisture of 18%, the following heat balances must be considered:

Temperature of ore and moisture on entering the drier, 62° F.

$2060.8 \times (212 - 62) \times .2 =$ 61,824 B.t.u. to heat solids 212°

$452.37 \times (212 - 62) =$ 67,855 B.t.u. to heat water 212°

$273.17 \times (970.4) =$ 265,084 B.t.u. to evaporate water

394,763 total B.t.u. required

$\frac{394{,}763}{13{,}500} = 29.24$ lb. of coal (containing 13,500 B.t.u. to the pound) required if all the heat were utilized.

$\frac{29.24}{85\%} = 34.4$ lb. of coal burned per dried ton of ore when 85% efficiency is obtained (15% being lost in radiation, exhaust gas, and carbon in ash).

A plant of 300,000 tons' capacity per annum (1000 tons per 24 hours) would cost, under present conditions, approximately $35,000. The cost per ton of dried ore would then be as follows:

Depreciation and repairs:	$\frac{\$35{,}000 \times 12\%}{300{,}000} =$	$0.014
Interest on investment:	$\frac{35{,}000 \times 6\%}{300{,}000} =$	.007
Fuel at $6 per ton:	$\frac{34.4 \times 6}{2000} =$	.103
100 hp. at 2½c. per kw. hour 42 tons per hour	$\frac{100 \times .746 \times .025}{42} =$	.044
Labor: 2 men per shift, or 6 per 24-hour day at $4.00 per day	$\frac{4 \times 6}{1000} =$	.024
Total cost per dried ton		$0.192

If driers of 50% efficiency were used, which is frequently the practice, the fuel consumption per ton of dried ore would be 58.5 lb. of coal, making the cost of drying per ton $0.206, an increase of 10.3c. or $30,900 per year.

To obtain high efficiency, the greatest difference possible should be maintained between the initial and exhaust temperatures, as these differences represent the percentage of heat given up in the apparatus. A temperature of 120° F. is as low as has been found practicable to reduce exhaust, but initial temperature is deendent more on the drier design. If the drier plates re not properly protected by wet material, or the suraces are not sufficiently large to diffuse the heat, and he hot gases pass over same at high velocity, due to onfined area, the initial temperature must be kept down y using excess air, and this involves the double objecion of increasing the volume of waste gases, carrying way a proportionate amount of heat, and necessitating ncreased velocity through the drying compartment, takng out more dust, which is often the most valuable part f the product.

---

*Engineer, L. R. Christie Co., Pittsburgh, Penn.

No attempt should be made to take sufficient air hrough the material to absorb the moisture, as this inreases the volume, with the objection cited above. In ractice I have obtained the best results when the volme of gas used was not more than sufficient to absorb 0% of the moisture, the remainder going off as a free apor. This is not a fixed quantity, but is controlled by he amount of moisture before and after drying and the aterial treated.

In drying ore or material of a sticky tendency, it is ecessary that the drier shell be externally heated at he feed end, as this causes a film of steam to form beween the plates and material, preventing adhesion. It s hardly necessary to mention the importance of rugged nstruction and accessibility to working parts to prent delay and expense for repairs. The initial cost of a ier installation is not as serious a consideration as ficiency and continuity of operation.

Homestake Mining Expenses

The expenses for mining various properties of the Homestake Mining Co. during 1918 were as follows:

Assaying	$8,113.37	Powder storage	$4,084.66
Damages	216.08	Sundries	79,012.83
Coal	89,166 77	Surveying	15,969.05
Labor	1,502,505.34	Teaming	4,205.00
Lumber	6,134.83	Diamond drilling	13,083.33
Machinery	340,854.80	Timbers	62,877.87
Oil	10,929.95	Transportation	14,402.82
Electric power	25,573.54	Water	204.87
Steam	76,098 10	Wood	755.00
Powder	224,377.69		
Total			$2,478,565.90

"Transportation" probably includes ore tramming. A total of $216.08 occurs in a separate account of "Damages," but whether these are of the material or legal variety is not stated. The expenditure of $204.87 for "water" probably refers to the cost of drinking water. The value of such separate accounts, even when logically classified, is dubious when the sum of $79,012.83 appears under "sundries."

Specific Gravity Table

In the accompanying table, the specific gravities of the commoner minerals and metals have been classified and arranged in sequence. The table will be found useful for the rough differentiation of concentrated raw products, and as a reminder of the various forms in which a metal may occur. The figures for specific gravity are from Dana.

.Gr.	Gold	Silver	Copper	Lead	Zinc	Miscellaneous	Gangue
						Bitum. Coal 1.14–1.4	
						Anthracite 1.32–1.7	
2			Chrysocolla 2–2.24			Graphite 2.09–2.23	Opal 1.9 –2.3
							Gypsum 2.31–2.33
		Quartz line 2 66				Brucite 2.38–2.4	Orthoclase 2.47–2.52
						Serpentine 2.5 –2.65	Kaolinite 2.6 –2.63
						Labradonite 2.7-2.72	Quartz 2.65–2.67
							Calcite 2.71
						Muscovite 2.76–3	Anorthite 2.74–2.76
3							Talc 2 7 –2.8
						Anbydrite 2.9–2.98	Dolomite 2.8 –2.9
						Tourmaline 2.98–3.2	Aragonite 2.93–2.95
							Biotite 2.7 –3.1
						Magnesite 3.0 –3.12	Fluorite 3.01–3.25
						Apatite 3.17–3.23	Amphibole 2.9 –3.4
					Calamine 3.4 –3.5	Orpiment 3.4 –3.5	Pyroxene 3.2 –3.6
						Realgar 3 55	Epidote 3.25–3.5
						Titanite 3.4 –3.56	
						Diamond 3.52–3.53	
						Cyanite 3.56–3.67	Rhodonite 3.4 –3.68
						Spinel 3.5 –4.1	Rhodochrosite 3.45–3.68
			Azurite 3.77–3.83			Limonite 3.6 –4.0	
						Siderite 3.83–3.88	
			Malachite 3.9 –4 03		*Sphalerite 3.9 –4.1	Corundum 3.95–4.1	Garnet 3.15–4.3
					Willemite 3.89–4.18	Manganite 4 2	
						Rutile 4 18–4.25	
			*Chalcopyrite 4.1–4.3		Smithsonite 4.3 –4.45	Psilomelane 3.7–4.7	
			*Enargite 4 43–4.45			Chromite 4 32–4.57	Barite 4.3 –4 6
						*Stibnite 4 52–4.62	
						*Pyrrhotite 4.58–4.64	
						Ilmenite 4.5 –5.0	
						Zircon 4 68–4 7	
	va		*Tetrahedrite 4.4 –5.1			*Molybdenite 4 7–4.8	
						Pyrolusite 4.82	
5	Pyriteline 5					Marcasite 4 85–4.9	
						*Pyrite 4.95–5.1	
					Franklinite 5.07–5 22		
			*Bornite 4.9 –5.4			Hematite 4.9 –5.3	
			*Chalcocite 5.5 –5.8			Magnetite 5.17–5.18	
			*Bournonite 5.7 –5.9		Zincite 5.43–5.7	Millerite 5.3 –5.65	
		Cerargyrite 5.55				Arsenopyrite 5.9–6.2	
		Iodyrite 5 6–5 7					
6		*Proustite 5.77–5.64		Anglesite 6.12–6.39		Scheelite 5.9 –6.1	
		*Pyrargyrite 5.77–5.86	Cuprite 5.85–6.5				
		*Polybasite 6 –6.2					
		*Stephanite 6.2 –6.3					
7						*Bismuthenite 6.4–6.5	
				Cerussite 6 46–6 57			
				Pyromorpbite 6.5 –7 1			
		*Argentite 7.2 –7.3		Wulfenite 6.7 –7 0		Wolframite 7.2 –7.5	
				*Galena 7 4 –7.6			
8	*Sylvanite 7 9 –8.3						
		*Hessite 8.31–8.45					
9						*Cinnabar 8 –8.2	
			Copper 8.8 –8.9				
10		Silver 10.1 –11.1					
13							
14	Amalgam 13.75–14 1					Mercury 13.5	
	Gold-Electrum 15.6 –19.3					Platinum 14 –19	
20							
						Iridosmine 19.3–21.1	
22						Iridium 22.4	

* Minerals that yield to flotation.

COMPARATIVE SPECIFIC GRAVITIES OF MINERALS

Economics of Concentration

By R. S. Handy*

A discussion of the recent paper of A. P. Watt which appeared in the "Journal" of May 3 and which was entitled "Economics of Concentration." In his paper Mr. Watt showed that, in addition to technical efficiency and metallurgical recovery, it is important for the metallurgist to consider carefully the further treatment of low-grade concentrate, particularly the concentrate which cannot be profitably marketed. He suggested the desirability of re-treatment after a full consideration of smelter charges and freight rates. The use of a separate re-treatment plant was advocated where the low-grade concentrate is of such a nature as to admit of cleaning. In the paper that follows, R. S. Handy defines the conditions under which it is profitable to ship a concentrate and takes the position that a re-treatment plant separate from the mill fosters carelessness on the part of mill men and operatives.

I HAVE read with great interest A. P. Watt's article entitled "Economics of Concentration," in the *Journal* of May 3, in which he makes a strong argument for the use of "economic recovery" in determining mill efficiency. This factor of economic recovery, or "economic extraction," as it is called, has been the guilding element in the operation of the Bunker Hill & Sullivan concentrators for the last nine years, having been introduced by myself in 1910. For many years, while the mill efficiency was being gradually built up by changes in the flow sheet, the economic extraction appeared upon each daily report as well as in the monthly and yearly reports, as it still does.

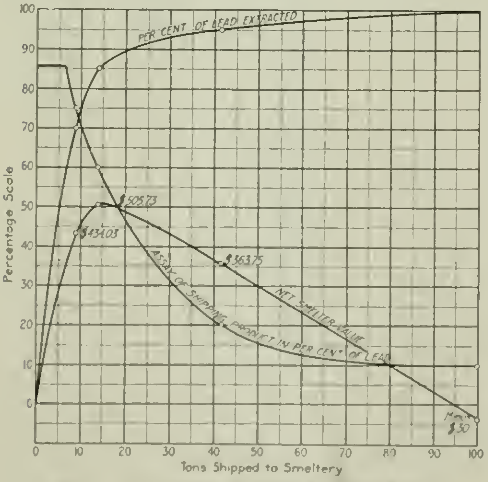


FIG. 1. MAXIMUM ECONOMIC EFFICIENCY

Because the subject is one of much importance, and in the hope of provoking further comment from lead operators, I desire to discuss some of the points brought out in Mr. Watt's article.

The use of "profit" and "loss" in his discussion of "smelter returns" is, I think, unfortunate, because it might leave the impression that it is profitable to ship any grade of concentrate that will return any net value whatever. To my mind it is profitable to ship a concentrate only when the gain due to eliminating waste therefrom is equaled by the value of the metal lost, plus the cost involved in eliminating this waste. I shall try to illustrate this point by examples.

Comparison of Possibilities

Suppose 100 tons of mill feed assays 10% lead and contains 10 tons of lead in the form of galena. Assuming a price of 4c per lb. for lead, the total value of the lead in this lot is $800. Taking a smelter contract in which 90% of the lead is paid for at market rates, and under the terms of which $7.50 per ton is deducted for freight and treatment, various methods of handling this lot of ore may be compared.

Example 1—If the ore is shipped directly to the smeltery, the metallurgical extraction, so far as the mill is concerned, is 100% and the smelter returns are:

90% of 10 tons equals 9 tons lead at $80	$720 00
Freight and treatment on 10.44 tons galena at $7.50	78.30
Net value of galena	$641 70
Freight and treatment on 89.56 tons waste at $7.50	671.70
Net smelter value (deficit)	$30.00

Example 2—Suppose, instead, the ore is concentrated and the extraction is 95% of the lead in a concentrate assaying 20% lead. There will be 47.5 tons of such concentrate, and the smelter returns will be:

90% of 9 5 equals 8.55 tons lead at $80	$684 00
Feight and treatment on 9.94 tons galena at $7.50	74 55
Net value of galena	$609.45
Freight and treatment on 37.56 tons waste at $7.50	281 70
Net smelter value	$327.75
Economic extraction { Gross value lead Net smelter value } 40.97%	
Cost of milling 100 tons ore at 40c	40 00
Profit	$287 75

In this example there has been eliminated 52.0 tons of waste at a saving of $390 in freight and treatment at a cost of $71.65 in lead lost plus milling cost, leaving a gain, due to these causes, of $318.35.

Example 3—Assuming an extraction of 85% of the lead in a concentrate assaying 60% lead, there will be 14.17 tons of such concentrate, upon which the smelter returns will be:

90% of 8 5 tons equals 7 65 tons lead at $80		$612 00
Freight and treatment on 8 90 tons galena at $7 50		66 75
Net value of galena		$545 25
Freight and treatment on 5 27 tons waste at $7 50		39 52
Net smelter return		$505 73
Economic extraction, 61 22%		
Cost of milling 100 tons at 60c		60 00
Profit		$445 73
Saving due to waste	$632 17	
Costs in lead and milling	154.88	
Gain	$477.29	

Example 4—Again, if there is a metallurgical extraction of 70% and a grade of 75% lead, 9.33 tons of concentrate are produced, as is shown:

---

*Mill superintendent, Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho

90% of $7 equals 6.3 tons lead at $80	$504.00
Freight and treatment on 8.14 tons galena at $7.50	61.05
Net value of galena	$442.95
Freight and treatment on 1.19 tons waste at $7.50	8.92
Net smelter return	$434.03
Economic extraction equals 54.25%	
Cost of milling 100 tons at 80c	80.00
Profit	$354.03

Here $662.77 has been saved in eliminating 88.37 tons of waste, but the lead lost was worth $189.90 and the milling cost $80, leaving a gain of only $392.87. It is obvious that the economic peak occurs somewhere near the conditions expressed in *Example 3*. The relation of the metallurgical extraction to the concentrate assay will affect this economic peak, but there is a maximum economic efficiency for every concentrating plant. With a given smelter contract the economic peak is not affected by ordinary variations in metal prices. The conditions just described are shown graphically in Fig. 1.

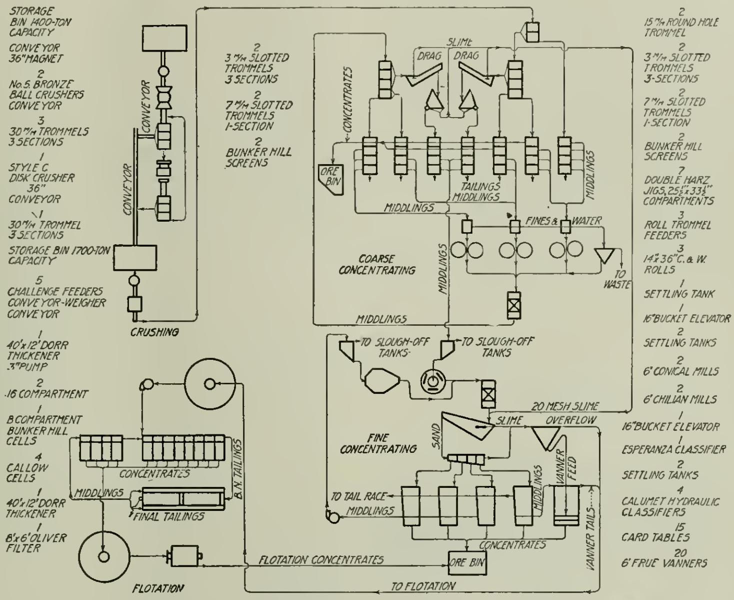


FIG. 2. FLOW SHEET BUNKER HILL & SULLIVAN M. AND C. CO.'S WEST MILL, NO. 2

TABLE I.

Size	First Class Per Cent. Weight	First Class Assay, Per Cent. Pb	Second Class Per Cent. Weight	Second Class Assay, Per Cent. Pb	Middling Per Cent. Weight	Middling Assay, Per Cent. Pb	Tailing Per Cent. Weight	Tailing Assay, Per Cent. Pb	Total Per Cent. Weight	Total Assay, Per Cent. Pb
30 mm. to 15 mm.	0.45	80.0	2.66	45.0	19.70	23.3	21.82	0.0	44.63	13.7
15 mm. to 7 mm.	1.60	75.0	2.93	40.0	20.55	8.6	21.58	0.0	46.66	8.8
7 mm. to 3 mm.	0.42	70.0	0.57	30.2	4.38	1.9	3.30	0.0	8.67	6.2
Totals	2.47	75.0	6.16	41.0	44.63	14.4	46.70	0.0	99.96	10.8

TABLE II.

Product	Broken to Pass 15 mm. First Class Per Cent. Weight	Broken to Pass 15 mm. First Class Per Cent. Pb	Broken to Pass 15 mm. Second Class Per Cent. Weight	Broken to Pass 15 mm. Second Class Per Cent. Pb	Broken to Pass 7 mm First Class Per Cent. Weight	Broken to Pass 7 mm First Class Per Cent. Pb	Broken to Pass 7 mm Second Class Per Cent. Weight	Broken to Pass 7 mm Second Class Per Cent. Pb
30 mm., 2d class	0.94	68.0	1.72	33.0	0.14	65.0	1.58	30.0
15 mm., 2d class	....	....	....	....	0.42	60.0	2.51	37.0
Totals	0.94	68.0	....	....	0.56	60.7	4.09	34.0

Though smelter contracts and metal prices have a bearing upon profit from ore concentration, waste is valueless, and under the conditions outlined at the beginning, it costs as much (from the producer's point of view) to ship and to smelt a ton of waste as it does to ship and to smelt a ton of galena. This is a vital matter in lead concentration, but, as Mr. Watt says, it receives too little attention.

This brings up the question of re-treating, or re-grading, products from a concentrator by means of a special plant built for the purpose. I am opposed to this procedure unless the products from re-treatment are covered by a special smelter contract. There should be no machine in a re-treatment plant superior for concentrating purposes to the machines in the concentrator, or, if there is, it should be moved into the concentrator forthwith. This being admitted, what can be done in a re-treatment plant that cannot be done in the concentrator? There is no excuse for the use of a concentrating machine that does not make at least one finished product—either concentrate or tailing—and when either of these products has reached a desirable grade it should be sent to its final destination. A re-treatment plant fosters carelessness on the part of operatives in the concentrator; whereas, if properly encouraged, these operatives display an almost uncanny ability to maintain uniform grades in the mill products.

In connection with the selection of concentrates of a desired grade, a recent test on Bunker Hill mill feed may be of interest. The feed, being all through 30 mm. in size, was screened on 15 mm., 7 mm., and 3 mm. screens. The material remaining on each of these screens was hand-sorted into the products shown in Table I. The second-class products were subjected to the same treatment that they receive in the mill, that is, the 30 mm. size was broken to pass 15 mm., the 15 mm. to pass 7 mm., and the 7 mm. to pass 3 mm., and the materials were re-sorted. Products resulting from this treatment are shown in Table II, and the summary of the whole operation appears in Table III.

There was only one particle of first class in 1500 gm. of material on the 15 mm. screen. If the jigs treating this material are required to produce a high-grade concentrate, it is easy to see that the beds must be subjected to excessive wear while an occasional particle of the required grade is being discharged; whereas, if only tailings and middlings are produced, the beds discharge freely without appreciable wear on the particles, and a large tonnage of low-grade tailings may be released. When these middlings are re-jigged they form a uniformly high-grade bed, which likewise discharges freely with little wear.

TABLE III.
Summary

Product	Per Cent. Weight	Assay. Per Cent. Pb
First Class	3.97	71.8
Second Class	4.66	33 4
Middlings	44 63	14 4
Tailings	46.70	00 0
Totals	99 96	10 8

Tables I, II, and III show that by re-crushing the second-class product, assaying 42% lead, from two sizes, 1.5% of the weight of the whole sample was selected in a product assaying 67% lead. With a large tonnage of mill feed, and considering that this process is continued throughout the flow sheet, it can be seen that many tons of waste are thus separated from the second-class product while, in many plants, it would go to the concentrate bins. This plan of separation and selection has resulted at the Bunker Hill mills in raising the grade of the concentrate 12%, of the metallurgical extraction 10%, and of the economic extraction 11%.

Phosphate-Rock Industry in 1918

The phosphate-rock industry in the United States may be said to have "marked time" in 1918, for the quantity of rock sold differed only about 4% from that sold in 1917. For the whole country there was a decrease in output of 93,527 tons, or 3.6%, but a gain in total value of $443,379, or 6 per cent.

The quantity of phosphate rock marketed in 1918, according to R. W. Stone, of the U. S. Geological Survey, was 2,490,760 long tons, valued at $8,214,463, as compared with 2,584,287 tons, valued at $7,771,084, in 1917. The output by states in the last two years is shown in the table.

The table shows that Florida land pebble constituted 80% of the output of the country and that the land-pebble output was 7144 tons less in 1918 than in 1917, a slight decrease. Florida hard and soft phosphate, however, increased from 18,608 tons in 1917 to 70,383 tons in 1918, or 278%. Most of this increase was made by a greater output of hard rock. The output of the state as a whole increased 44,631 tons, or 2%. The statistics for Florida were compiled in coöperatio with the Florida State Geological Survey. The outpu of South Carolina increased about 11%, but that o Tennessee and Kentucky was 27% less than in 1917 In the Western States also there was a proportionatel large decrease—from 15,000 tons in 1917 to 12,00 tons in 1918, or about 20%. The failure of the industr to make a greater output was due largely, it is believe to the shortage of labor caused by the war.

PHOSPHATE ROCK SOLD IN THE UNITED STATES, 1917-1918

State	1917		1918	
	Quantity (Long Tons)	Average Price per Ton	Quantity (Long Tons)	Averag Price per T
Florida:				
Hard and soft rock	18,608	$8.56	70,383	$7 4
Land pebble	2,003,991	2.65	1,996,847	2 7
	2,022,599	$2.70	2,067,230	2 9
South Carolina:				
Land rock	33,485	$4 14	37,040	4 45
Tennessee:				
Brown rock	a 447,203	$4.29	a 374,535	5.12
Blue rock	65,904	3.12		
	513,107	$4.14	a 374,535	5.12
Western States	b 15,096	$2.77	b 11,955	3 53
	2,584,287	$3.01	2,490,760	3.30

a Includes several thousand tons of brown rock from Kentucky. b Includ 1917: Idaho, Utah, and Wyoming; 1918: Idaho and Utah.

Java's Trade in Billiton Tin*

The exports of Billiton tin from Java for 191 amounted to 2185 tons, and the production was 756 tons. In 1916, a total of 20,300 tons was produce of which 11,500 tons went to America; and in 191 there was produced 15,000 tons, of which the Unite States took 13,000 tons. Of the 2185 tons exported i 1918, the United States received 1490 tons; Japan, 38 tons; and Hongkong, 314 tons.

In a general way the price of Billiton tin throughou the year followed the market quotations for Banka ti The government controlled the exports, and shipment were made only under license.

The following monthly quotations per picul (136 lb. of Billiton tin, representing first cost, may prove o interest, the guilder quotations being reduced to Ameri can gold at the rate of $0.402:

Months	Lowest	Highest	Months	Lowest	Highe
January	$60.75	$76 18	July	$83.01	$96.0
February	71 96	80.40	August	93 67	99 7
March	78 99	86.43	September	89.45	95.27
April	84 22	91 25	October	89.24	89.24
May	86 03	94 87	November	69.95	89 24
June	80 00	87.03	December	60.09	69 95

The mines are worked by the Billiton Co. under concession granted in 1852, which was extended i 1892 for a period of 35 years, thus expiring on Apr. 3 1927. In the 1892 agreement it was stipulated that th company should receive five-eighths of the yearly profi The geological formation of the beds on the island o Billiton, as well as the occurrence of the ore, is simila to that of Banka, but in Billiton there are tin vein that are rich enough to work.

The company has installed electrical machinery fo the workings, the largest of which is at Manggar, th capital of the district, in the eastern part of the islan This station has installed two "werks-poor" Diesel mo tors, each of 1200 hp., with an engine in reserve. Th station supplies about 800 kw. Three more Diesel m tors, of 1200 hp. each, have been ordered from Amste dam, making a total, when in position, of 720 horsepower.

---

*Commerce Reports, May, 1919.

Notes on Flotation

BY JOSEPH P. RUTH, JR.*

A general presentation of flotation factors has the important advantage of starting discussion. Through such discussion new ideas form, and better understanding of intricate problems results. The article that follows will be read with interest by flotation operators and technical men, as it generalizes the important elements controlling flotation. Flotation depends for its success in the treatment of a suitable ore upon the delicate adjustment of not easily controlled conditions. More of the practical operators should describe their operating difficulties and their methods of overcoming them, for the information of other and less experienced operators.

FLOTATION is not nearly so complex a process as most interested persons consider it. Flotation of mineral particles is effected by bringing several different phenomena into proper relationship with one another. The establishment of this balance between the different factors is not always easy, and it is for this reason that the difficulties of flotation arise. It will no doubt be some time before the fundamental principles underlying flotation are completely understood, but much of the difficulty of understanding the process is due to trying to understand it from investigation made of conditions in the large plant.

FACTORS IN FLOTATION

The five most important or positive factors in flotation are, in my opinion, these—agitation, the solubility of the contaminant (usually oil), the surface tension, the size of the bubbles formed, and the size of the sulphide particles. I have tried in Fig. 1 to show the interaction and interrelation of these five factors, which must all be adjusted closely with respect to one another in order to get successful flotation. The curves shown in the figure are drawn to illustrate a general condition in relation to time. Each of these factors varies according to its own laws, but, for any one factor, the other four conditions must be adjusted, and as each one of the five changes, the other four have to be changed to a greater or less degree. It is to this interdependence of the five variables that the difficulties in flotation are to be ascribed, in so far as it concerns practice. The work of Ralston, Bancroft, Hildebrand, Coghill, and others will no doubt lead in the end to a far better understanding of the physical phenomena of flotation.

The figure will be more readily understood when I state that its purpose is to show that as agitation becomes more violent, or prolonged, a greater part of the soluble portion of the oil goes into solution and an increasing proportion of the oil particles, floating in the pulp as a "reserve," is insoluble residual oil; that as more of the oil goes into solution, the lower becomes the surface tension of the bubbles; that the lower the surface tension of the bubbles becomes, and the greater the agitation, the smaller are the bubbles which are formed; that the smaller the bubbles become, the smaller is also the mass of any liftable material which these bubbles can float.

The interrelation of these five factors or variables is complex, and it is difficult to represent them graphically. Let the operator study the phenomena as he finds time, while attending to the flotation machines in the mill. Then let him draw his own graph. The simple act of drawing such a graph will help him to crystallize his ideas the better. Finally, when he has the graph which satisfies him the best, he will find that, by studying it and considering how, when one factor is changed in a certain way, the four other factors also have to be changed if the same relative resultant or "lifting ability" is to be maintained in the cell, he will learn the better how to cope with the difficulties that are so constantly arising in the operating plant because of the many ways in which the changes in the complex conditions of actual mill work affect these five factors.

ADVERSE FACTORS

Just as there are these five positive or helpful factors, so also are there two additional factors which by their effect upon certain of these positive or contributing factors affect adversely the flotation as a whole. These negative or interfering factors are electrolytes and colloids—the latter more probably, in most instances, fine-grained suspensions that in their behavior approximate to that of colloids, rather than true colloids. Occasionally, no doubt, the effects of these two conditions may in themselves be helpful, but I am inclined to believe that when they do help flotation it is far oftener through their negative effect upon certain of the five positive factors. In such instances they bring the five

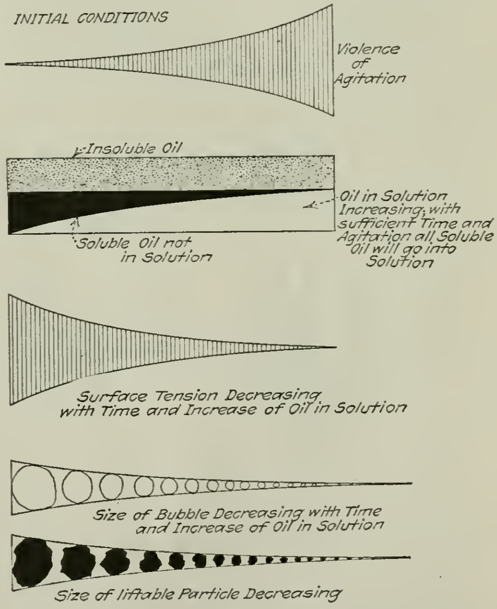

INITIAL CONDITIONS
Violence of Agitation
Insoluble Oil
Oil in Solution Increasing; with sufficient Time and Agitation all Soluble Oil will go into Solution
Soluble Oil not in Solution
Surface Tension Decreasing with Time and Increase of Oil in Solution
Size of Bubble Decreasing with Time and Increase of Oil in Solution
Size of liftable Particle Decreasing

FIG. 1. COMPARISON OF FLOTATION CONDITIONS IN RELATION TO TIME

positive factors back again into proper balance with one another by reducing the effect of some factors, rather than by their own direct positive effect upon the flotation action itself.

---

*1727 Champa St., Denver, Colorado.

The greatest lifting power is that obtained when a bubble filmed with pure water is brought into contact with the liftable material. Bubbles can be formed by blowing air into pure water, but such bubbles are large in size, small in number, and lacking in persistence. The advantage of adding a contaminant (generally an oil, in practice, but it can also be a salt, and, possibly, certain colloids will act similarly to oil) is that by such addition the bubbles are rendered smaller and more persistent. For example, take a laboratory flotation machine having glass sides and capable of having the amount of air injected into the pulp in any given interval of time kept constant (my type of laboratory machine is especially adapted to this experiment, but several others can be used); put distilled water into the machine and start it. The bubbles will be relatively large. Then without altering the operative conditions in the least, except to add a drop or two of oil, watch the bubbles become much smaller almost the instant the oil is added. Moreover, the greater contamination up to a certain point, the smaller become the bubbles generated by the same amount of air and the same amount of agitation.

Referring again to Fig. 1, it will be noticed that the smaller the bubble, and the smaller the surface tension, the smaller becomes the particle of liftable material that can be floated in the cell. In other words, a particle that might have been floated by the large bubbles formed in pure water can no longer be floated. To be floated the particle must be made smaller. The reasons for this are three: (1) the smaller a particle becomes, the less is its mass; (2) the smaller the particle becomes, the larger is the ratio of its surface to its mass; (3) the larger the particle, the greater is the frictional rub upon the particle as it is lifted by the bubble through the pulp.

Effect of Reduction in Size of Liftable Particle

Many operators fail to recognize the important effect that reduction in size of the liftable particle has upon flotation. Consider a sphere, for instance; and what follows is equally true of the cube and other polyhedrons. The surface of the sphere varies as the square of its diameter; the volume as the cube. Consequently, as the diameter is reduced, the surface decreases less rapidly than does the volume or weight. In fact, the ratio of surface to volume changes as the reciprocal of the diameter. Surface tension, or whatever the force may be that causes the lifting of floatable particles by the bubble, is dependent as to its amount, so far as any individual particle is concerned, upon the size of the surface in contact between the bubble and the particle in question, as well as upon the intensity with which that particular substance is gripped by that particular bubble film. By reducing the size of the particle the amount of surface that can be gotten into contact with the bubble is diminished. But as this surface decreases less rapidly, while the size of the particle is being reduced, than does the mass of the particle, and therefore than does also the pull of gravity upon the particle (which is one of the principal forces opposing flotation), the size of the particles in the pulp can be reduced until the diminished flotative power of a unit area of bubble surface (reduced in intensity because of reduction in intensity of the bubble's surface tension by the oil added as contaminant) is again capable of floating the liftable material under the new conditions that have been set up.

That is one effect of reduction in size of a liftable particle upon its flotability. Another gain rises from the fact that as the bubble begins to move with its load the resisting force of friction begins to oppose its rise. This frictional resistance is twofold in its nature. First there is the mechanical rub of the pulp upon the bubble; second, there is the viscosity or internal resistance of the pulp liquid to displacement that must be overcome. The smaller the particle, the less will be both kinds of frictional resistance. Therefore, the smaller the particle, the less likely it is to be brushed off a bubble while the pulp is being agitated.

Unfortunately, as the size of the valuable mineral is reduced for any given grade of ore, the greater becomes the number of particles that must be brought into contact with the bubble surface if they are to be floated, and so the greater, other things being equal, becomes the difficulty of saving the valuable mineral from the gangue. In fact, it is possible, although many do not seem yet to appreciate it, to grind the pulp so fine that it is impossible to make an efficient recovery upon it by flotation. In other words, just as years ago it was found that an ore could be ground too fine for efficient gravity concentration, now it has also been found that to a certain degree the fact also holds true in flotation.

Probability of Contact

The probability that all the liftable particles in the pulp will be brought into contact with bubble surface is a function mainly of the ratio of total bubble surface to the amount of the surface of liftable particles that must be floated. The smaller the individual bubbles, the larger is the total bubble surface obtained for any given volume of air put into the bubbles. The flotative efficiency of any contaminant is, therefore, to a considerable degree a question of its effect relatively both upon the surface tension of the bubble film and upon the strength of that film; for upon the strength of the film depends the size to which the bubbles can be reduced without their coalescing immediately when they come in contact with one another during agitation of the pulp.

Not only can the probability of contact be increased by increasing the bubble surface, but also by lengthening the time during which contact is possible. Decrease in the size of the bubbles decreases the rapidity with which they rise through the pulp, for the smaller the bubbles the greater is their surface in proportion to their displacement, and so the larger becomes the relative frictional resistance of both the liquid and the suspended gangue particles to the rise of the bubbles through the pulp. Consequently, the greater also becomes the probability that the bubble will become loaded with liftable particles, and, of course, the heavier the load that is carried by the bubbles the slower will they rise through the pulp.

One of the most important points in the design of a flotation machine is this matter of promoting probability of contact not merely between bubble and pulp, but between bubble and sulphide particle in the pulp. Bringing the bubble and the sulphide particles efficiently into contact with one another, and the obtaining of proper aëration of the pulp, are the principal points in the mechanical aspect of the process. Too little importance had been given to these two phases of the problem in the design of the various flotation machines on the market.

ACTION OF FLOTATION MACHINES

Fig. 2 shows in diagrammatic section a rather common type of flotation machine. The cascade type of machine and those types in which an air lift or centrifugal pump is used to circulate the pulp through an exterior chamber come within this general type, so far as pulp and bubble travel are concerned, for in these types of machines the pulp is withdrawn from the bottom of the cell and enters it again at the top behind a baffle so as not to disturb the bed of froth that is cleaning itself in the collecting chamber of the machine.

The difficulty in flotation is to catch the heavier and larger particles of valuable liftable mineral. Consider what happens to these particles in a machine of a general type as shown in Fig. 2. It is known that the tendency of matter is to continue its motion in the direction imparted to it unless influenced by some other force. The finer particles in the pulp tend to lose their velocity rapidly after they get away from the confined space behind the baffle and enter the cell proper. But the coarser particles of the pulp, and especially the sulphide particles, tend to keep on sinking and to circuit directly down to the draw-off opening in the bottom of the collecting chamber. On the other hand, the bubbles, as shown by the skeleton arrows, begin, because of their buoyancy, to rise to the surface of the pulp just as soon as they have got outside of the more intense influence of the current near the baffle board and before the suction that is drawing the pulp to the discharge opening can exert control over them. Owing to this short-circuiting of the bubble air back to the surface by way of the froth bed, the time that the bubbles are in that part of the pulp path where they can come in contact with the coarser particles of sulphide is comparatively short, considering the length of the total path followed by the pulp. In other words, the pulp in such types of flotation machines has to pass through the circuit more times in order to get contact with the coarser particles than would be necessary were the bubbles and pulp traveling together in the same direction for a greater distance through their respective paths.

In Fig. 3 is shown a diagrammatic section of a paddle-wheel type of agitator. The same general criticism applies to this type as to the one shown in Fig. 2. But there is still another disadvantage attending the use of these two types of machines. That is the scrubbing effect which the pulp has upon the bubbles as they begin to lag behind, and then to rise through the pulp. This scrubbing and impingement of the gangue particles upon the sulphide load carried by the bubbles tend to tear off from the bubble surface those particles of such low liftability, because either of size or inherent nature, that they are just being held by the bubble. These particles must then go around the circuit again if they are to be caught, and then, possibly on the second passage through the critical zone, they will be torn off the bubbles and fail to be lifted up into the froth bed where they will become comparatively safe. Prolongation of the baffle board will aid somewhat in meeting the first of these objections, but, because of the greater confinement of the current, and its inability to dissipate itself in the body of the collecting chamber before the pulp particles come within the influence of the suction at the bottom of the cell, the second objection becomes more cogent than before. The principle is wrong, and so a compromise is the best that can be effected in overcoming the difficulty.

Fig. 4 is a pneumatic machine of the mat type in diagrammatic section. In this type of flotation machine the general direction of travel of pulp is across the direction of rise of the bubbles in the machine. It would appear, at least at first glance, that the difficulties mentioned in the preceding paragraph were obviated. But this is more apparent than real. The truth of the matter is that the actual travel in such machines consists of an up-and-down, slowly progressive movement of the pulp particles through the machine. The bubbles displace liquid at the bottom of the cell. As they rise, pulp from above must come down to fill the space which they occupied, while at the same time the air bubbles tend to draw along behind and with them a certain minor amount of pulp. This sucking action tends to make the bubbles coalesce with one another, thereby reducing the amount of bubble surface and in that way decreasing the probability of contact with the sulphide particles per unit volume of air used to form bubbles. In its downward movement the pulp tends to scrub the sulphide particles off from the bubble surface. This scrubbing action is, if anything, even more severe than in many other types of machine, and is especially hard upon the larger sulphide particles that have become attached to bubble film. In fact, it is probable that in many of the mat pneumatic machines the loading of the bubbles with sulphide particles occurs largely at the bottom of the froth bed where the pulp is whipped up against it, and

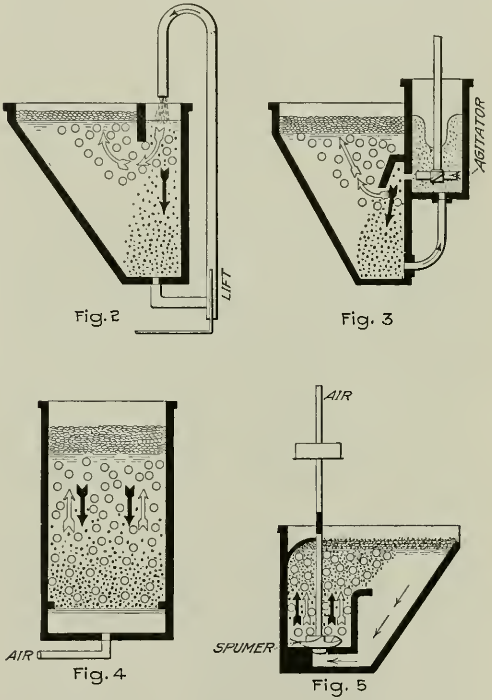


Fig. 2

Fig. 3

Fig. 4

Fig. 5

FIGS. 2, 3, 4, 5. ACTION OF FLOTATION CELLS where, owing to the rapid rise of other bubbles, the mineral-laden froth is soon pushed out of range of the pulp's rub. This whipping of the pulp against the bottom of the froth bed tends to give certain compensating efficiency to the mat type of machine. But it is also evident that the larger particles of sulphide cannot be lifted up to the top of the pulp bed without resort to excessive formation of bubbles and the lifting of a rather dirty concentrate, at least in the rougher cells. In this explanation of the manner in which the froth is mainly loaded with sulphide particles in the mat type of pneumatic machine, the reader will find the reason why such machines cannot be made to treat coarse pulp as efficiently as is possible with a paddle machine.

Fig. 5 shows a diagrammatic section of another flotation machine. In it the agitation and aëration are accomplished by a specially designed device called a "spumer." Air is sucked down the hollow shaft by the rotation of the spumer while at the same time the spumer also sucks air and pulp up from the bottom of the collector chamber of the machine. The rotation of the spumer thus throws air and pulp out, practically together, with a vortex motion into the agitation chamber, causing good contact to be obtained between the pulp and the bubbles, as both are traveling along with one another at slightly different velocities, owing to the buoyant effect that tends to accelerate the rise of the bubbles through the pulp until they have become fairly well loaded. As both sulphide particles and bubbles are traveling together for a large part of the circuit, and as the sulphide particles have a momentum that takes them along with the bubble travel, much larger sulphide particles can be floated than with other types when using the same surface tension and the same size of bubbles. Moreover, there is less tendency in this type of machine for the pulp to scrub the particles off from the bubbles. This is because of the way in which the bubbles tend to rise with a relatively slow differential speed out of the pulp while it is travelling horizontally across the top of the collecting chamber.

I do not wish to infer from these remarks that good work cannot be done with all the standard flotation machines if proper conditions are obtained. What I do say is that the obtaining of contact between bubble and sulphide particles is necessary in order to float the sulphide particles, and that, therefore, the greater the probability of contact and the less the likelihood of scrubbing the particles off the bubbles after they have become attached to them, the more efficient is the machine. Moreover, to get flotation with other machines, the sulphide particles must be crushed finer than is necessary to float the same mineral when the pulp and the bubble flow are in the same direction. This is a considerable advantage, it seems to me, for the finer the particles into which any given amount of sulphide mineral is crushed, the greater is the number of particles that must be brought into contact with bubble surface, and, therefore, other conditions being equal, the greater becomes the difficulty of catching all of them.

SIZE OF BUBBLE

The size of the bubble is important for three reasons: (1) the smaller the bubbles are, other things being equal, the less rapid is their rise through the pulp; (2) the smaller the bubbles, the less is the tendency for them to coalesce when they come in contact with one another; (3) the more uniform the size of the bubbles is, the less is the tendency for them to coalesce. Coalescence of bubbles is undesirable because of decreasing efficiency of the air per unit of volume put into bubbles, and on account of the commotion that coalescing, or "blebbing" action, produces in the pulp.

Naturally the question arises as to how the size of the bubbles can be regulated. In the first place, the larger the proportion of oil in the bubble surface, the smaller the bubble becomes, other conditions being kept constant. With the amount of oil or contaminant constant, the size of the bubbles that are generated depends upon the speed at which the air is put into the pulp and the rapidity at which the pulp is forced through the aëration zone. The smaller the amount of air fed into a unit volume of pulp, the smaller are the bubbles that are formed, and the greater the speed at which the pulp is traveling through the aëration zone, the smaller the bubbles are for any given feed of air.

FLOTATION OILS

Much has been said about the amount of oil used in flotation, and much attention has been given to the results that can be obtained with different oils. In my opinion one oil is about as efficient in flotation as another The whole point of the oil problem, is, I believe, to get the oil adjusted in solubility to the violence of agitation resorted to in the treatment of the pulp. The less violent the agitation, the more soluble the oil that must be used to obtain the best results on any ore. The more violent the agitation, the greater is the proportion of insoluble oils which must be mixed with the soluble oil to maintain proper flotative conditions within the cell.

Referring to Fig. 1, in which I have attempted to picture the relationship which exists between the five positive factors in flotation, the reader will appreciate that it is necessary to keep the amount of soluble oil or contaminant in the pulp constant throughout the machine. He will also realize that the more violent the churning which the oil and pulp receive, the more rapidly will the soluble portion of the oil go into solution. Whatever oil may be in solution tends t go largely and rapidly into bubble surface. The bubbles as they pass into the froth bed take the oi within their films out of the pulp. Consequently, in order that the films of the next series of bubbles may have the same surface tension as that of those formed the instant before, an amount of oil must have gon into solution equal to that which went into the bubbl surface during the same interval of time. That thi feeding of oil to the pulp may go on constantly, throughout the machine as a whole, in proportion to the amoun of oil that is passing out of the pulp liquid into bubbl film, a reserve of oil must be scattered through the system, and this oil must be so proportioned as to solubilit that it dissolves at just the right speed to maintai proper flotative conditions in the cell. If it were no for this properly proportioned reserve of as yet undissolved oil scattered through the pulp, the surface tensio of the bubbles would vary greatly in different parts o the machine, and so, as in all other respects the conditions in the several cells are similar, the flotative actio in some part of the machine would not be kept at a high efficiency as in others.

It therefore follows that too violent agitation make it impossible to keep a constant condition of contam nation throughout a series of cells. By mixing the contaminant oil with a more or less visoous insoluble oi the rate of solution of the contaminant is diminishe and constancy of conditions increased.

Repair Work in Milling Plants

BY CHAS. LABBE*

It is important that expenses in making repairs in milling plants be kept at the lowest possible figure. Of course, extensive repairs often call for renewals and transformations, but the present high cost of new machinery makes the repair crew an important adjunct. Repairs are due principally to wear of the machinery. Accidents also occur and necessitate repairs. Many transformations and improvements are included under the heading of repairs. They are not repairs proper, but in the great majority of cases they are made by the same crew and charged to the repair account. An outline of repairs can be made by following the mill flow sheet.

WHEN hard pieces of ore wedge themselves between the bars of the grizzly and are continually driven in by ore falling upon them, bending of the bars results, making the spaces unequal. They can be straightened with a crowbar and a ratchet jack, the foot of the latter resting on the sides of the chute. By changing the jack from one side to the other a quick adjustment can be secured, so as to reach every bar. The bars may be worn down so far that they have lost their strength and are bent downward. The only remedy would be to replace them, or, at least, replace a worn bar by a new one. The sides of the chutes may have to be relined in those places where heavy rocks are dumped.

Planking does not last long, and pieces of sheet iron must be nailed or bolted to the sides. The same work may have to be done in the bins, but here a lighter sheet iron can be used, a No. 26 or 24. It helps a great deal to keep down wear, and the ore slides much easier than on rough wood. Inside next to the gates a heavier sheet iron must be used, No. 10 to 16, often reinforced with discarded rails or flat iron such as old wagon tires which have been straightened.

In mills where shooting is done in the ore bins the repair crew usually has to work overtime. Large and heavy sheets become so warped and buckled or swollen out of shape that they must be taken to the blacksmith shop. The warping is straightened on a large iron block with hammer and flatter. For the swelling, a small hole is drilled (with diameter the same as the thickness of the sheet) at the highest part, the damaged place heated red in the forge and hammered down following the contour of the hump, starting near the foot and spiraling toward the hole. As the metal expands, the hole will be nearly closed when the work is finished. If it must be waterproof, a touch of the oxyweld flame or a small rivet will finish the job.

BELT CONVEYORS AND ELEVATORS

The belt conveyor from time to time requires the replacement of rollers, shafts, and bearings, and damaged or out-of-order grease cups, and while these repairs are being made there will be a good opportunity to line up several rollers, and add or remove side rollers. All rollers must revolve freely, and one must make sure that the grease reaches them. Remove all dust or ore which has accumulated in the front of the rollers. It may be necessary to take up the belt. Move the take-up bearings as far in as they will go, put the belt clamp on at about the length of the conveyor, and cut off as needed. Sometimes the belt breaks and the ends fly 50 ft. apart. A small belt can be brought back by hand, but for an 18- or 24-in. belt a 1-in. rope must be used, made fast with four to six timber hitches on each side, and, with a rope block, the ends should be brought back as close together as possible, so that they may be handled with the belt clamp. Patches can be put in with belt lacing where needed, care being exercised to see that they do not protude over the outside edge. The lacing should be put in so that the smooth side is on the running side. All the roughness must be on the carrying side. Patches put in with ordinary care do not affect the straight running of the belt.

ELEVATORS

Wherever there are elevators, repair mechanics are needed. No matter where the mill is put, be sure to get all the fall necessary for the continuous downward descent of the ore. The buckets wear and need replacing. Dry or wet, there is always a quantity of leakage, which causes a rapid wear of chain links, pulleys, and bearings. Always provide the elevator boot with a discharge gate at the bottom, and place the boot where it can be emptied by simply opening the discharge gate. Accessibility in this case will mean a great saving in time later.

CRUSHERS

Rock breakers are usually designed to stand all the work they are to perform, which is the hardest in milling plants. Wear takes place in the bearings and on the breaking jaws. All the bearings are babbitted, and when worn down they must be rebabbitted. Use only the grade of babbitt made for that purpose. Many babbitts are either too soft and do not stand the pressure, or are too hard and brittle. In most crushers the crushing jaws can be changed end for end. When worn at one end, which is mostly the lower end, taper bolts must be drawn very tight; and if the jaw plates have a chance to move sidewise it is best to wedge them tight, or, better, pour zinc to keep them in place. If the pitman cap studs break often this is caused by the back toggle being set on the wrong slant. The toggles must point down toward the pitman, and worn toggle and toggle seats must be taken out and overhauled at the machine shop. There must be plenty of head room at the crusher, and a crawl with chain block similar to the one over the stamp batteries must be installed even before erecting the crusher. Such an installation will pay for itself at the first repair. Over large crushers it is imperative.

In the gyratory rock crusher a common repair is the babbitting of the eccentric. A special sleeve is always provided, thus simplifying the job. The old babbitt is chiseled or melted off, the sleeve clamped on and the babbitt poured in. As soon as cool, the sleeve is removed and the oil grooves are cut. The concaves must be replaced when worn to a safe limit. To take them out, the first one (which is the hardest) must be shot out with powder by boring a small hole in the zinc. Sometimes blasting can be avoided if by careful examination a loose concave can be found by trying with the hammer, the zinc chiseled off so as to let drive a sharp moil, and then a crowbar used. To put in new concaves, a guide ring is often used, which facilitates the work. If none is at hand, each concave is braced to the head with a strip of wood. Clay softened with oil is used (as in general babbitting work) to prevent zinc from running out. Be careful that no foreign matter drops between the concaves, as it will impair the strength of the zinc and make boiling certain when pouring. The concaves will set tighter if they are heated before pouring.

---

*Mechanical engineer, Johnnie, Nevada.

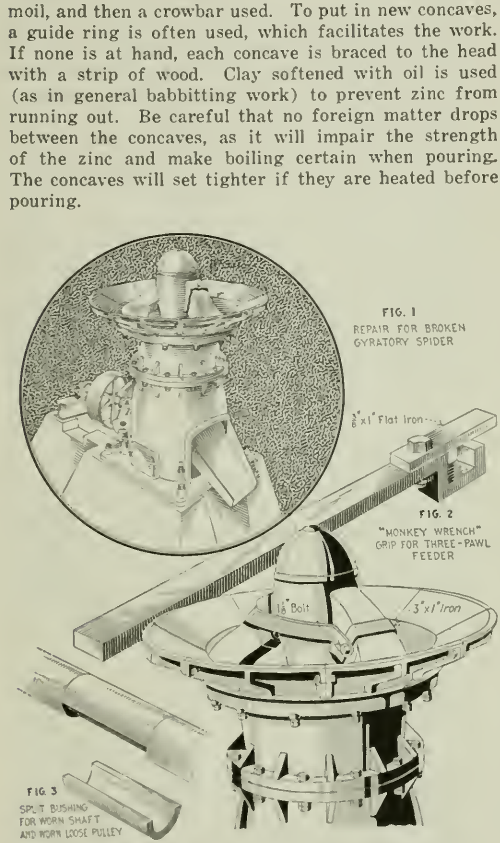


FIG. 1
REPAIR FOR BROKEN GYRATORY SPIDER
3/8"x1" Flat Iron
FIG. 2
"MONKEY WRENCH" GRIP FOR THREE-PAWL FEEDER
1 1/8" Bolt
3"x1" Iron
FIG. 3
SPLIT BUSHING FOR WORM SHAFT AND WORM LOOSE PULLEY

QUICK REPAIRS OF MILLING MACHINERY

To take up the wear and to keep the crushing uniform, the shaft is raised, but when the lower edge of the crushing head comes above the lower edge of the concaves nothing can be gained. Either the concaves or the head must be changed. To take the head off, it is best to remove the entire shaft to the machine shop, because, as a rule, it is tight, and often the hydraulic press must be used.

In some crushing plants a duplicate shaft is kept with a different head. The one already used is put in when a new set of concaves is placed, and when the concaves are somewhat worn the shaft with the new head is put in. Thus the adjustments for uniform crushing are easy and a head can be changed at the shop when convenient.

A tedious repair is the replacement of a broken shaft, and a broken spider is as bad, if not worse, as a clamp must be forged in place to fit around one arm near the shaft bushing, another clamp fitted at the lower part of the broken arm, and a strong draw bolt put on each side. But in places where big rocks hit the spider, bolts must be omitted. A piece of flat iron is heated and bent in place around one arm, extending to the lower part of the other arm; then both ends are fastened with a bolt, as shown in Fig. 1. The heat must be kept on the sides of the clamp while tightening the bolt. In cooling, the contraction brings the broken parts together.

FEEDERS

Nothing is more troublesome to the mill man than an unreliable feeder. The principal cause of trouble is lost motion. In the three-pawl friction grip, the bars and blocks become worn and often drop out. A piece of light iron, $\frac{1}{16}$ by $\frac{3}{4}$ in., bent on one end, will help in taking up the wear, but, as a whole, this three-pawl grip is being replaced by the "monkey-wrench" grip, which is, in every particular, simpler and more satisfactory, being easily made with a piece of pick steel. Still better is the one which has a small loose wedge of hard wood which can be taken out and replaced easily and quickly when worn.

ROLLS

To keep rolls in good working order it is necessary to maintain the roll shells in a smooth, straight shape. The corrugations are caused by an incorrect speed and an uneven feed, and they are fewest in rolls fed with an automatic feeder which delivers an even stream of ore over the entire width of the roll face. When rolling down the spout a classification of the material takes place. The large pieces bounce toward the edges, and those of small size fall directly in the rolls. To prevent corrugations and flanging, the whole shaft and roll is adjustable endwise by a collar or nuts and washers.

When no feeder is used, an adjustable deflection plate can be bolted in the hopper (all the bolts provided with lock washers or cotter pins to prevent their loosening and falling in the rolls), directing the ore toward the high places of the rolls. A simple device also used is a frame holding two or three carborundum bricks, usually 3 in. square and about 6 in. long. They are placed in the top housing and ride on the roll, their own weight being sufficient to wear off the ridges.

Sometimes with hard ores and soft-spotted shells it is necessary to true the shell surface in the lathe or in place. If done on the lathe the whole roll and shaft must be taken out, whereas if done in place the top housing is removed, two square pieces of steel are bolted on the frame, and a lathe compound rest with tool holder is clamped on the bars, the speed reduced by using a 1 or 2 hp. motor, back geared and belted to the large pulley of the roll. To change a roll shell it must be remembered that the hub is made of two flanges—one tight and one loose. The loose one must be forced out by three or four bolts and some pounding. Often the shell must be heated by coiling old rope around the outside, soaked with waste oil, and lighted.

The bearings may need rebabbitting. This can be done in place or in the machine shop and bored out to size; but care should be taken that the oil grooves are of ample size. It is advisable to leave an empty space on the side where the shaft exerts no working pressure, and to have such space filled with loose hemp or flax, or, still better, with woolen waste resting in oil. This provides an abundant supply of oil to the journal and at the same time wipes off any dust or rock which may have found its way into the bearing. The dust-proof covers must be examined periodically.

Much has been written about the repair of stamp mills, but a few words here will not be out of place. The mortar block may need replacing, and in that case the stamps must be raised as high as possible, the mortar either hung up with chains to the camshaft and post or moved out of the way. A templet must be made while the old block is in place, and corrections noted on the templet. The old block is then taken out and the muscles exercised at the concrete mixing until the mortar block is at correct height. Give to the concrete ample time for setting. As a block of such size cannot set properly in less than two weeks, there will be ample time to ascertain if the camshaft is level.

If the camshaft boxes need rebabbitting it must be done. Tappets or boss heads may have to be changed, and stem guides overhauled. The bull wheel may be loose on the shaft, or the belt tightener may need some repairing. I will not mention screen frames, as there should be a good supply on hand ready to be put on at a moment's notice, but the line shaft must be tested for alignment. The battery posts and stems must be checked to see if they are plumb on two sides, and nuts and bolts attended to. A finger jack may need a new handle, or the carrying edge may be so battered and short that the piece of wood must be replaced. I mention camsticks made of discarded rubber belting. They will last much longer if a piece of strap iron about 1 in. wide and about $\frac{1}{16}$ in. thick is fastened lengthwise over the wearing part.

Tube Mills

One of the main repairs of the tube mill is the relining. Less time is needed to replace metal lining than silex or rock lining, and it is favored now in the majority of mills. It is more satisfactory in the long run. Where freight costs are high and time is likely to be lost in waiting for the proper setting, the silex lining is not to be favored. While running, some of the lining may fall off, and cemented patches are unreliable. In the steel-plate lining the wear is more even, but considerable wear is first apparent on the countersunk bolts, which is soon noticed by leaks, and such bolts must be replaced. All leaks must be attended to at their first appearance, as in running they keep increasing. To make a leak-proof bolt, place the bolt in place, tighten it up so as to be sure that the nut and washer go as far as needed and that the head is drawn up. Then back up the nut and washer one thread or two threads, *not more.* Wrap the wicking or rope (swabbed with asphaltum paint) tight around the bolt, tighten up the nut, and it will not leak.

The feeder scoop may need some repairing. If side plates must be replaced, it is best to send the whole scoop to the shop and put an extra one on. Patches can be put on while in place, either with holes drilled and bolts, or with the oxyweld. The wearing point of the scoop must be of soft steel, either cast or forged, and the sharp point a piece of chrome or manganese steel, welded on. This makes an unbreakable and lasting point.

Some tube mills have a discharge of the closed type fitted with a plate or screen for retaining the pebbles. The grate type has the advantage over the drilled holes in that it permits the use of a thicker plate. The slot shape is self-clearing while revolving, whereas with the round holes any piece wedged in must be punched out. Ascertain how much the lower half of the trunnion bearings is worn down. The babbitt lining may have to be changed for a new one. Test the drive shaft for alignment and inspect the pinion and key.

Mention will be made only of the drag type of mechanical classifiers, although the other types placed in the tube-mill circuit wear in the same way, which is noticed on the ends of the rakes or edges of spirals. With all, the purpose is the same—to bring back the oversizes. In the drag type the pieces of angle iron will probably have to be replaced. The easiest way to do this is to disconnect the frame from the rods and links and to hoist the frame out with rope blocks. Place it on a flat car and run it to the machine shop, where there will be room and tools to cut the rivets off. Put new pieces on. If only one or two pieces were loose or out, a new one can be put in place with bolts without taking anything apart. While the rake is out, clean the classifier tank. Sometimes the bottom has iron and sands cemented together, forming a floor equal in hardness to an emery block. The cams may have to be replaced; also the rollers and pins. Bearings may need babbitting, but it is easier to take them out and put new ones in than to babbitt them in place.

General Repairs

The concentrators may also have to be repaired, but it is mostly the replacement of a worn-out part—simply to take the old piece out and place the new one in, and a slight readjustment of the table.

There are other repairs, such as a worn, loose pulley, which may also have worn the shaft. In such case the shaft has to be put on the lathe and dressed true. If the pulley had a bushing, a new one must be made, or it may be that the pulley had no bushing and the original bore is worn out of true. Then the pulley is rebored and a split bushing made to fit pulley and shaft. A bushing may be worn, but available for further service by a little tightening. This can be done by taking it out and dipping it in solder or babbitt, or the bushing may be split with the hack saw, a piece of tin can wrapped around, and the whole pressed back into place.

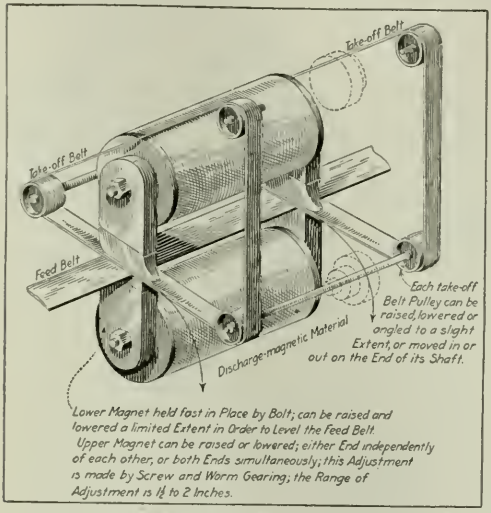
A pulley can be enlarged so that the repair will not cost more than a new one. The small ones (such as motor pulleys) can be made larger by gluing paper on them. Larger ones can be increased by wrapping belting around, held with elevator bolts, but this should not be carried to excess. Two to six inches can be gained by bolting strips of wood across the face of the whole circumference. Before use the face must be trued up either on the lathe or in place. Pulleys can be made 8 to 16 in. larger by using a piece of sheet iron or the rim of a pulley of the size wanted and putting studs and nuts radially in the original rim. In this way the new rim can be centered and trued up, by screwing or unscrewing the studs, and when finished they can be riveted on or welded on with the oxyweld.

There is room for improvement in the design of bearing boxes. Why not make them with removable die cast liners, the castings simply bored out and faced on both sides to standard sizes? Also in many places roller or ball bearings could be used with great advantage. Their first cost presents the chief difficulty. There would be a big market for them if they were made cheaper and in standard sizes. I believe a fan, dynamo, or the pedestal bearings of centrifugal pumps can be constructed with ball bearings and a saving effected in oil and power. I do not see that they have to stand harder work than the front wheel of an automobile. In the future, I feel sure that the designer will ask the repair man about some details, but when I realize that the hoist, compressor, pumps, cyanide plant, and engines have to be repaired, excuse me, but I must go and get busy.

Working Adjustments of the Wetherill Magnetic Separator

By GEORGE J. YOUNG

THE general features of the Wetherill separator are sufficiently well known to make it unnecessary to describe them in detail here. Fig. 1 indicates the more important magnet adjustments. The description that follows applies to a 4-pole machine provided with a 6-in. feed belt. Adjustments which the operator can make, and the method of making them, are relatively simple, but require judgment. The lower magnet of each pair can be raised and lowered to a limited extent, and the adjustment is necessary in order to make the feed belt level or to eliminate a hump caused by one of the lower poles being too high. Once the adjustment has been made, the lower magnet should be bolted firmly in position, because the upper will lift the lower magnet if the bolts of the latter are not tightly secured. The upper magnets are raised and lowered by means of a worm gearing, operated by a sprocket chain and a hand wheel. Each end of a magnet is provided with an independent adjustment attachment, and, within certain limits, either pole of an upper magnet can be raised or lowered. The adjustment is required for increasing or decreasing the pole distance.



Each take-off Belt Pulley can be raised, lowered or angled to a slight Extent, or moved in or out on the End of its Shaft.

Lower Magnet held fast in Place by Bolt; can be raised and lowered a limited Extent in Order to Level the Feed Belt.
Upper Magnet can be raised or lowered; either End independently of each other, or both Ends simultaneously; this Adjustment is made by Screw and Worm Gearing; the Range of Adjustment is 1½ to 2 Inches.

FIG. 1. ADJUSTMENTS OF WETHERILL SEPARATOR

Each pair of magnets (upper and lower) is provided with an ammeter and a rheostat. The resistance of the rheostat is divided into a sufficient number of parts to make the current increment for a shift of the handle of the rheostat, one button, quite small. By means of a suitable field rheostat in circuit with the d.c. generator, the current to each magnet can be regulated within any reasonable limitations; but, necessarily, the allowable maximum current should not be exceeded.

The feed belt is driven by a step pulley which permits of four speeds, a range more than sufficient for the work that the machine is called upon to do. Slack in the feed belt is taken up by a tightener, and this adjustment must not be neglected. The feed hopper is provided with an adjustable gate and feed sole, so that adjustment may readily be made. For a coarse feed, down to 30 mesh, the feed sole can be left in its lowest position, but for a fine feed it should be raised until a smooth feed bed results. It can then be wired in proper position.

The take-off belts are of thin, smooth rubber. They are provided with step pulleys, and can be driven at three speeds. For some kinds of work I am of the opinion that a belt with fine transverse corrugations would give better results; and experimental machines, at least, should be provided with them, as well as with the smooth belts. The take-off belts are provided with adjustments so that they can be slightly raised or lowered, shifted from side to side, and tightened. It is necessary to have the belts lined upon and symmetrically placed with reference to the pole pieces. The belt should be moderately taut. Sometimes trouble with the take-off discharge can be remedied by slightly loosening the take-off belt. The portion passing under the pole piece should be horizontal and should touch the pole piece lightly.

The upper pole of a pair of poles is made wedge-shaped, and the lower is rectangular in section and flat. The maximum field is from ½ to ¾ in. wide by 7 in. long.

POLE DISTANCE AND AMPERAGE

Pole distance is one of the most important adjustments, for upon it depends the satisfactory operation of the take-off belts, the cleanness of the products, and the effectiveness of the separation. The nearer the poles are to each other, the greater the concentration of the magnetic field for a given amperage. If the poles are too close, the magnetic material clinging to the take-off belt will brush across the bed upon the feed belt and carry non-magnetic material into the discharge of the take-off. On the other hand, if the pole distance is too great, the magnetic material will pass through a relatively greater vertical interspace, and a better opportunity will be afforded for the non-magnetic material to drop back upon the belt from which it was lifted with the magnetic particles. It is impracticable to use a great pole distance, even with an amperage sufficient to lift the magnetic particles, because the take-off belts do not discharge properly under such conditions. With coarser material a greater pole distance can be used than with fine. Minimum pole distance ranges from ⅛ to ¼ in., measured above the feed belt, and the maximum is 1 in. Fig. 2 illustrates the relation between the six poles of a three-magnet separator.

By the use of the rheostat and suitable current connections, the amperage upon a magnet can be varied from 0.05 to 6. This affords sufficient range for most of the conditions that a separator will be required to meet. In making the amperage adjustment, it is best to start with a small current, 0.1 ampere on each magnet. The current to each magnet can be increased gradually after starting the feed and the work that it is doing judged by the discharge from the take-off belt. Excessive amperage will be indicated by a bunchy and intermittent discharge.

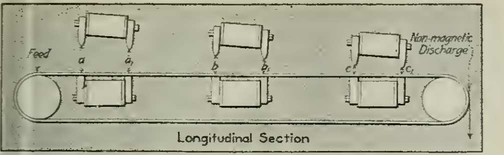


FIG. 2. ADJUSTMENT OF SIX-POLE SEPARATOR

The various conditions with which the operator will have to cope are illustrated in Fig. 3. A normal discharge is shown by *A*. The stream of material has the appearance of a thin, slightly curved rod. In *B* the stream of material drops with a greater curve and sprays out more than in *A*. This condition may be due to too low a speed of the take-off belt, too high an amperage, or too great a pole distance. In *C* the take-off stream drops sharply, and part of the material returns to the belt. The portion which is discharged falls in masses. Excessive amperage usually causes this condition. In *D* the magnetic material collects in a nebulous mass in constant motion below the horn of the upper pole. After a certain volume has collected, a portion is discharged. Both excessive amperage and pole distance cause this condition. In *E* the magnetic material bridges across the poles at a point beneath the take-off horn. Material of high magnetic permeability under high amperage will act in this manner. So tenaciously does the bridge form, that the take-off belt will be stopped.

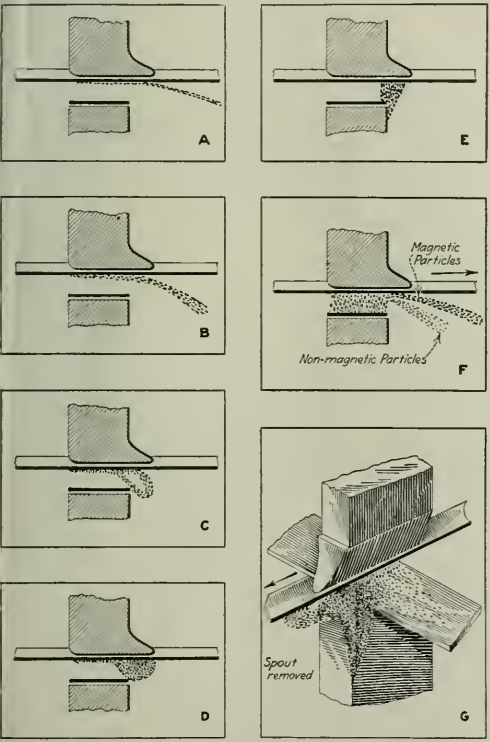


FIG. 3. VARIATIONS IN DISCHARGE FROM POLE PIECE

An aggravated case of excessive pole distance and high amperage is shown by *G*. The magnetic material builds up on the corner of the lower pole from the "boiling mass" just beneath the discharge horn. In this position it pushes the non-magnetic material off the belt and "drips" down below the lower magnet.

The condition represented in figures *C*, *D*, *F*, and *G* is readily explained. A magnetic particle on the feed belt is lifted to the upper magnet pole, but is prevented from touching it by the take-off belt. The take-off belt pulls the particle to one side and eventually out of the strongest portion of the field. If the force in the direction of the take-off is strong enough, the particle will be thrown a sufficient distance so that there is no danger of return. Increase of amperage with a given pole distance increases the force of the magnetic field, and often to such an extent that the particle is drawn back before it can fall into the discharge hopper. The force exerted upon the field must be just strong enough to lift the particle to the take-off belt, and any increase interferes with the proper discharge of the magnetic particles. Particles of low magnetic permeability will discharge properly, even if the magetic field is excessive. Increase of the pole distance diffuses the magnetic field over a larger area, and this tends to cause strongly magnetic particles or very small particles to return to the field.

Fig. *F* represents a condition caused by an excessive amount of magnetic material removed by one belt. A stream of non-magnetic particles is pulled off with the magnetic ones. There is a practical limit to the capacity of the take-off belt, and if this is exceeded the non-magnetic product is contaminated. Sweeping also takes place under the same conditions.

Speed of Take-Off Belt and Thickness of Feed

The take-off belt must develop a sufficient horizontal component to propel the magnetic material out of the field. For strongly magnetic material the highest speed is essential, whereas for weakly magnetic minerals a lower speed may be sufficient. Take-off capacity is also determined by speed, and where there is a large burden of magnetic material the highest speed is necessary.

Too thick a bed on the feed belt causes a disturbance beneath the take-off belt and results in non-magnetic material being discharged with the magnetic. It also causes some of the magnetic material to be discharged with the non-magnetic. For good separation a thickness from 1½ to 2 grains high is desirable.

Speed of Feed Belt and Uniformity of Feed

With a given thickness of bed, capacity is determined by the speed of the feed belt. Too high a speed produces dust and does not allow sufficient time for some materials to react to the magnetic field. The width of the maximum field is from ½ to ¾ in., and at 30 ft. per min., the lowest speed, the time interval is 1/12 sec. for the passage of this narrow strip. At 90 ft. per min. the time is 1/36 sec. At the minimum speed, the magnetic particles begin to rise before they reach the magnetic field, but at the maximum speed, 110 ft. per min., the particles pass the magnetic field and are pulled back as shown in Fig. 4. This applies to highly magnetic substances such as iron filing. It is evident that with minerals of low magnetic permeability, consideration of this time interval is even more important. With weakly magnetic material, low speeds are desirable, and with highly magnetic, high speeds are not objectionable. Experimental runs indicated the largest crops of magnetic material at the slowest feed-belt speeds.

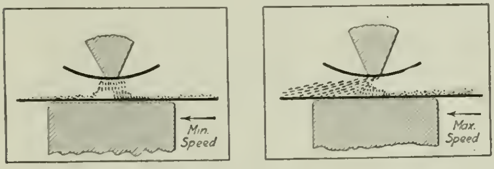


FIG. 4. ACTION OF MAGNETIC PARTICLES AT DIFFERENT SPEED RATES

Uniformity in feed rate produces a bed of uniform thickness and is essential for good separation. Too great disparity in the size of the material particles must be avoided to secure this. Sizing is essential in most cases, but numerous sizes, such as would be required in dry concentration, are not necessary. The material must be thoroughly dry. Certain minerals develop a tendency to stick and hang in the feed hopper. As a rule roasted or magnetized ore will feed satisfactorily, even though finely divided. If it is necessary to crush the material, it should be done before roasting.

Differences in magnetic permeability of the minerals and compounds to be separated are important as affecting the adjustments of the separator. Needless to say, minerals of high magnetic permeability are more readily separated and permit of easy adjustment. Minerals of low magnetic permeability require more careful adjustment and maximum field strengths. The proportion of magnetic material in the field has considerable influence upon the capacity of the separator. Where there is a small proportion, as, for example, 10%, the capacity of the separator is determined by the capacity of the feed belt. With proportions exceeding 50%, the capacity of the separator is determined by the capacity of the take-off belts. In the *Journal* of Sept. 16, 1918, p. 868, I discussed this subject at length.

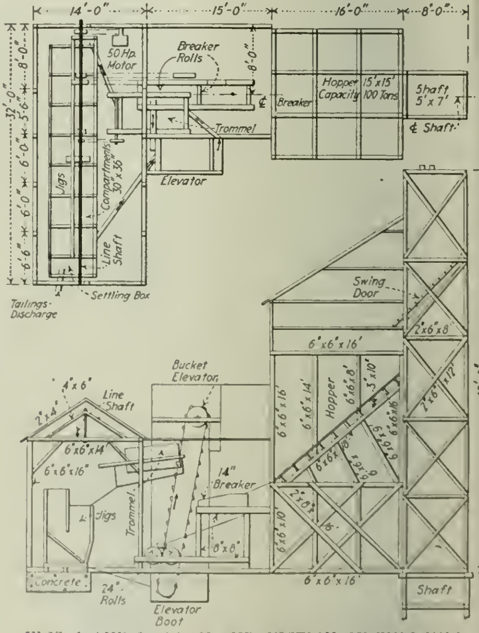
The Design of a Small Zinc Mill

By W. F. Boericke*

The plan and section of a small zinc mill, supposed to have a capacity of 75 to 100 tons per eight-hour shift, are illustrated by Figs. 1 and 2 of the accompanying drawings. The mill was erected during the boom period of 1916, in only six weeks' time, at the remarkably low cost of $7200. The principal objective at the time was to get the mill built and operating as soon as possible, to take advantage of the extraordinary prices for ore then prevailing. It ran successfully for six months, and made a satisfactory recovery from a comparatively thin feed of high-grade ore. That is to say, on heads running about 4.5% Zn the tailings averaged about 1.5% Zn, an estimated recovery of 66 per cent.

A glance at the flow sheet (Fig. 3) will show that the mill was of the simplest character, without a single unnecessary piece of machinery. Indeed, the design might be criticised as lacking some details that would have added considerably to the recovery. Though ac mitting this, the owners undoubtedly believed that th mill would do well enough for the purpose intende If the mine developed sufficiently to justify a furthe capital outlay, it would be an easy matter to enlarg the mill. Much money is often lost by putting u equipment and buildings far more elaborate than th mine can afford or can supply with ore. When there i doubt as to the future of the orebody, and yet some immediate return is required, it is often necessary to compromise with efficiency for the time being.

In this particular case, only one mill elevator wa needed in the entire milling process, whereas three o four elevators are required in the usual mill. On account of a natural slope of the ground, no tailings elevator was required. The disposal of the chats from th last cell by returning to the elevator with the oversize and thence to the rolls and over the jigs, is the weakes point in the design. As there was only one elevator however, this was necessary, in order to get them ove the jigs again. An improvement would have been t run them through a small set of "chat rolls," thenc to an elevator, and through a second trommel. Th oversize should be returned to the rolls, the undersize going direct to a set of four sand jigs. This would prevent overcrowding the rougher jig, and thus secure better work.



FIGS. 1 AND 2. PLAN AND SECTION OF ZINC MILL

One of the principal difficulties in a single-jig mill is that the jig is likely to be overcrowded, with attendant difficulty in adjusting the beds. Unless the jig-line shaft is split, the jigs will all operate at the same speed, although better results might be obtained by running the last cells at a different speed from the first. It is customary to run the rougher about 180 r.p.m., whereas the sand jigs may have a fast, light pulsion stroke, with little suction stroke, at a speed of 220 r.p.m. Such refinement is difficult to obtain when all the work must be done on a single jig. The practical result is that, in general, the tailings from the single-jig mill are higher in zinc than in the case of the two- or three-jig mill. But a great deal depends on the watchfulness and individual skill of the mill man, and his experience with that particular type of ore. Excellent work can be done with a small mill, with the right kind of ore and the right kind of men.

---

*Mining engineer, Galena, Ill.

The amount of water required for a mill of this kind is about 500 gal. per min. A large proportion of this can be saved and re-used, by drawing it off from the settling box, and running to the mill pond, from which it can be pumped back to the mill. The amount needed from the mine, or an outside source, need not exceed 100 gal. per min. Where pure water can be obtained, however, it is better to use it, as there is less chance of contaminating the concentrates with limestone. Frequently the substitution of fresh water, instead of re-using the water, has cut down the lime in the concentrates more than 1 per cent.

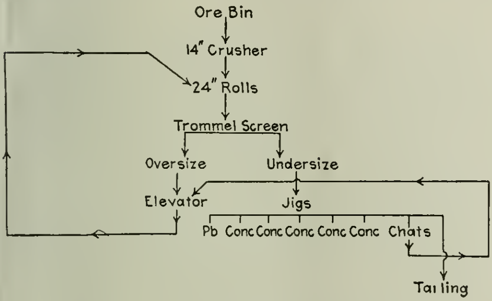


FIG. 3. FLOW SHEET OF ZINC MILL

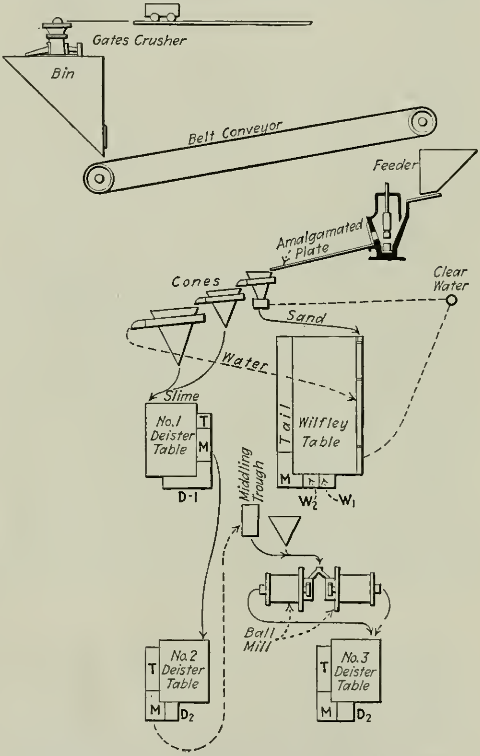
The small mill has considerable advantage over its larger prototype. It requires fewer parts, and consequently there is less danger of breakdowns and loss of time. Adjustments are simpler and more quickly made. Power and water consumption are smaller. It is generally more easily kept warm, an important consideration in a cold climate, where below-zero weather brings fresh troubles for the mill man. Depreciation charges are less, if this item be charged against the milling cost.

Labor costs are usually about the same as in a larger mill. The crew consists of a crusher-feeder, a mill man, and a helper, and the same crew can run a properly designed mill of three times the capacity. Hence the per-ton milling costs are much higher than in the operation of a big mill. The total amount of lumber required for the mill plans shown was about 20,500 board feet. A 50 hp. motor was used.

Homestake Tungsten Mill

The tungsten mill of the Homestake Mining Co. has a battery of five stamps, which are electrically driven and crush from 15 to 25 tons per day. The screen is 22 by 12 mesh, steel wire, with openings 0.02 by 0.056 in. An amalgamated plate, 4 ft. 6 in. wide by 4 ft. long, is used outside the mortar, and small pieces of copper plate are placed at suitable points on the tables and in launders, from which an appreciable amount of amalgam in collected. The tailings pass to one of the plate houses, and thence to the general classification and cyaniding systems of the large mill. The average gold content of the tailing is about the same as in the general run of Homestake ore. The arrangements of the tungsten mill are sufficiently elastic to allow of various combinations of units to suit different grades of ores, and are available for general testing purposes.

The ball mills are cast-iron barrels, 2 ft. diam., inside, by 2 ft. 6 in. long. The feed and discharge are through hollow trunnions, and chrome-steel balls are used. Two grades of concentrate are made on the Wilfley table, and one grade is made on the first Deister, and a fourth low-grade product on the two lower Deister machines. The concentrates are received in iron-lined boxes and dried by steam. Middlings collected from the lower Deisters are carried by hand to a V-shaped trough, whence a small stream of water conveys them to the feed box of the ball mills.



FLOW SHEET OF HOMESTAKE TUNGSTEN MILL. W, W, D, D INDICATE FOUR GRADES OF CONCENTRATE. T = TAILING. M = MIDDLING

The mill was started in June, 1916, and has since been operated continuously on an ore which has yielded an average of 2% WO_3 in the form of a concentrate averaging 54 per cent.

North Butte's bonus system of paying miners is working satisfactorily, with increased efficiency shown. Development work on Edith May fissure continues in grade of ore above 4%. Development work on upper levels has put considerable tonnage of second-class ore in sight or indicated. Crosscutting continues at Sarsfield shaft, with no change.

An Outline for Flotation Test Work

By H. L. HAZEN

IN PREPARING an ore for flotation tests the sample is crushed, as nearly as possible, by the method to to be used in the prospective mill. The value of an entire investigation may be seriously impaired by failure to observe this condition. The results of preferential flotation tests made on ore dry-ground in a disk grinder would be no criterion of those that would be obtained in practice where the same ore is wet-crushed in a ball mill. In dry grinding, not only is there a tendency for the mineral to become superficially oxidized, but the physical nature of the gangue is often widely different from that displayed after wet grinding. For example, in the case of a Mexican lead-silver-gold ore that came under observation the pulp, after dry grinding in a disk machine and pulping in water, settled to about half the volume that it occupied when wet-ground, all conditions except the method of grinding being the same.

Usually dry grinding tends to impair the amenability of an ore to treatment by flotation, but occasionally the reverse is true. It was found in an investigation for the treatment of a graphite ore that after the ore was ground dry in a disk grinder the major portion of the graphitic content of the ore could be concentrated in a mechanical type of flotation machine without the addition of reagents, but after wet grinding in a ball mill the addition of a reagent was necessary to cause the graphite to float.

Again, the price received for a concentrate may depend upon its physical condition, which, in turn, will depend upon the manner in which the ore was ground. This is illustrated by graphite ores on which special grinding tests are necessary to determine the method that will produce the greatest amount of No. 1 flake graphite.

Preliminary Tests

General conditions are first established that will give a commercial extraction of the valuable mineral and a concentrate of suitable grade. This is the stage of preliminary tests, made to determine the amenability of the ore to treatment by flotation. In this connection, is it not only necessary to discover the reagents that will give the best extraction, but the general flow sheet for the prospective treatment of the ore must be determined. If the desired extraction can be obtained by direct flotation, this would be the most desirable method, as it gives a simple flow sheet and low operating costs, and it would hardly be expedient to carry the investigation, at this stage, past the selection of the proper reagents.

Should direct flotation fail to give a satisfactory extraction, the value of auxiliary methods that might aid flotation in giving the desired result should be investigated. By way of illustration a few of the actual examples that have come under observation are given: With some complex copper-zinc ores carrying a large amount of pyrite it was found necessary to make first a bulk flotation concentrate and then roast the concentrate and re-float it before a commercial separation of the copper and zinc minerals could be obtained (Horwood's process). In making tests with another base-metal ore no mineral whatever could be extracted until the sands and slimes were separated. A certain volcanic mud carrying oxidized copper, after sulphidizing, required a dilution of ten to one for flotation. With many oxidized ores and a few unoxidized ones table concentration proved to be a helpful auxiliary to flotation.

The reason for placing emphasis on extraction in the preliminary tests is to minimize the work as much as possible and therefore the cost of the investigation. For example, if it were later found that some reagent other than those reagents established at the time of testing would materially increase the extraction, all work subsequent to these tests would have to be repeated so that conclusions might be drawn from tests made with the new reagent.

Locked Flotation Tests

Assuming that the results obtained in the preliminary flotation tests justify further work, all subsequent experiments are made in such a manner as to reproduce, as nearly as possible, mill results. Should the flow sheet as established in the preliminary tests require the use of other methods in conjunction with flotation, these methods must be incorporated in all tests made to determine the details that affect the returns derived from the treatment of the ore, such as fineness of grinding, quantity of reagents and other factors. In view of the fact, however, that flotation is the metallurgical method under consideration, the remainder of this outline concerns itself only with that phase of the treatment.

The middling product in flotation always contains gangue, occasionally mineral not entirely crushed free from gangue, and valuable mineral that yields to flotation only slightly, a portion of each of which in practice would enter the tailing product when the middling is returned to be treated with the incoming ore. The tailing product from a single flotation test never represents the character, and not always does it determine the assay value, of that product as obtained in continuous operation.

For the purpose of obtaining in the laboratory a representative flotation tailing product, a locked test is made on a number of equal portions of a crushed sample of the ore. The middling product from the concentration of the first portion is added to the second portion, the middling product from the treatment of this combination is added to the third, and so on until the desired number of portions have been treated. In this manner the gangue, and perhaps some mineral, in the middling product is given an opportunity of entering the tailing, and a stage of equilibrium is soon reached in which the tailing receives as much gangue or mineral from the middling product of the preceding run as it in turn gives up to the new middling product. Once this stage is reached, the tailing product will closely represent that obtained in practice.

It is occasionally found that the assay value of the successive tailing products of a locked test will increase steadily up to the point of equilibrium, and this maximum assay value will represent the assay that will be obtained in the prospective mill unless some method is found to render the mineral more amenable to treatment by flotation. Equilibrium is usually reached at the end of three or four circuits, but a locked test of five circuits gives a desirable factor of safety.

Fineness of Grinding

A sample of the ore is crushed to pass 40 mesh, and a screen analysis, with assays, is made on a portion of the crushed material. Five other portions from the same lot of ore are successively concentrated, forming a locked test as already discribed, and a screen analysis, with assays, is made on the fifth flotation tailing product. The percentage extraction from each screen size s calculated from the weight and assay of the respective sizes as obtained in the two screen analyses, and the coarsest size to which the ore should be ground in practice so as to give the greatest commercial return is determined from a consideration of the extractions and the cost of grinding. For the purpose of determining accurately the critical crushing point, another sample of the original ore is ground to pass a screen one size coarser than the economic size determined by the first test, and the entire test is repeated.

It has generally been found that for mechanical reasons 40 mesh is about the coarsest material that an be efficiently handled in a flotation machine, and the ore need be ground no coarser than that for the first of he foregoing tests. With many ores this one test will determine the critical crushing point with a close approximation to accuracy, and the second test may someimes be neglected if other data on corroborating ests are at hand. In the majority of cases, however, he test on more finely ground ore should be made, beause the increased comminution will liberate a greater uantity of colloidal material, which will have a decided ffect both upon the character of the froth and the mount of reagents necessary and therefore may affect he extraction from the different sizes of crushed ore.

Besides this, when dealing with gold and silver ores n which the gold and silver is intimately associated with two or more base-metal sulphides, the extraction rom the various sizes as determined with ore crushed o pass a 40-mesh screen may not be the same as if he ore were crushed to a finer mesh. The reason is ound in the different hardness and flotative qualities f the base-metal sulphides. As an example, a larger ercentage of the galena than of the sphalerite contained in an ore will, on crushing, enter the finer sizes, nd as the lead sulphide is usually more easily floated han the zinc sulphide, a better extraction of the associated precious metals might be obtained from the finer izes with coarsely crushed ore than if the ore were more finely comminuted. The second test, made on ner ore, will eliminate any error due to either the resence of more colloids or a difference in the hardness nd amenability to flotation of the constituent materials.

The method so often used of crushing samples of the riginal ore to pass various mesh screens, and concenrating each sample separately, will not indicate the ritical crushing point with accuracy. In the first place, hen an ore is crushed in the laboratory to pass a ertain mesh, the number of particles of any given size ill vary greatly from that resulting from crushing on he milling scale to pass the same mesh screen. The everal reasons for this follow:

1. The degree of comminution of an ore crushed in the boratory to pass a given mesh varies inversely as the frequency of screenings made during the grinding. It depends upon the personal inclination of the investigator, for instance, whether an ore crushed to pass 80 mesh contains 20% to 50% plus 200-mesh material in the final product.

2. Almost universally the mill depends for classification upon the rapidity with which the particles of the ground ore settle through water, whereas in the laboratory the classification is made with screens. With the exception of flaky mineral, such as molybdenite, graphite, and mica, the main factor controlling the size of the constituent minerals in the final mill product is their specific gravity, and the heavier minerals will be more finely crushed than the lighter ones. In the laboratory, specific gravity plays no part whatever in determining the fineness of the ground ore; size is the only factor.

3. A mill working in closed circuit with a classifier will receive in the oversize return a large amount of ore already ground to the desired fineness and which by regrinding is comminuted more than is necessary.

4. The first crushing that a lump of ore receives on entering a ball or pebble mill produces immediately some material of the requisite fineness, which is ground still finer as it proceeds through the mill, thus tending to produce an overground product.

In the second place, when crushing various samples of the original ore to pass different sized screens, and concentrating each sample separately, slight assay errors could easily cause the economic crushing point to be incorrectly determined. As an illustration, take a gold ore crushed to pass a 60-mesh screen with 10% plus 80 mesh, on which, by re-grinding the 10% to pass 80 mesh, 50c. more per ton of plus 80-mesh material can be obtained. A test made on a sample of the original ore crushed to pass 80 mesh would result in a tailing product assaying only 5c. less than if the ore had been crushed to pass a 60-mesh screen. Five cents per ton could be easily lost in assay errors and 60 mesh reported as critical grinding point instead of 80 mesh.

The ore, crushed to the economic fineness, is tested to determine the smallest amount of reagents, the minimum time of treatment, and the lowest ratio of dilution required to give the extraction. It is difficult to determine in the laboratory the exact amount of reagents which will be consumed in practice, because in continuous operation the usual constant return of water from the tailing, carrying soluble reagents, will generally result in a rather lower consumption of the reagents than used in test work. This, however, gives the investigator a feeling of security in reporting the maximum quantity of reagents necessary in practice as the minimum quantity found to be sufficient in the test work. A large amount of test work could be done to determine the minimum quantity of reagents, but this can more readily be done in the mill. From the time of treatment and pulp dilution, the size of flotation machine can be determined.

Corroborating Test

A locked flotation test is made under the conditions established as giving the greatest profit from the treatment of the ore. This is the last test of the investigation and is made to substantiate the conclusions drawn from the preceding tests. The type of flotation machine to be recommended for use in the prospective mill should be used in this test, as, other conditions being constant, the extraction is often affected by the type of flotation machine employed. All the products of the test are assayed, and they should closely parallel mill results.

Ammonia Leaching of Copper Ores*

By LAWRENCE EDDY

DURING 1918 a number of improvements, mostly of a mechanical nature, were made at the plant of the Kennecott Copper Corporation, at Kennecott, Alaska. The leaching plant at Kennecott is designed to treat the tailings from a wet concentrating mill, and has handled up to 450 tons per 24 hours. The maximum capacity, however, with the equipment to be described, is over 600 tons per day.

The ore contains copper in the form of sulphides, mostly chalcocite, with some covellite, and also oxidized copper in the form of the carbonate, malachite. The gangue is limestone. There is no native copper present. Treatment of the ore on concentrating jigs and tables gives a good recovery of the heavy sulphides, but the malachite is inclined to be porous and flaky, and is of nearly the same specific gravity as the limestone; hence 40% of the copper in this material passes into the tailings. The ordinary acid leach is not suitable to recover this copper, because it also attacks the limestone. Flotation would entail more grinding, and sulphidizing.

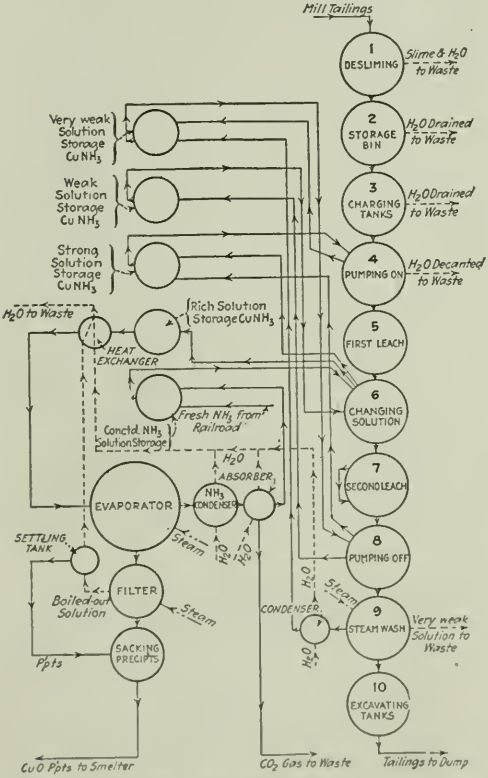


FIG. 1. FLOW DIAGRAM

Under these circumstances ammonia leaching was adopted, and the process has now been cheapened so as to permit its application to a wide range of ores. Ammonia will not recover gold or silver, or any coppe sulphides, unless roasting is resorted to. With oxidize copper having the general form $CuCO_3 \cdot Cu(OH)_2$ a dark-blue solution is formed which on heating gives off NH vapor, CO_2 gas, and deposits a heavy black powder consisting mostly of CuO. I am not prepared to give th chemical formula of the blue copper-ammonia solution I believe that it is a mixture of cuprous and cupri combinations; also that the proportions differ unde different conditions. Table I shows the character o the mill tailings as they reach the leaching plan Copper sulphides are also present, in addition to th oxidized minerals, to the extent of 0.20%, but bein inactive in the leach they are considered as part of t gangue. Roasting would not pay, because of the sm quantity of sulphides which would be recovered.

TABLE I. SCREEN TEST OF MILL TAILINGS

Size	Per Cent. Weight	Per Cent. Copper in Oxidized Mineral	Percentage of Distribution of Copper in Oxidized Miners
+ 12 mm.	5.6	0.69	3.8
+ 9 mm.	17.0	0.71	12.0
+ 6 mm.	24.5	0.75	18.3
+ 2 mm.	27.6	0.79	21.7
+ 1 mm.	5.6	0.90	5.0
+ 40 mesh	4.1	1.20	4.9
+ 60 mesh	1.9	1.43	2.7
+100 mesh	2.7	1.41	3.8
+150 mesh	1.3	1.20	1.6
+200 mesh	1.5	1.45	2.2
—200 mesh	8.2	2.94	24.0
	100.0		100.0

TABLE II. SCREEN TEST ON LEACHING PLANT HEADS

Size	Per Cent. Weight	Per Cent. Copper in Oxidized Mineral	Percentage Distribution of Copper in Oxidized Miner
+ 12 mm.	6.0	0.69	4.7
+ 9 mm.	18.1	0.71	14.7
+ 6 mm.	26.1	0.75	22.4
+ 2 mm.	29.4	0.79	26.5
+ 1 mm.	6.0	0.90	6.2
+ 40 mesh	4.4	1.20	6.0
+ 60 mesh	2.0	1.43	3.3
+100 mesh	2.9	1.41	4.7
+150 mesh	1.4	1.20	1.9
+200 mesh	1.6	1.45	2.6
—200 mesh	2.1	2.94	7.0
	100.0		100.0

TABLE III. SCREEN TEST OF LEACHING PLANT TAILINGS

Size	Per Cent. Weight	Per Cent. Copper in Oxidized Mineral	Percentage Distribution o Copper in Oxidized Miner
+ 12 mm.	6.0	0.21	6.1
+ 9 mm.	18.1	0.18	15.7
+ 6 mm.	26.1	0.18	22.7
+ 2 mm.	29.4	0.19	26.9
+ 1 mm.	6.0	0.19	5.5
+ 40 mesh	4.4	0.25	5.3
+ 60 mesh	2.0	0.28	2.7
+100 mesh	2.9	0.28	3.9
+150 mesh	1.4	0.29	1.8
+200 mesh	1.6	0.32	2.5
—200 mesh	2.1	0.68	6.9
	100.0		100.0

BRIEF COMMENT ON FLOW DIAGRAM

Item 1. The mill tailings are leached as they con from the jigs and tables without any further crushin They must be deslimed, however, because the slim have the bad effect of cementing the ore in the leachi tanks, forming a hard mass that is penetrated wi difficulty by the leaching solution or the steam was It is also much harder to excavate the leached tailin unless they are cleaned of material finer than 200 mes

---

*Abstracted from *Chemical and Metallurgical Engineering*, Vol 20, No. 7, p. 328.

Desliming apparatus consists of two Esperanza classifiers 5 ft. wide and 30 ft. long. One only is in use at a time, the other being a spare. Table I shows the character of the deslimed ore. Most of the minus 200-mesh material has been removed, but all the fine sands are left in the ore. At present these slimes are run to waste, pending further development as to their treatment. An extraction of 80% can be obtained from the deslimed ore. Screen tests show that the best results are obtained with finer sizes, plus 60-mesh material giving the best extraction. However, the extraction from the coarser sizes does not drop enough to warrant putting in a crushing plant, which, if in operation, would cause a still greater slime loss.

Item 2. A 300-ton storage bin is installed to permit of short shutdowns in either mill or leaching plant without inconvenience.

Item 3. The ore is fed from bin gate to an elevator by a 32-in. apron feeder. It is elevated to the top of leaching tanks and conveyed by a chain scraper to the charging doors on the tops of the leaching tanks, into which it drops by gravity. The resulting cone of ore is leveled off inside the tanks by revolving the excavator mechanism backward, and by hand shoveling. The rate of charging the tanks is about 600 tons per 24 hours.

Item 4. It is to be understood that processes 4 to 10 are applied to the ore without transferring it from one tank to another. The order in which each step of the process occurs is from top to bottom of the chart. There are eight steel leaching tanks, constructed as shown in Fig. 2, which are charged and used in rotation. Process 4 requires about eight hours, during which the lixiviant is pumped into the bottom of the tank and rises up through the material. This displaces the moisture contained in the ore, which is approximately 5% of the dry weight. Part of this can be decanted off the top of the charge and run to waste as it rises above the incoming ammonia solution, but part becomes mixed with ammonia and is decanted into the weak-solution tank. The remainder is left in contact with the ore, where it dilutes the leaching solution.

Item 5. The ammonia solution is allowed to stand on the ore for 12 hours, without agitation.

Item 6. A portion of the first leaching solution, approximately saturated with copper, is pumped from the bottom of the leaching tank. At the same time an equal volume of concentrated ammonia, together with some weak copper-ammonia solution, is pumped on the top of the charge.

Item 7. For 30 hours the leaching solution is circulated through the charge by a centrifugal pump, which draws the solution from the bottom and discharges it on the top of the charge.

Item 8. Having dissolved all the copper that will go into solution in 30 hours, the leach is now drawn off from the bottom of the charge and transferred to the storage tank for strong copper-ammonia solution; at the same time 20 or 30 tons of weak solution or wash is pumped to the top of the charge and allowed to trickle down through it, so as to wash out the strong leaching solution.

Item 9. Steam is turned into the top of the tank for about 12 hours, so that it heats the entire charge. This vaporizes any ammonia left in the ore, the weak ammonia vapor passing out of the tank through the drain pipes in the bottom and being recovered in a special condenser, from which it is transferred to the weak-solution storage tank. When the ammonia content of this condensate has fallen to 0.45%, the wash is considered finished and the steam is turned off.

Item 10. The doors in the bottom of the tank are opened, and the tailings discharge to a conveyor belt and are transferred to the tailings dump. Less than half the charge runs out by gravity; the rest is excavated by means of a number of scrapers that revolve about a central shaft and are lowered in the tank by means of an automatic feed screw. Some of the tanks are not yet equipped with this excavating mechanism, and in them a light "slip scraper" is used. This is guided by hand and pulled by a small hoisting cable working through the top door of the tank. This device is unsatisfactory, because a great deal of time and valuable cooling water must be expended before a man can get into the tank to guide the slip. Formerly all tanks were excavated by hand shoveling at a cost of about 11c. per ton.

THE LEACHING TANKS

Fig. 2 is a sectional view of one of the leaching tanks, of which there are eight. The incoming ore was formerly distributed over the tank by means of a rotary feeder, to prevent segregation of the finer particles. Recently this has been found unnecessary, and now the ore is simply dumped into the tank through one of the top doors and leveled off. This method of charging gives a light porous bed of ore, which is easily penetrated by the solutions. It is advisable to level off each charge carefully, so that identical volumes of leaching solution will always just submerge the ore. Otherwise costly irregularities in the operation of the plant will ensue, and the storage tanks will be taxed by a large amount of idle solution.

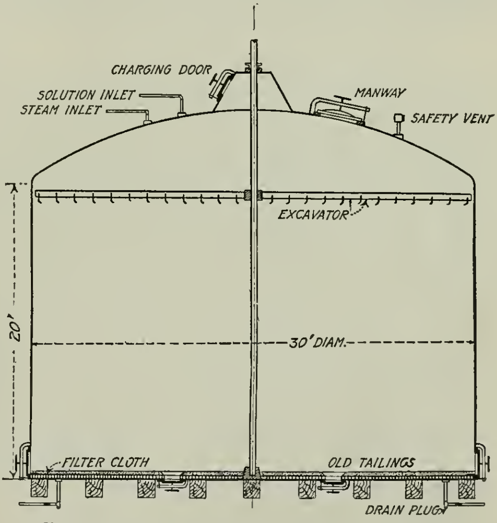


FIG. 2. SECTIONAL VIEW OF LEACHING TANK

While the tank is being charged, and during the interval between charging and the application of the first leaching solution, a considerable quantity of water seeps out of the ore and is allowed to escape by unscrewing drain plugs in the bottom of the tank. If this water were left in the ore it would dilute the leaching solution, and eventually would have to be boiled out of the system in the evaporators at a considerable expense for steam. Therefore this drainage is important, and should be encouraged as much as possible by hurrying other processes to allow a maximum interval for drainage. Plugs are used, because no valve or cock has been found that will remain tight more than a few weeks. Where lines run from one tank to another a little leakage through the valve will cause no loss of solution, and an ordinary all-iron gate valve is perfectly satisfactory, but all pipe ends that lead from the system must be protected by plugs.

The tanks are made of single-lap riveted steel plate, about $\frac{5}{16}$ in. thick. It is well to construct the dome top with a short radius, so as to furnish added strength against suction. Occasionally during the steam wash, a vacuum results, due to too rapid condensation of the steam, and this may buckle a weak top. The same thing occurs when a careless operator pumps solution out of the tank without opening a relief valve on top of the tank. In opposite effect, too much steam may cause the flat bottom to bulge and leak badly at about 5-lb. gage pressure. All these difficulties can be obviated by a good safety valve, set for small differences both of pressure and vacuum. Such a device, made entirely of iron, has not been found on the market and must be made to order. Vapor pressures as mentioned previously are all measured by a mercury manometer.

LEAKS IN TANKS A LARGE EXPENSE

Owing to alternate heating and cooling, and to accidental deformations due to excessive pressures, the leaching tanks soon leak at the seams, especially around the bottom, where the pressure is greatest. Recalking is only a temporary relief, and often leaks occur at points of support or at other inaccessible places. Such leaks are one of the largest sources of expense in the plant. Constant vigilance must be exercised to detect new leaks, and, if they are beyond remedy, to arrange receptacles to catch as much of the solution as possible. One of the routine duties of the operator must be to collect and empty these drippings. A concrete floor has been placed under each tank to catch leaks, but it fails in its purpose because so much water gets into it that any ammonia is diluted to a point at which it does not pay to recover it. I believe that this difficulty can be eliminated by electrically welding the tanks when they are first installed. It is doubted whether this would prove practicable on tanks which have been long in service and the seams of which are coated with silt and scale.

Gage glasses on leaching tanks are unnecessary. If used, they must have all-iron fittings, which are expensive and hard to get. One should guard against running up the cost of installation with such accessories, which may be convenient, but not indispensable.

CONSTRUCTION OF THE FILTERS

The entire bottom of the leaching tank is covered with a filter bed adapted from cyanide practice. One thickness of heavy duck makes a satisfactory filter and can be purchased already sewed and cut to fit the tank. To protect this cloth from mechanical wear a cover of "coco matting" is placed over it. Both cloth and cover are cut 6 to 10 in. larger than the bottom of the tank, and this flap is calked into a recess left between the tank wall and the wooden grid which supports the cloth. A piece of manila rope calked into the trough holds the cloth firmly in place, and as an added precaution strips of wood are nailed around the circumference on top of the filter and its cover. The grid to support the cloth can be made of fir strips 2 in. high and 1 in. wide nailed together so as to leave a 1-in. space between each two strips. They must be notched on the under side to permit free drainage of the filtrate along the bottom of the tank to the outlets. They should not be fastened with metal clips or strips, because these soon disintegrate in the leaching solution, and lodge in valve seats, pump impellers, and other places. After from 18 to 24 months' service the grid becomes soft and pulpy and must be replaced. The life of a filter can be greatly extended by always leaving 6 in. of tailings on top of it when excavating the tank. Under such circumstances filter cloths and covers ought to last 12 months. This natural filter bed must be changed every few months when it becomes saturated with slime. This bed forms a dead space in the tank that will not impart any copper to the leaching solution which occupies it; hence the first few tons of solution drawn off the tank after the first leaching period will be low in copper, and should be run into the weak-solution tank to avoid diluting the main part of the rich solution.

DOORS, PIPING, AND PUMPS

All doors and frames are of cast steel, with finished surfaces where necessary. They can be shut on a gasket by means of a screw clamp. The most satisfactory and cheap gasket for everyday use on 12 by 12-in and 12 by 16-in. doors consists of several thicknesses o building paper, well smeared with some sticky substanc such as paint—cold-water paint is good. This gaske can be used but once. Sheet rubber packing makes a better but much more expensive gasket that can b used several times. Asbestos sheet and woven packin is yet more expensive but no better. Cotton wicking i always kept for emergencies. Improperly packed door in the bottom of the tank cannot be readjusted after th tank is full, but their leaks can be mitigated by calkin with a bit of wicking around the outside.

Under some conditions the ammonia solution has chemical action on iron. A hot solution containing little copper will corrode the iron walls of a pipe t such an extent that the pipe is eaten entirely away a the threaded connection after a few months, and mu be renewed. Metallic copper is left behind, and pr sumably the iron goes off as a hydroxide. After mo than two years of continual service, the leaching tank however, do not show evidence of such action. It thought that the solution has to be in rapid motion, a when flowing through a pipe, in order to promo corrosion.

It is possible to transfer all ammonia solutions need in this process with six pumps. There are also a nun ber of pumps required to handle cooling water for t condensers, water for use in excavating the leachi tanks, and other uses determined by the local conditio It is good practice to have not more than two sizes pumps, of standard make and construction. This mea that all-iron ammonia pumps will be used on ordina water service, but the saving in the initial outlay f spare parts alone will cover the additional cost of t pump. When it comes to piping, a great saving in t money tied up in the warehouse can be effected by stalling not more than two different sizes of pipe. F all ordinary work 2-in. piping is ample, both for suction and discharge. By arranging the pumps on interconnected headers, as shown in Fig. 3, it is possible at times to allow two suction lines to discharge into the same pump, so as to give ample capacity.

The most satisfactory small-size pump which has been tried out is a centrifugal pump, direct connected to an electric motor. Such a pump, with a 5-hp. motor and inclosed-type impeller, will deliver 125 gal. per min. against a 50-ft. head. The inclosed impeller is more efficient than the open type, but must be carefully watched, and bits of wood and ore that lodge there removed, as these cut down the capacity of the pump and of the whole plant. Before installing a pump it should be carefully inspected, because manufacturers of all-iron pumps obstinately insist on fitting them out with such parts as brass petcocks and screws, which must all be taken off before the pump is used.

Small reciprocating steam pumps are troublesome to pack and oil, in comparison with centrifugals, and are not economical unless their exhaust can be utilized. There is an excess of waste heat about a leaching plant as it is, so that, ordinarly, no use can be found for any such exhaust steam.

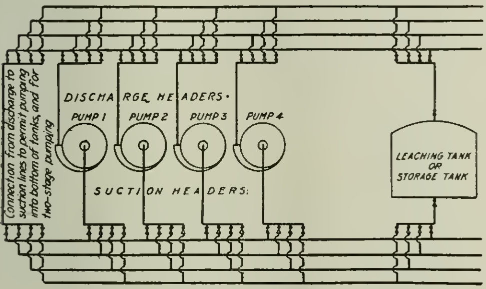

Connection from discharge to suction lines to permit pumping into bottom of tanks, and for two-stage pumping
DISCHARGE HEADERS.
PUMP 1
PUMP 2
PUMP 3
PUMP 4
LEACHING TANK OR STORAGE TANK
SUCTION HEADERS:

FIG. 3. PIPE AND PUMP DIAGRAM

Air lifts, where the compressed air comes in contact with the solution, are not favored, because a certain amount of ammonia would be carried off with the exhaust air in the form of vapor. A steam injector might prove feasible for the purpose of charging the rich solution into the evaporators, where the heating of the solution would be a desirable feature. An all-iron injector for this purpose has been under consideration for some time. At present the evaporators are charged by a 4-in. centrifugal pump, which is a standard type at the Kennecott plant.

Filtrate From Evaporators Hard To Handle

The most difficult solution to handle is the filtrate from the evaporators, or "boiled-out solution," as it is called. It is hot and contains enough dissolved copper to act strongly on the iron valves and piping. Valve wedges and stems will be out of operation after only a few weeks' service. Copper oxide also is present, which has leaked through the filter cloths and is carried along in suspension. This acts like emery dust, quickly cutting the shaft and other surfaces of a pump. The most satisfactory method of handling this material has been to apply steam pressure to the filtering tanks, so as to force the liquid through the filter cloth and out to the settling tanks.

Operating a centrifugal pump is something of a fine art at best, and with ammonia solutions new symptoms develop which a novice would fail to diagnose. For instance, in pumping strong ammonia solution, the reduction of pressure in the suction pipe causes some ammonia to vaporize and spoil the priming of the pump. By placing an ammeter on the pump motor it is possible to detect many troubles, as the instrument shows whether a gland is too tight, or so loose as to let air suck into the pump (a common trouble), and detects a plugged pipe line or a valve accidentally left closed. By suitable connections one ammeter on the switchboard can be connected to any pump motor at will.

It is a great help in breaking in new operators to paint the various solution lines with distinctive colors. Solution pipes should never be buried, but should be left out in the open for easy inspection and repair. Pipes and valves carrying hot solution must be frequently replaced, so a lavish use of unions is good economy.

As for valves, standard all-iron "clip" gate valves are satisfactory, although they cannot be relied upon to seat absolutely tight after a little wear. Plug cocks may be used, but in the 2-in. size are hard to manipulate. Special ammonia valves and fittings, such as refrigerating plants use, are absolutely unnecessary and are expensive. A permanent pipe-fitter's bench, fitted out with vise, cutters, taps, dies, and similar conveniences, is an essential part of the plant.

Function of the Evaporators

The evaporator has a twofold purpose: first, to remove the dissolved copper from the system at the rate it enters into solution from the ore, so as to maintain the dissolved copper in a state of equilibrium; and, second, to remove water as fast as it is introduced from the moisture in the ore and from the steam that enters the system, so as to maintain the volume of solution nearly constant at all times. From the standpoint of economy it is important to minimize the quantity of water entering, so as to save steam in the evaporators; in other words, it is better to evaporate a small quantity of solution, rich in copper, than a large quantity of weak solution.

Fig. 4 shows one of the duplicate units evolved for use after expensive large-scale experiments with various types of evaporators. Although it will no doubt be further modified from time to time, this is by far the most satisfactory type put in operation up to the present.

The great difficulty in evaporator construction and operation has been the hard scale of copper oxide that tends to form over the interior surfaces both of the evaporator itself and also of any steam coils or other heating surfaces. This renders the ordinary continuous distilling column, with its complicated passages and trays, absolutely useless after a few hours' operation. The higher the copper content, the greater the trouble. However, scale will not be deposited on vertical surfaces, or on steep surfaces making an angle of 40° or less with the vertical. The evaporators of Fig. 4 are free from all scale trouble and will run for months without cleaning. There are no heating surfaces to crust, because steam is admitted directly to the solution from a perforated pipe. It is also essential to admit a jet of steam to the tip of the cone to keep the precipitated copper agitated. If allowed to settle it forms a dead space that would remain saturated with ammonia, and this ammonia would be lost when the precipitates are dumped into the filtering tank. Moreover, settled precipitates are likely to form a cake that will not readily pass through the discharge cock. It is sometimes necessary to start the discharge by means of a long poker worked through the vent in the top.

Details of Operation

At the start of operation, both *A* and *B* are filled half full of rich copper-ammonia solution. In practice this will test 5% copper and 7.5% ammonia. Steam is then turned into *A* only, and the valves in the vapor line are set so that the resulting vapors will pass from *A* into the solution in *B*, and serve to heat *B*. The vapors from *B* are passed through the condenser, which reduces the ammonia and water to liquid form. This condensate, together with the non-condensible CO_2 gas, flows downward through the absorber or cooler, the gas bubbling through the liquid so as to scrub out all the ammonia. The liquid is then received in a storage tank and held ready for use again as a fresh leaching solution. The CO_2 escapes through another scrubber, where it is washed with water or a weak ammonia solution.

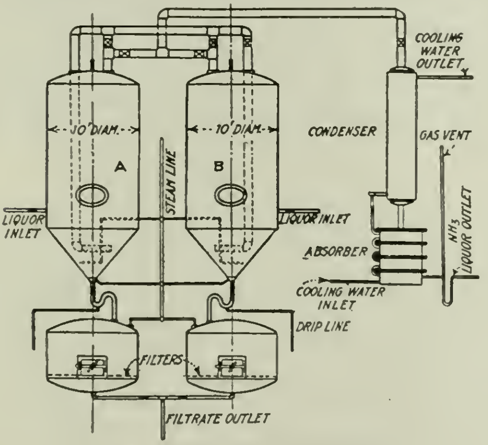


FIG. 1. DIAGRAM OF EVAPORATORS

As the solutions in *A* and *B* commence to become warm, the evolution of CO_2 becomes noticeable well before the boiling point is reached. No definite temperature can be set for this occurrence, because it depends on the composition of the solution, but usually the gas becomes noticeable at 130° F., and large volumes are given off before any ammonia vapor reaches the condenser. Between 160 and 170° F. and under a pressure of 2 to 5 lb. (gage) in the evaporators, the solutions begin to boil and evolve ammonia vapor. Soon after the ammonia starts, the evolution of CO_2 dies down and practically ceases. From this point to the end the evaporators show a bad foaming tendency; hence they are filled only half full at the start, and great caution is observed when admitting the steam. A practiced operator, however, will easily control his evaporators so that only an occasional trace of copper solution will pass over into the condenser. The first ammonia vapors to go over into the condenser are, of course, strong, but as the boiling continues they gradually become weaker, until at the end of the run they may be only 1 or 2% ammonia, the rest being water. The average ammonia content of the condensate from a complete run will be about 16 per cent.

After five or six hours' boiling the ammonia content of the solution in *A* will have fallen to less than 5%, and at this point copper begins to precipitate. It first comes down as a green copper carbonate, and would stay in this form unless steps were taken to prevent it. By raising the pressure in the evaporator to over 10 lb. (gage), and by keeping the precipitates agitated with the jet of steam in the tip of the cone, the carbonate is changed to the black copper oxide. This latter is a more desirable shipping product, because it will contain more than 75% copper, as against 60% for the green carbonate. However, if the market should develop, a good grade of copper carbonate could be produced.

Steam is kept on *A* until all but a trace of the copper has been precipitated and the ammonia content of the solution has been reduced to 0.03%. This should require 10 to 12 hours. At the same time the solution in *B* will have been reduced to about 2.5% ammonia, and the copper partly precipitated. Steam is now turned off *A*, the discharge cock opened, and the entire contents dumped into the filtering tank. Next a fresh charge of rich solution is pumped into *A*, steam turned on *B*, and the vapor valves reversed so that vapors from *B* pass into *A*, and from *A* into the condenser. The contents of *B* can now be boiled down to 0.03% ammonia and dumped into its filter, and the procedure continued indefinitely.

While the evaporators are boiling, steam is turned into the filter tanks at about 15 lb. pressure, so as to force the "boiled-out" solution through the filter and leave the precipitated copper oxide on the cloth. The precipitate can be dried in this manner to less than 18% moisture, in which condition it is sacked and shipped to the smelter. The filters consist of two layers of 8- to 10-oz. duck, protected by one cover of "hop cloth" and supported by a perforated metal screen. The cloths must be renewed about every four weeks, and the screens every four months. The filtrate should be passed through a series of settling tanks to save the small quantities of precipitate that always go through the cloth, together with the occasional large amount due to defective filters. The filtrate may also be passed over scrap iron, which will precipitate a small amount of cement copper from the last traces left in solution. If this is done, care must be taken not to allow the cement copper to cool while under the solution, because if it does the trace of ammonia present will redissolve it.

The discharge cocks on the evaporators are 4-in. all-iron abestos-packed plug cocks, with easily replaceable packing. Every week the plug should be taken out, polished, well oiled, and a new packing inserted. Even with this care, at times the cocks will leak and allow rich solution to escape from the evaporators. However, such leakage may be trapped and saved, as shown in Fig. 4.

The condensers are fitted with 2-in. boiler tubes of charcoal iron 12 ft. long, which must be renewed about every eight months. At least 65 gal. per min. of cooling water must be available for each condenser, although this quantity may not be needed all the time.

The services of one chemist are employed on routine analysis of solutions and experimental work. Analyses of the ore are made in the regular assay office by the mine assayer.

The following simple method of testing solutions for copper and ammonia was worked out by E. B. Hunn, plant chemist: Ten c.c. of solution to be tested is titrated against a standard cyanide solution until it is colorless; the amount of cyanide used indicates the percentage of copper in the solution. Another 10 c.c. is titrated against a standard H_2SO_4 solution, using methyl orange indicator. The acid reacts with both copper and ammonia until the solution is neutralized, at which end point it takes on a pale green color. From the quantity of acid used, and from the previously determined copper content of the solution, a specially prepared chart enables one to find the percentage of ammonia in the solution. These are the only determinations ordinarily needed to control the plant.

It is part of the operator's duties to sample every batch of solution which is pumped. He takes the sample from the discharge side of the pump through a special cock into a sample bottle, labels it and leaves it in a rack for the chemist. There is often a wide variation in ammonia and copper content in standing solutions at different depths in the same tank. On this account it is necessary to take the sample in several equal parts uniformly spaced over the entire time of pumping. The operator also keeps a daily log sheet, on which are entered the time, quantity, and disposition of every batch of solution pumped. Once daily he reads the gage glasses on every storage tank and enters this in the log sheet. Most of these storage tanks are 16 ft. in diameter by 20 ft. high, and the scale is calibrated to read in tons of 2000 lb. of solution. This unusual unit of liquid measure is convenient as to size, and saves a great deal of work when figuring in connection with quantities of ore, which of course are expressed in tons[1].

It is to be noted that all measurements, and the titrations for copper and ammonia, are really volumetric, and are accurate measures of weight only when the solution has a specific gravity of unity. This is seldom the case in practice, various solutions ranging from 1.06 to 0.97 gravity, so that for special purposes these differences must be taken into account.

Costs

The leaching expense amounts to $1 per ton of ore treated, but the figure is misleading. Conditions in Alaska are unusual. There is no standard method of keeping mining costs, and the cost of treatment is greater for rich ore than for lean ore. Therefore the following example has been worked out, using the same quantities of labor, steam and ammonia which have been found necessary at Kennecott, but changing the rates to conform with usual conditions elsewhere.

It should be especially noted that the figures refer to leaching expense only. No charges are included for overhead expenses, mining and crushing the ore, tailings disposal, freight to smeltery and smelting charges, or selling expense. Little if any profit could be shown in leaching such a lean ore if all these charges had to be borne by the leaching plant. But in the case of treating tailings from a primary concentrator, as at Kennecott, it is proper to charge mining, crushing, and tailings disposal to the main plant, which would have to bear this expense if the tailings were not treated. Under these circumstances it is possible to show a profit with very lean ores. It should be noted that ammonia and steam expense, which are the two largest items, vary not only in proportion to the tonnage of ore treated but also in proportion to the copper extracted. Hence it is not so expensive to treat lean ores. Power, maintenance, and supplies will vary as the tonnage, whereas labor is constant and not affected by either tonnage or production.

Construction expenses vary a great deal according to local conditions. In the light of past experience, and under normal conditions, it is thought that $300 per ton of ore-treating capacity per day would be a reasonable estimate of the first cost of a small plant as described. One item that must not be overlooked is the initial supply of ammonia. About 275,000 lb. of 26° aqua ammonia or equivalent must be accumulated, and this may cost more than $30,000. Unless skill and foresight are used in manipulating the plant operations, peak demands for ammonia will at times call for a much greater supply. The foreman must aim to keep all the ammonia at work, for idle solution represents not only profitless investment, but calls for additional storage tanks, and results in unnecessary loss from leaks and evaporation.

EXPENSE OF LEACHING 450 TONS OF CRUSHED AND DESLIMED MILL TAILINGS PER 24 HOURS

Copper (oxidized) content of ore leached	0.85 per cent.
Copper (oxidized) content of ore tailings	0.17 per cent.

Gross extraction is 13.6 lb. copper per ton leached. Of this about 1 per cent., or 0.1 lb., must be deducted as dissolved copper lost in the leaching process, leaving 13.5 lb. per ton to ship to the smelter. This is shipped in the form of copper oxide containing 75 per cent. copper and 18 per cent. of total weight as moisture (percentage of copper figured on dry weight). Smeltery deductions will amount to 0.2 lb., so that the net copper sold will come to 13.3 lb. per ton leached, or 5985 lb. per day.

Leaching Expense for		Total per Day	Per Ton	Per Lb. Cu Sold
Direct labor:				
1 Foreman at $6.00	$6 00			
1 Chemist 5.00	5.00			
3 Shift bosses 4.50	13.50			
3 Operators 4.00	12.00			
9 Laborers 3.50	31.50			
1 Repair man 4.50	4.50			
Total	$72.50	$72.50	$0.161	$0.0121
Power and lights:				
630 kw. at 2.5c. per kw (1.4 kw. per ton)		15.7	. 35	.0026
Ammonia:				
0.25 lb. per ton loss in leaching, lb.+	0.25			
0.02 lb. per lb. Cu loss in evaporators. 13.5 × 0.02, lb.+	.26			
Total loss per ton	0.51			
Cost, at $0.50 per lb. NH_3		114.75	.255	.0192
Steam:				
94 lb. per ton for steam wash	94			
16 lb. per lb. Cu for evaporation 13.5 × 16	216			
Total steam per ton	310			
Cost at $0.001 per lb		139.50	.310	.0234
Maintenance and repairs:				
Includes cost of all maintenance of machinery and buildings, both materials and extra labor necessary		25.00	.055	.0042
Operating supplies:				
Sacks, oil and waste, packing, etc		15.00	.033	.0025
Total leaching expense		$382.50	$0.849	$0.0640

Nipissing Mill Supplies

The consumption and cost of supplies at the low-grade mill of the Nipissing Mining Co. during 1918 were as follows:

Material	Total Lb.	Cost per Lb.	Total Cost	Pounds Consumed per Ton	Cost per Ton
Sodium cyanide	311,938	$0.332	$103,710,15	3.885	$1.2913
Caustic soda	29,025	0.0694	2,016,00	0.361	0.0241
Lime	478,940	0.0063	3,040,39	5.966	0.0463
Aluminum ingots	3,750	0.521	1,953,25	0.046	0.0233
Pebbles	556,035	0.015	8,716,11	6.926	0.1075
Coal	2,157,790	0.0031	8,701.92	26.880	0.1074
Borax	7,391	0.123	910.86	0.092	0.0103
Sodium sulphide	54,701	0.0405	2,216.62	0.681	0.0266
Power	....	......	51,111.44	....	0.6357
Oil (gal.)	13.124	0.137	1,809.51	0.163	0.0215
Coke	-	0.006	239.38	0.451	0.0029

---

[1] We presume that fluid ton of 32 cubic feet is used.—EDITOR.

Industrial News from Washington

By Paul Wooton, Special Correspondent

House Committee Continues Hearing On Potash and Tungsten

As a result of the hearings which have been conducted by the Committee on Ways and Means of the House of Representatives, many are seeking the opportunity to present their views before that body. Letters received by the committee indicate that most of the American industries are in immediate need of a protective tariff or of higher rates of duty than are in effect. Though general tariff legislation at the extra session is not under consideration, the committee expects to take advantage of this period to conduct hearings and to get the point of view of all concerned in the industries most affected by foreign competition.

In considering the potash question, one of the points of contention has been whether the licensing system is preferable to the ordinary tariff. The respective conclusions in that connection are shown in the following colloquy between George Otis Smith, Director of the U. S. Geological Survey, and members of the committee:

Mr. Treadway: You speak of this licensing feature being intended to stimulate domestic production.

Mr. Smith: I should say the license system might be described as a necessary evil connected with stimulating production.

Mr. Treadway: Suppose we removed that so-called license system; what other suggestion would you have? In other words, if we did not establish the licensing feature, what other suggestion would you offer as a method of stimulating production?

Mr. Smith: If I knew of a method, I would be very glad to offer it. I do not see just how that can be accomplished, except through keeping the Government's finger, if you like, upon the individual wholesaler or manufacturer—simply seeing that he buys as much of the high-priced domestic product as he does of the low-priced—proportionately as much.

Mr. Treadway: Then Mr. Moore's suggestion of a possible tariff provision does not meet your view as to the best method of producing domestic stimulation?

Mr. Smith: There is this difference between the methods: It is contended, and I cannot pronounce on the logic of that contention, that the tariff on the imported article is added to the price of that article and therefore paid by the consumer. In this case, the price paid by the consumer would not be the price of the imported article; neither would it be the price of the domestic article. But it would be a weighted average of the two. The problem is simply to secure a market during this five-year period, which was fixed as the period of development of the industry. I think it [the licensing system] is a way of accomplishing what a tariff system might also accomplish.

Mr. Moore: Minus the revenue the Government might also get under a tariff system?

Mr. Smith: And I believe plus the advantage of a slightly lower price to the consumer. I might add that, looking at it from the national point of view, I believe the net expense of safeguarding the domestic production of potash would be exactly the same under the two systems—though the items would be differently distributed. The question becomes simply one of method preferred.

In reply to an inquiry as to the estimated output of potash in the United States for the current year, Dr. Smith said:

It is too early even to make an estimate on the subject, because there have been plants that have shut down, necessarily, and the best estimate that we can give is a capacity estimate at the beginning of this year, which we figure at approximately 100,000 tons.

A. G. White, the mining economist of the U. S Bureau of Mines, however, does not agree that a tariff or a bounty is better than a licensing system. He said to the committee:

I believe the bill as presented is the best method of accomplishing the preservation of the potash industry. The principal reason for that belief is the fact that in endeavoring to start or maintain a new industry the best policy is to pay only for what you get; don't charge the country with anything that you don't get. Under this bill a higher price for potash is only maintained for the production you get. If you establish $2 or $2.50 as the price that you will pay for domestic material, you only pay it on the production that you get. If our estimates are wrong and we don't get production, it costs us nothing. We now have a capacity to supply about half of our tonnage requirements. That has been an accomplishment of the war. Many of these new plants which have developed have never had any advantage of the high prices during the war. There has been, so far as financial assistance is concerned, very little governmental assistance, if any, to the potash industry. The $50,000,000 bill was not turned over to the Interior Department. It originally rested in the hands of the President, but it was not turned over to the Interior Department until the date the armistice was signed. Not a dollar of that $50,000,000 fund has ever been used in any connection with the potash industry. The Government assistance to the potash industry consisted largely in the exploration of our potash resources.

Alsace produced about 4% of the total German output under German restrictive control. The capacity of the Alsace mines is much greater than 4% of the pre-war total. They are now producing twice their capacity before the war, and the Alsatian mines probably could produce four or five times in excess of their production before the war with the pumping out of a few mines and making a little new development, so that we have the two situations, the possibility of German potash, when the peace terms are signed, coming back into this country, and also the possibility of the development of a considerable French industry, which may also have, and has already had, its effect in this country. I understand that arrangements are being made to import French potash at the price quoted by dealers in New York, ranging from $1.50 to $1.75 per unit which is somewhat over twice the pre-war price.

Frank L. Hess, the geologist of the U. S. Geological Survey who specializes in tungsten, in the course of his testimony before the committee, made the following statement with regard to tungsten:

I think there is no doubt that for the present, for the next two years, there cannot be much production in the United States under present conditions. There is now at least 4500 tons of ore in storage in New York, or close to New York—imported tungsten ores. I can only give you hearsay evidence on this—but it is the best I can get. One firm I know is said to have backed a buyer in Hongkong to the extent of $17.50 a unit on all of the tungsten ores he bought, and it has 1500 tons of that in New York now. Another firm has at least 1000 tons on which it paid at least as much—up to as much as $17.50 a unit. A third firm has backed a buyer to the extent of 1000 or 1500 tons up to $16.30 a unit. The first 1500 tons I spoke of is Chinese and a part of the other is Chinese, but the larger part is

Bolivian and a little Argentina ore, I believe. That ore is going to hang like a pall over the market until it is gone. Now, if a tariff is put on that ore it will go at a price that will let those men out with a good profit. If a tariff is not put on, that ore is going to be held until those men find a favorable opportunity to let go or until they make up their minds they cannot make their money on it or until they conclude to swallow their dose and let go. That is one of the things that is going to hold back the production.

I believe, from all the information I can collect, that Chinese ore can be brought to this country for less than $7 a unit, but there are some peculiar circumstances that come in there that may keep it from coming in for a good while at that price. When the price was $25 and upward, before the armistice was signed, the steel companies sent men scurrying all over the world to buy tungsten ores. Of course, they went to China. The officials there—every man who got a chance at it—got a squeeze out of it—and those squeezes were all paid on the basis of $25—the price in New York City. Now, those officials are not going to let anybody get ore out now unless they pay something like that squeeze, and it is going to take a good while for them to make up their minds that such a price cannot be obtained.

Other pertinent statements made by Mr. Hess follow:

In the mines in this country, it is impossible to make any definite estimate or prophecy, except perhaps for the next year or two I think we might say we have in sight and we can produce 3000 tons for, say, three years. After that I should say it would be altogether a problem.

I might say conditions are changing all the time in the tungsten market. I do not think that the variation in the quantity produced and the quantity imported was due altogether to the discovery of the foreign field. The Australian field was discovered long before we began to be large importers. And I think you will find that our tungsten production and tungsten imports are closely connected with the rise and fall of the steel trade. You can almost surely take the use of tungsten as a barometer of the steel trade.

I think all that has been stated to you about the costs in the Colorado field is conservative. I do not believe they can produce profitably for less than between $17 and $20 per unit.

Roy C. McKenna, of the Vanadium Alloy Steel Co., another of the witnesses, said:

It is my contention that the market from April, 1916, to April 1917, dominated by American production, clearly proves that $17 a unit was the dead line for all except a very few American producers; and that a price of between $17 and $26 was needed to enable the fields, discovered during the boom period, to operate. In April, 1916, tungsten ore sold at between $75 and $85 a unit in New York. In May, 1916, the price dropped to a nominal quotation of $40 a unit. In September, 1916, tungsten ore could be freely purchased at prices around $17 a unit. The vast majority of all American tungsten properties ceased operating, or were operating only in part. In April, 1917, our company purchased 1100 tons, 550 tons domestic and 550 tons South American, at a price of $17 a unit f.o.b. Latrobe, Penn., and shortly afterward sold ferrotungsten for export to offset the quantity of tungsten ore purchased. From the summer of 1917, to the signing of the armistice in November, 1918, the market for tungsten ore was remarkably steady, around $25 a unit. Since November, 1918, the price of tungsten ore has steadily declined. This was due, to a large extent, to the discontinuing of certain taxes imposed on tungsten ore by Chinese Province officials, which, during the early part of 1918 was equivalent to from $4 to $6 a unit.

With the discontinuing of these unfair taxes, Chinese ore can be laid down in New York at under $7 a unit. The quality of Chinese ore is such that a premium of $2.50 to $3 a unit is paid for the best grade of South American and domestic ores.

The tariff that we have now does not any more than take care of the differential in wages between foreign countries and this country. There always was considerable high-speed steel imported into this country under any tariff act that we have had. The tariff of 15% ad valorem is needed in addition to the tariff which we would need to compensate us for the increased tariff on tungsten.

George H. Bailey, of the American Mining Congress, said:

The whole object of the proposed legislation is to stabilize the price of tungsten, which now has an extremely wide range of prices. The ad valorem tariff will work just the opposite effect. For example, a large foreign tonnage caused by opening an easily accessible mine or surface deposit would lower the price, lower the ad valorem tariff, and let the ore pour into the United States and destroy the industry here. With a scarcity of foreign ore, or in time of emergency, the demand would be abnormal, the prices would be greatly advanced, the ad valorem tariff would advance in the same proportion, and instead of reducing the fluctuation it would be actually extended. In short, the ad valorem tariff would increase the range of fluctuation in direct proportion to the percentage of the tariff.

Five thousand tons is Director Smith's estimate of the normal tungsten needs of this country. The estimate is made in the following statement:

The consumption before the war was in the neighborhood of 2000 tons a year. Last year it increased to something over 16,000 tons. I think that shows the stimulus given by war conditions, but that is not an estimate of what we may expect after the war. I think a conservative estimate is that 5000 tons would probably represent the normal consumptive needs of this country.

The import ratio of our consumption has increased somewhat during the war and, of course, was especially high last year, when by far the larger part of the tungsten consumed was imported. The question of supply, whether this country can be self-sufficient in the matter of tungsten for all time, I think can be answered in the affirmative. We have tungsten ore sufficient to meet our needs for many years, but there is reason to believe that the deposits would begin to decline in course of time, but, of course, we would expect to find some other deposits as yet unknown. However, it is a fact that under the war stimulus there was pretty active prospecting and new deposits were found.

Board Will License Tin Imports

It was announced on June 16 by the War Trade Board that applications will now be considered for licenses to import pig tin and all metal alloys containing tin, including tin drosses, tin oxides, solder drosses, type metals, anti-friction metals, waste metals and other metals containing tin; subject, however, to the following conditions and limitations: (1) That such licenses will permit the importation only of shipments made from points of origin on or after June 30, 1919; and (2) that such import licenses will not be valid for entry until Aug. 1, 1919.

The duty recently imposed upon the exportation of certain lead ores was removed on May 31, 1919, according to a consular report. The ores affected by this decree are galena and litharge of all kinds, and all other non-silver-bearing lead ores. These ores are those included in Item 5 of the schedule of export duties, previously issued.

All contracts entered into by the nitrate division of the War Department and the director of explosives have been liquidated. Sixty-one per cent. of the contracts made by the Chemical Warfare Service have been liquidated.

Zinc Industry of Missouri, Arkansas, Kansas, and Oklahoma*

BY OTTO RUHL†

YOUR secretary has asked me to bring up to date the subject presented last year—"Zinc Mining and Production in Missouri, Arkansas, Kansas, and Oklahoma." The chapter covering the last 10 months' mining operations in the Joplin-Miami district is but a repetition of the picture given you a year ago, with the exception that the lights have been fading, and the shades are deeper. To change the figure of speech somewhat, we then thought we were traveling over a rocky road in the darkness, and since then we have skinned our shins often on the rocks of high costs and waded deeper into the slough of lower receipts for our product, and are today praying with all our hearts that this is the darkest hour before dawn.

Hard hit last year, the zinc-mining industry of these four states is today in even a worse state than then. In Missouri one can count the active milling plants practically on the fingers of two hands. Arkansas has but a negligible output of zinc ore today. The two states of Oklahoma and Kansas are supplying the bulk of the output. Singularly enough, we find the efforts of the field to curtail its output only partly successful, a result due to the gradual but inevitable fruition of prospecting efforts begun two years ago. It has been said, and truthfully so, that 10 years' prospecting was accomplished in the Oklahoma field in two years' time. The results have been the development of a large number of mines whose output has been thrown upon the market and kept up the output of this district, in the face of untoward price conditions, to an unusual level. Much of this output is not the result of studied operation, but is incidental to prospecting and development, and in most cases is produced at a staggering loss. Yet the tonnage of these mines in the aggregate has maintained the output of the district at close to 10,000 tons per week.

It is difficult to reconcile this heavy production with the facts generally known as to prices for ores, and with the fact that so many mills are closed down. A census taken of the mills of the field within the last month showed that of 208 mills only 58 were operating, or approximately 28% of the potential producers. With the 58 operating, however, the bulk of the tried operators and the low-cost mills is found, a synonym for either high-class operation or extremely rich properties.

The following tables of shipments and prices for corresponding months of 1918 and 1919 show a consistent decline in prices received, but disclose no such decline in output:

COMPARATIVE PRODUCTION ALL GRADES ZINC ORE, 1918–1919

Month	1918, Tons	1919, Tons
January	32,995	27,102
February	22,250	40,228
March	47,955	50,851
April	45,810	36,899
May	44,315	47,579
Total	194,325	202,659
Surplus on hand	27,500	16,000
Grand total	221,825	218,659

COMPARATIVE ZINC ORE PRICES, 1918–1919

Month	1918 Per Ton Blende	1918 Per Ton Calamine	1919 Per Ton Blende	1919 Per Ton Calamine
January	$57.02	$32.67	$43.44	$35.01
February	55.00	33.00	41.78	26.27
March	50.14	34.73	41.54	27.74
April	42.03	32.93	38.87	26.61
May	47.79	31.00	37.80	24.80

Compared with 1918, the 1919 period shows an average reduction of $11.89 for blende ores and $3.06 for calamine ores. One would naturally assume that the reason for this condition must be explained by greatly reduced cost of operation. Though there have been some reductions in costs, they have not been commensurate with the reduction in prices received for the product. The reductions in cost have been approximately 10% in labor and a small reduction in hard iron and powder. Other costs either have been maintained or actually advanced, as in the case of power and lubricants. A reduction in one class of supplies is practically balanced by the advances in others. It therefore becomes increasingly apparent that much of the production being maintained is made at a loss. Recently, when the price of ore dropped to a $35.00 base, some of the strongest operators in the field shut down some of the best and richest properties, and weaker concerns and poorer properties can still be found desperately trying to keep going.

Under these conditions the production of the field is approximately 9000 to 10,000 tons, and its potential production, on a $45 to $55 market, can be readily determined at 50 to 60% more. From this situation it is evident that Joplin operators are hoping for a hurried revival of zinc consumption and a greatly increased use for this metal.

The end of the war brought with it the end of all price agreements and the coöperation between smelters and ore producers. The whole market situation reverted to the old open system where everyone was for himself and "the devil take the hindmost." The coöperative action between the sheet-zinc manufacturers and the high-grade zinc-ore producers, which was so satisfactory during the war period, today is almost forgotten history, and a similar movement to take care of all classes of ores, and with all the smelters, met a like fate before it was more than born. Certainly the industry needs such coöperation today as much as if not more than during the war period. But, so far as one can now see, the inevitable law of the survival of the fittest must take its course, and only those with unusually rich deposits can survive the squeezing process of high production costs and low ore prices. How long this process must continue to bring about the extermination of the output which will again balance local supply and demand is difficult to answer.

It was pointed out in last year's meeting that the souls of operators were born, kissed by the enthralling rapture of eternal optimism. The past year's history is confirming evidence that they will endure impossible conditions and yet live. If they cannot produce ore for a profit, they do it for philanthropy, and the world gets its zinc metal mined for less than cost.

---

*An address delivered at the meeting of the American Zinc Institute, St. Louis, Mo.

†Consulting mining engineer, Joplin, Mo

The salient features of the year's history, as reflected in the zinc-mining industry of Missouri, Kansas, Oklahoma, and Arkansas, are: (1) That the production in Missouri and Arkansas has grown smaller since last year. (2) Output of Oklahoma and Kansas holds strongly at 9000 to 10,000 tons. (3) Production is maintained at a high level, in spite of large numbers of mills closed down. (4) Only the richest ore deposits can be worked and the best-organized companies operate, and much of the ore is being produced at a loss. (5) Ore prices declined $11.89 per ton over last year, but this did not greatly reduce output of ore. (6) Cost of production remains high, and changes in some items, though lower, have been balanced by others that have advanced. (7) End of the war brought all price agreements to an end, and no coöperative efforts since have been successful.

Tariff on Metals for Canada

TORONTO CORRESPONDENCE

The changes in the Canadian tariff proposed by Sir Thomas White, Finance Minister, are expected to benefit materially the metal industry of British Columbia. The new tariff will give a protection of $20 per ton on lead, 1c. per lb. on zinc and spelter, and 1½c. per lb. on copper alloy, with an ad valorem duty of 15% on the semi-finished product. The difficulty in lead production hitherto was that the ore had to be sent to the United States for treatment. Under the proposed changes it will be profitable to treat in Canada lead ores which are largely refractory, the treatment of which was an expensive process. Several British Columbia mines which have been closed down are preparing to reopen, and are in the market for machinery.

Concentration of Iron Ore at Mineville, New York

A decided change in the milling practice at the properties of Witherbee, Sherman & Co., at Mineville, N. Y., resulting in considerable improvement, has been made, according to a writer in the *Iron Trade Review* of June 12, 1919. With the aid of equipment which has been installed for re-treated tailings, the latter now contain on an average only 5 to 6% iron.

After each crushing, ore containing more than 60% iron is removed automatically, for transfer to stock bins, whereas tailings containing less than 5% of iron are rejected by the use of a magnet of lower tension. The ore is crushed first to a size which will pass through a 2-in. mesh screen. The 2-in. material, which remains after the 60 and higher per cent. ore is withdrawn, and after the tailings containing less than 5% ore are rejected, contains an average of 30 to 40% iron, the variation depending upon the grade of ore that is being worked. The ore then is re-crushed to a smaller size and the same process is performed again. In fact, the operation of withdrawing ore containing 60% or more of iron, and of rejecting tailings containing less than 5%, is repeated a number of times.

When the ore has been crushed to a size which will permit it to pass through a ¼-in. mesh screen, the re-crushing and separating are continued into much finer sizes, but from this point all tailings are thrown out which contain less than 6% iron. Therefore, the average metallic content of the tailings ranges from 5 to 6%. The average content of the concentrates is 64 and 65% iron, and this content may be increased or lowered by varying the intensity of the magnets employed in separating. At present, the purest material which is being turned out contains 71% iron, this being produced for special use.

After extensive experimenting, Witherbee, Sherman & Co. have developed a byproduct which for the last year has been manufactured successfully from the tailings from the Old Bed ore. The crude Old Bed ore has an average phosphorus content of 1.6%, and the tailings from this ore run 3% on the average. During the many years since the Old Bed originally was worked, there accumulated an enormous tailings pile, and investigations were undertaken with a view to utilizing the phosphorus content of these tailings for manufacturing fertilizer. This now is accomplished by milling the tailings to remove the iron obtainable from them.

By the use of tables of the Hooper, and Sutton, Steele & Steele pneumatic concentrating type, the gangue, which is composed mostly of silica and hornblende, is separated from the apatite. After the apatite crystals have been removed, they are mixed with barium sulphite, and the resulting product is a first-class fertilizer, called barium phosphate, which is sold to dealers.

Exports of Mining Machinery

The exports of mining machinery from the United States during April, 1919, according to the figures of the Bureau of Foreign and Domestic Commerce, were as follows:

Countries	Oil Well Machinery	All Other Mining Machinery
Belgium	....	$8,100
France	$17,416	17,149
Norway	....	5,000
Portugal	....	668
Spain	....	4,348
Sweden	....	1,381
Switzerland	....	1,500
England	787	88,582
Scotland	....	68
Canada	14,627	66,730
Costa Rica	....	2,500
Guatemala	....	11,850
Honduras	....	1,721
Nicaragua	....	7,185
Panama	....	6,998
Salvador	....	3,324
Mexico	111,005	162,532
Cuba	19	11,171
Dutch West Indies	195	....
Dominican Republic	2,058	....
Argentina	37,923	....
Bolivia	....	49,808
Brazil	220	18,448
Chile	675	99,272
Colombia	2,107	1,045
Ecuador	7,176	....
Paraguay	190	....
Peru	5,424	17,185
Venezuela	14,050	500
Japanese China	....	2,043
Chosen	....	17,507
British India	22,969	....
Dutch East Indies	65,019	20,883
Hong Kong	....	250
Japan	....	7,631
Persia	1,954	....
Australia	....	16,296
New Zealand	29	210
Philippine Islands	16,133	2,173
British South Africa	....	136
Portuguese Africa	108	....
Egypt	535	....
Totals	$310,619	$654,194

Regulation of Acidity of Flotation Pulp at Anaconda is effected by the flotation operators, who maintain the pulp in the last spitzkasten of the flotation machines neutral to slightly acid to methyl orange. The tests are made hourly, or oftener if adjustments are being made.

Domestic Graphite Sales in 1918

Domestic crystalline graphite sold during 1918 amounted to 10,564,080 lb. and was valued at $1,454,799, according to the U. S. Geological Survey. Production came from Alabama, New York, Pennsylvania, California, Montana, and Texas.

Amorphous graphite to the amount of 6560 tons, valued at $69,455, was sold from mines in Colorado, Nevada, and Rhode Island. The output of amorphous graphite in 1917 was 8301 short tons, valued at $73,481.

Quicksilver in First Quarter of 1919

According to figures compiled by F. L. Ransome, about 5,960 flasks (75 lb.) of quicksilver was produced in the United States from Jan. 1 to Mar. 31, 1919. Returns from twenty-three productive mines gave a total of 5,924 flasks, and it is estimated that 36 flasks was obtained from two or three small mines in California and Oregon whose operators were not heard from. Of the 5,960 flasks produced, 4,023 flasks is credited to California, 1,698 flasks to Texas, 193 flasks to Oregon, and 46 flasks to Nevada. No production was reported from Idaho or Arizona. The quicksilver reported on hand at the mines or in transit to market at the end of the quarter amounted to 4,419 flasks.

As was expected, the output during the first quarter of 1919 was considerably less than that during the first quarter of 1918, which was 8,764 flasks. The unsold stocks at the end of the first quarter of 1918 amounted to 2,800 flasks, or 1,619 flasks less than at the end of the first quarter of 1919.

The falling off in production is the result of a combination of causes, chief among which were a lessened demand for the metal and a consequent downward trend of prices, the continued high cost of labor and supplies, and the curtailment of underground exploration and development during the war, when energy was directed chiefly to immediate production.

The price of quicksilver, compared with the prices that prevailed before the war, was still high at the end of the quarter, but not high enough to offset the general decrease in the tenor of the ore immediately available and the high cost of mining and treatment.

Round Mountain Mining Co.

The Round Mountain Mining Co. is unique among mining companies in Nevada, in that a considerable part of its operations is in placer mining. Its lode operations are largely in the hands of lessees. In addition to the unfavorable operating conditions faced by all gold-mining companies during the recent period of higher costs, this company was handicapped by an inadequate water supply. The results of drilling operations for the purpose of prospecting the gravel banks ahead of the giants have been favorable, and the manager estimates that 600,000 yd. of material of a value of more than $1.00 per cu.yd. was sampled and proved in 1918. No dividends have been declared during the last three years, but about $150,000 of new assets, according to the last annual report, was added out of earnings.

During the year ending Dec. 31, 1918, a total of 71,367 cu.yd. of placer gravel was moved by hydraulicking, yielding 5299.84 oz. of bullion, having a value of $68,324.07. In addition to this amount, $2683.39 was received in royalties from the placer leases. The total operating cost was $48,792.38 and the total realization, $22,215.08. This operating cost does not include depreciation of pipe lines, main tailrace and placer equipment, but does include the cost of maintenance of pipe lines, sampling placer banks, and the development of branch races preparatory for 1919 operations. The gross value recovered, exclusive of placer-lease royalties, was 95.73c. per yd. The operating cost was 68.35c. per yd., or a realization of 27.38c. per yard.

During the year the production of the leases on bedrock in the Great Western "A" pit was $4586.66 from an area of 91,100 sq.ft. The gross yield was 5.03c. per sq.ft., of which amount 1.1c. per sq.ft. was paid to the company in the form of royalties. The cleaning of this area cost the lessees 5.1c. per square foot.

Drift leases on small areas west of the Gold Leaf cut were let during the year to determine definitely the values of the gravel overlying bedrock and to guide the company in future operation in this area; and 1450 tons removed by these bedrock lessees from an average width of 6 ft. of gravel yielded $6923.71, or $4.775 per ton, indicating a value per yard for this 6 ft. of bedrock material of $6.366. This area was found to be free from boulders and cemented gravel, and the drift-lease operations have proved a large additional yardage, of a value not looked for by the company, and no drift leases have been let since the above yardage values were determined.

In 1918, the company cleaned 45,500 sq.ft. of bedrock, yielding $9167.61, or 20.15c. per sq.ft. The average cost of cleaning this bedrock was 12.86c. per sq.ft. It will be noted that, of the total cost, development or the cutting and installation of branch races represents 5.9%, hydraulicking 72.8%, bedrock cleaning 12.2%, maintenance 4.6%, and sampling of placer banks 4.5%. Labor represents 77.2% of the total cost; administration and departmental costs were 10%, power was 2% and supplies were 10.8 per cent.

The final clean-up of the main tailrace was made in November, 1918, and yielded $10,045.11. Of this amount $6160 was obtained from the flume clean-up and $3885.11 recovered from milling 180 tons of concentrates from the lower end of the main tailrace, the concentrates showing a tonnage value of $21.58. This final clean-up represents 14.7% of the total gold recovered.

The production of the lode lessees of the Round Mountain Mining Co. for 1918 was 2131 tons of ore, having a value of $78,202.34, or $36.69 per ton. In addition, 20 tons of ore having a value of $627.05, or $31.35 per ton, was produced from the Blue Jacket group, held under lease by the Round Mountain Mining Co. The company received in the form of royalties from these operations $17,441.87, or $8.189 per ton, and in addition received as a royalty from the Blue Jacket lessees $64.36. Adding to this the amount received from losses for the use of the mill, there is total revenue from lode-lease operations of $19,657.24, equivalent to $9.14 per ton.

As an additional benefit to the company, the lessees performed 2292 ft. of development work as follows: 452 ft. of winzes, 643 ft. of raises, 238 ft. of crosscuts, and 959 ft. of drifts. Of this work 1313 ft. was done in the No. 1 workings, 127 ft. in the No. 2 workings, 323 ft. in the Stebbins Hill, and 529 ft. on the Saddle Back claim. In addition, 1033 ft. of working levels were retimbered and restored by the lessees.

Twenty-seventh Engineers

The bronze medals that are to be given by the Association of the 27th Engineers to all former members of the regiment will be sent to them by first-class mail on July 1. Each envelope will contain the medal, a letter, and a mailing card for acknowledgment of the receipt. Each member of the regiment receiving the medal is earnestly requested to fill out the card, put a postage stamp on it, and mail it promptly.

The delay in sending the medals has been due largely to the time required in correcting the roster which has been used for the mailing list. In spite of all that has been done, there still remain 100 or more men for whom we lack correct address. It is therefore urged that every one who receives a medal and reads this notice will let former members of the regiment know that the medals have been sent, and if anyone fails to receive his medal before July 15, let him write to the undersigned.

It is important that every member of the regiment, in filling out the receipt card, or writing to the office on any other subject, state the letter of his former company.

The preparation of the history of the regiment is in hand, but it is likely to be a couple of months before it will be complete and mailed.

Since the disbandment of the regiment I have received letters from a good many of the men, perhaps 250 of them. With few exceptions they report the prompt return to their old employment or the finding of new jobs, and a general spirit of contentment seems to prevail. Men who are out of work or who have met with misfortune otherwise are singularly few, and this is of course a condition that calls for congratulations.

It has not been possible to reply personally to all of the letters containing messages that did not require specific answer, but the writers of them may know that Colonel Perry has looked through the file and has appreciated deeply the friendly remembrances of him that have been expressed.

We shall all be greatly obliged if mine managers will post this notice on their bulletin boards for the information of former members of the regiment who may now be in their employment, and who may not read the *Journal*. W. R. INGALLS.

115 Broadway, New York.

Miners Strike at Grass Valley

SPECIAL CORRESPONDENCE

Following the refusal of their demand for an increase in wages of 50c. per day, the entire underground night shift of the North Star Mines Co., at Grass Valley, Calif., consisting of 120 men, went on strike on June 13. The present scale is $4 per day for machine men and $3.50 for shovelers, with bonuses for extra work. Surface men were not consulted as to the proposed move. The day shift followed the night shift, and all underground work ceased. The strike then spread to the Empire mine, where the men quit in a body without consulting the management.

A mass meeting held on June 14 by the strikers was presided over by J. B. Bennetts. The situation was discussed and committees were appointed to present demands upon the management of the Pennsylvania, Allison Ranch, and Orleans, the first two being at Nevada City and the third being owned and operated by the North Star company. Employees of the Champion mine declined to join the strikers.

The burden of the strikers' arguments was that they could not support their families on present wages, some claiming that local merchants were charging 30% and more over Sacramento prices. The bonus system is said to have been unpopular as well. Surface men present were asked to join the strike, but refused. A strike pledge was signed and a relief fund discussed. Between 500 and 700 men are now idle (June 15).

The management of the North Star mines is reported to be insistent upon closing permanently rather than accede to the strikers' demand. It is stated that under present conditions the mine is just about holding its own. The small mines will be governed by the action of the larger ones. There are a number of gravel claims in operation throughout the county, but no effort has been made to include their operatives in the strike.

Labor Situation at Cobalt

TORONTO CORRESPONDENCE

The miners at Cobalt, Ontario, at the instance of a representative of the Dominion Department of Labor, have agreed that they will not strike until Gideon D. Robertson, Minister of Labor, at present in the West, returns to Ottawa and uses his influence to effect a settlement. The attitude of the miners is stated to be favorable to conciliation.

The Cobalt union demanded recognition of the union; an eight-hour day, or 44-hour week, and in case of underground men the eight hours to be from collar to collar; and a wage scale of which the following is a summary:

Minimum base wage for all underground men, irrespective of the class of work, $4.50; men working in shafts and raises without helpers, $5.50, together with rubber boots and oilers; all surface labor, minimum, $4; blacksmiths, carpenters, and mechanics $5; hoist men, pump men, and pipefitters, $4.50; and in addition to the above a bonus of 25c. a shift with silver selling at 80c. and additional 25c. a shift for each 10c. above 80c. With the present price of silver this would mean a dollar a day bonus, in addition to the above scale. The union also asks time and a half for overtime and double time for Sundays and legal holidays, with not more than a dollar a day to be deducted for board. In case more than a dollar a day is charged, wages are to be raised the same amount. The scale calls for a minimum of $4.50 for underground men, but runners and helpers expect to be paid more than the muckers.

Though the managers do not object to dealing with committees of their own men, they are refusing to recognize the Western Federation. At present the operators are practically conceding a split between the eight hours face to face and the eight hours collar to collar.

Wages in Cobalt are higher than at any other camp in eastern Canada, and living conditions are among the best. Under the present price of silver, drill runners are making $5 a day; helpers $4.25 to $4.50; muckers $4 to $4.25; and surface labor $4 to $4.25. The proposed new scale would mean that several of the smaller properties and those which are nearing exhaustion would be unable to operate at a profit. In view of the high wages already being paid, it seems unlikely that these demands will be accepted.

Editorials

Progress in Milling

MILLING or wet concentration, and to some extent dry concentration, plays a most important part, and will continue to occupy its position, in American mining practice. From the day of the Gilpin County slow-speed, high-drop, inside-amalgamation mill, and the California stamp mill, there has been steady progress. The advance has been marked more by the greater perfection of mechanical devices than by radical changes in principle, although the introduction of hyposulphite leaching, the cyanide process, copper-ore leaching, zinc-ore leaching, and the flotation process must not be overlooked.

A review of the field shows that amalgamation of gold ores still occupies an important place, although the amalgamation of silver ores has disappeared. The hyposulphite leaching method has been completely discarded. The cyanide process still occupies an important place, although the flotation process threatens a part of its field. Leaching of certain types of oxidized copper ores is achieving increasing favor. The leaching of zinc ores has developed into considerable importance. Flotation has been adopted to a large extent, both as a primary and as a supplementary method of treatment, and wherever sulphide ores are handled this method deserves consideration.

The overshadowing importance of flotation is due principally to the fact that it affords a simple and effective method for the treatment of the more finely divided mineral particles which can be only indifferently saved by vanners, tables, and slime-concentration devices. By its use the recoveries from ores of copper have been increased from 60 to 80% up to 80 and 90%, and in some instances above the last-named figure.

The treatment of slimes long occupied the best efforts of ore dressers, and the invention of special tables, the perfection of the vanner, and the development of the round tables and buddles indicate the thorough way in which the mechanical methods were tried out. Despite these efforts, the treatment of slime and the more finely divided portion of mill pulps left much to be desired. The introduction of oil flotation held out vague hopes that this radical departure from mechanical methods would be more successful.

The slow development of the Elmore process through its various stages indicated a nearer approach to the solution of the problem. The final stages in the perfection of the flotation process were sudden, and its position was quickly attained. A quantitative appraisal of its present importance has yet to be made, nor have its manifold possibilities been exhausted. The least that can be said is that it has effectively removed the restrictions upon fine grinding, and has put recoveries obtained in concentrating mills upon almost an equal footing with those obtained by chemical methods of treatment.

The field of minor separatory methods, such as electromagnetism, electro-statism, and dry methods of separation, has broadened out, particularly in respect to the first two mentioned. Electro-magnetic separation now occupies an important place in the cleaning of iron-bearing zinc concentrates, tungsten concentrates, chromite, and rare earths. It demands consideration as a primary method for the treatment of magnetic iron ores. By the use of magnetizing roasting its field has been still further extended, and new applications may be expected.

Electrostatic separation is practiced to a limited extent in the cleaning of zinc concentrates, and has found application in the dressing of graphite ores. Dry concentration appliances have attracted some attention, although it is recognized that their field is limited and their use indicated only under special conditions.

Rapid progress in crushing and grinding, particularly in mechanical appliances, is a noteworthy feature in modern milling practice. The Blake rock crusher as a type has been greatly increased in size, and is still an important machine. Several different types of gyratories, each with important characteristics, are in use. The disk crusher competes with rolls for intermediate crushing. The cyanide process was responsible for the introduction of the tube mill, and the early ball mills were the forerunners of the short cylindrical ball mill now used as a fine grinder. Both the Huntington and Chilian mill have had to meet the competition of this modern fine grinder. Whether they will hold their own or not has yet to be decided. Stage crushing and grinding is a feature in many mills, although in many instances much simplified as compared with former practice.

In jigs and tables there has been little improvement. Both seem to be secure in their present position, the former for the prompt removal of coarse valuable minerals from the ore stream, the latter for the removal of grains of intermediate size. For ores characterized by coarse mineralization, jigging removes such a large proportion of the valuable mineral at a lower cost than could be done by other methods that there is no economic advantage in displacing it. The same may be said for the table. Further, there is no economic advantage in crushing any finer than sufficiently to liberate the recoverable proportion of valuable mineral.

Despite the temptation to simplify flow sheets by eliminating jigs and tables, and resorting to flotation as the sole means of separation, there is a well-marked tendency to adhere to stage concentration and to use flotation as a supplementary process for the treatment of the more finely divided material. This applies with greater significance to the ores wherein the minerals are in various-sized grains and aggregates irregularly distributed in the gangue, and less so with those ores in which the minerals are finely divided and disseminated throughout the gangue. With the latter type of ores the simplified flow sheet has important advantages which are becoming better appreciated.

Sizing screens, trommels, and classifiers present few new features. The increasing adoption of the ball mill in closed circuit with classifiers has resulted in the use of a greater variety of the drag type of classifier. Spigot classifiers of well-known types, as well as hindered settling classifiers, dewaterers, slime and flotation concentrate thickeners, filters, and flotation concentrate driers, exhibit no noteworthy additions during the current year.

The latest event of critical importance in milling is the decision of the U. S. Supreme Court in the flotation patent issue. The result of this decision is to clarify and make definite the limitations of the Minerals Separation, Ltd., patent. Whether a mining company will find it more advantageous to use a flotation agent in excess of 1%, and thus avoid paying royalty, or to use a lower percentage and pay royalty, will be determined by laboratory experiments and comparative costs of the alternative methods.

Rest Periods in Work

THE ever-growing demand for shorter working hours lends encouragement to any suggestion that will increase output. The National Industrial Conference Board, in its Research Report No. 13, publishes the results of introducing rest periods into the regular working hours of a large number of industries.

Experience has shown that in nearly all industries in which the manual work performed is a constant repetition of certain movements, or in which the brain work done varies but little from hour to hour, both body and mind become fatigued long before the workday is finished if an attempt is made to keep at the work continuously. It has been shown that, in nearly all of the plants cited in the report of the board, fatigue has been materially reduced and output noticeably increased through the introduction of short rest periods at proper intervals. These must not be at haphazard moments, but must be carefully regulated to conform to the temperament of the operative and the nature of the occupation; they may vary from one minute of rest in three of elapsed time to 20 minutes of rest after two hours of work.

The most notable achievement in increased efficiency, due to the introduction of rest periods, was obtained in connection with riveting work. In this occupation the best continuous records were made when a rest period was provided after the driving of every ten rivets; the total time allotted for this purpose aggregating 5 hours and 20 minutes out of a 10-hour day.

Around mining or metallurgical plants the work is generally so varied and so distributed in the time cycle that neither the brain nor the muscles become tired, hence little attention is given to any plan for rest periods. On the other hand, systematic rest periods might well be a subject for experimentation in such occupations as those of an ore-sorter, whose work consists of picking ore from a belt, or a hoisting engineer, who is directing the movement of a hoist that is running continuously.

The human system is such that if work is stopped for a few moments before actual fatigue has been reached, the system soon returns to normal vigor; but, once having become fatigued, a long rest spell is required to restore the original condition. The idea of rest periods is presented not from a sociological or humanitarian standpoint, but rather represents the instruction of an operative in a manner of working so that he may earn more with less effort. It is essentially an economic question.

The Mexican Question

THE American public has shown a fine spirit in standing off and allowing the authorities at Washington to handle the Mexican problem as they saw fit. Despite occasional outbursts of feeling, and the impatience shown, there has been commendable coöperation, and the hope that in time Mexico might radically improve the existing conditions has been perennial. Of late a decided change is evident, and a feeling that something must be done to eliminate border disturbances and insure the safety of Americans in Mexico.

At no time has there been any justification for the absence of a firm governmental policy for the protection of Americans and their property rights. On the border, the Villa menace has been temporarily dispersed by the energetic drive of the U. S. Army. From the Mexican authorities comes the promise to save Americans from bandit attacks. On the prompt fulfillment of this agreement will depend subsequent events.

In Congress during the past week full investigation of all relations between the United States and the Republic of Mexico has been demanded by a resolution introduced in the House. On June 23, another resolution, directing the Secretary of War to send United States troops into Mexico to protect American lives and property there, was introduced.

The Mining and Metallurgical Society of America has submitted to its members, for formal adoption or rejection, the following resolutions:

> Whereas their professional duties frequently call American mining engineers to Mexico; and,
>
> Whereas the modern mining industry of Mexico has been mainly developed by American engineers; and,
>
> Whereas many American mining engineers have suffered indignities, the loss of their property and even of their lives while traveling or sojourning in Mexico in the peaceful pursuit of their business; and,
>
> Whereas such conditions have culminated in the murder at Teziutlan, on Apr. 16, 1919, of Edward L. Dufourcq, an able and highly esteemed mining engineer and a member of the Mining and Metallurgical Society of America; therefore be it
>
> Resolved that the Mining and Metallurgical Society of America hereby protests to the Department of State in Washington against further disregard by the American Government of conditions in Mexico that make it unsafe for American engineers to go there in the practice of their profession and for the care of business interests intrusted to them; and be it further
>
> Resolved that the Mining and Metallurgical Society of America urges the American Government to take prompt and effective steps toward the establishment of such law and order in Mexico as will safeguard the persons and property of our citizens and extend its protection to all Americans in any part of the world to which they may be called in the pursuit of their legitimate affairs.

Mining engineers, metallurgists, and mine operators are greatly interested in the Mexican situation, for many of them have suffered material injury by reason of conditions in Mexico. The action of the society is another example of the service that it has rendered to the mining industry.

Organized action is necessary, and particularly so in the present situation, as the signing of the armistice and the reported acceptance of the Peace Treaty by Germany have removed all excuse for further vacillation and delay on the part of the Federal Government.

Illiteracy in the United States

A SALIENT and significant feature of the current reports of official Federal and state organizations, charged with the compilation of vital statistics, presented at a time when it is proposed to rearrange social and industrial relationships on a new basis having for its purpose the amelioration of many defects of the old, is the amazing percentage of illiterates in this country.

Eight and one-half million persons in the United States, over ten years of age, cannot read a newspaper, sign, or letter. Five and one-half millions of them cannot read anything in any language. These facts are brought to public notice in the report of the Department of the Interior, which has been compiled from several sources, including data on illiteracy in the drafted army, supplied by the Surgeon General's office. Further comparisons show that the illiterates and aliens of the country outnumber all the people in 15 states combined, and, as voters, would outweigh the influence of Greater New York, Philadelphia, and Chicago in national affairs.

This condition presents a problem which is national in scope. The South leads in illiterates, the North in non-English speaking population. Altogether, 10% of the adult population of the United States cannot read the constitution under which they live or the laws which they are presumed to know.

No particular study is necessary to create an appreciation of the economic waste involved in this deplorable condition, aside from other reasons for the correction of such an evil. Disregarding the cultural and social advantages of education, how can a man perform other than plain manual labor, or become but a poor substitute for machinery efficiently designed and operated, if he is unable to read or write?

Efficiency is becoming more and more essential in commercial competition. This country has witnessed the enactment of much radical legislation and governmental interference with individual preferences and habits of citizens, admitted to be necessary for obtaining efficiency, which is regarded as one of the most important national attributes. Certainly no other single factor can have as much influence on the final degree of national efficiency as the percentage of illiterates in the population.

The subject deserves the thoughtful attention of the leaders of every industry, and our lawmaking bodies should be brought to a realization of the importance of remedying the conditions responsible for the existing large percentage of illiterates in our population.

BY THE WAY

F. W. Maclennan, the new general manager of the Miami Copper Co., may justly claim the distinction of being the first Arizona mine operator who used an airship to inspect the properties of his company. Mr. Maclennan accompanied Wilbur A. Wright in a flight over the Globe-Miami district on June 16, and is said to be enthusiastic over the possibilities of the flying machine and its worth to the manager of the future.

The following are extracts from an official publication of 1890, issued by a commission, bearing the stamp of authority of a great government, which includes in its pages an article on exploring for iron ore:

"Magnetite ores are frequently found with a large body of green and granite rock on the north and a body of quartzite on the south side. Frequently these may be a considerable distance from each other, but in the interval between them may be found a body of ore. These rocks when they come closer together form the walls of the vein enclosing the ore. Their distance apart can be calculated upon as a means to discover the depth of the deposit, it being generally considered that the point where they meet together underground will be the depth of the deposit. Frequently timber of fine growth in the iron formation indicates the presence of iron ore, as a good many mines have been found when the timber is straight and of good size, clear of underbrush, and of better quality in comparison with other trees of like kind in that vicinity. Where the timber is good and iron ore is found, it is generally first class but where the timber is of poor growth and a mixture of all kinds of scrubby wood, the ore as a rule is of inferior quality. Invariably very fine springs have been found where mines of a permanent character have been located. None of these are infallible signs, but all have their bearing on the subject, and attention to them will be rewarded with good results. Magnetic ores are generally found in beds. They are of all sizes, some containing a few tons, others enormous quantities.

"The writer gives it as his firm opinion, justified by facts, that no iron deposit surrounded on all sides by the same kind of rock will be lasting. Sometimes large outcrops on the surface have been found in these occurrences, but in every instance on practical working such deposits have been exhausted at short depths. It is deemed useless to spend money on iron-ore deposits unless they are found with the granite on one side, and then, between the granite and ore, diorite or green rock occurs, and on the other side of the ore quartzite or crystalline lime rock. The reader will perceive that this gives a distinct formation, which, experience goes to show, assures a permanency of deposit.

"The dipping to the north of an iron deposit is a very important feature in connection with its permanency. This northerly dip is caused by the abundance of ore in the mine, and its consequent attraction in that direction toward the North Pole. In some instances large deposits of ore occur dipping to the south near the surface, but at a further stage of development these dip to the north, which is a sure indication of a large body of ore.

"We may add that a large part of the mines now being worked in the Marquette district have been found at great depths. These discoveries were made through actual workings in a regular formation, although no trace of them was seen on the surface, showing that in working in a right formation large bodies of ore are constantly being found, although away from and apparently thrown off from the mine proper. This is accounted for by the ore coming in contact with an older formation of rock not showing on the surface.

The Western office of the *Engineering and Mining Journal*, formerly in the Newhouse Building, Salt Lake City, Utah, has been transferred to the Rialto Building, San Francisco, California.

Personals

Horace V. Winchell is expected to be in New York during the latter part of June.

F. F. Sharpless has left New York for Virginia on professional business.

Amor F. Keene has been elected a director of the South American Gold and Platinum Co.

James MacNaughton, first vice-president of the Calumet & Hecla, is in Boston on business.

M. L. Reqoa is the author of an article, "Technical Training," published in the June issue of "Sinclair's Magazine."

Will E. Malm, of The Malm-Wolf Co., examined mining property in Arizona recently.

George A. Packard, mining engineer and metallurgist, of Boston, Mass. has returned from Brazil.

Franklin W. Smith, is making a tour of the mining camps of Nevada and sections of California.

J. P. Kerby, representing a New York syndicate, recently visited the Rice Lake gold area, Manitoba.

Arthur Notman, superintendent, Copper Queen Mine, of Bisbee, is in New York accompanied by his family.

A. J. Clark, metallurgical engineer for Homestake Mining Company, at Lead, S. D., is in New York on business.

Gerald Sherman, consulting engineer for the Phelps Dodge Corporation, is visiting Philadelphia and other Eastern cities.

Fred Walter McNair, president of the Michigan College of Mines at Houghton, is in Washington on Government business.

Edwin Reeder, in charge of iron mining interests at Mexico, Ky., is in Houghton visiting relatives on his summer vacation.

Ralph Ziesemer, of the firm of Smith & Ziesemer, engineers, of Bisbee, Ariz., has returned from a business trip to California.

Donald G. Campbell will be engaged in exploration and development work for the coming year, near Lost River, Alaska, via Nome.

Capt. Clinton Ball, recently returned from overseas engineer service, has joined the faculty of the Michigan College of Mines.

Oliver E. Jager has been appointed metallurgist to the British America Nickel Corporation, Ltd., Nickelton, Ontario, Canada.

J. B. Foster, president, and **James P. Portens,** superintendent of the Bonney mine at Lordsburg, N. M., will be in Chicago until July.

J. Therseau, of Minneapolis, representing oil operators of that city, is investigating the oil fields of the Peace River district, Alberta.

Fred MacCoy has resigned as mining engineer for the United Verde Copper Co. to accept the position of general manager of Negociacion Minera de San Rafael y Anexas, S. A., operating the San Rafael mine, in Pachuca.

Fred Searls, geologist and mining engineer, has returned to San Francisco after having served two years in France as an officer in an engineering corps.

Julius Kruttschnitt, Jr., Arizona manager for American Smelting and Refining Co., with headquarters at Tucson, is visiting San Francisco and Los Angeles.

E. A. Kronquist, assistant geologist of M. A. Hanna & Co. is at Crystal Falls, Mich., engaged in geological research of the Miohigan iron country for his company.

Rush M. Hess, consulting engineer for the Southern Manganese Corporation, has opened an office for general mining practice at 807 Brown-Marx Bldg., Birmingham, Ala.

Charles E. Newton has been appointed dean of the Oregon School of Mines, Corvallis, Oregon. Mr. Newton was formerly associate professor of metallurgy at that institution.

J. A. Potter, superintendent of the leaching plant of the New Cornelia Copper Co., at Ajo. Ariz., has returned home from an extended visit to the East, including a trip to Michigan.

Edward S. Wiard has resigned as consulting engineer for the Colorado Central Mines Co. and the Onondaga Mines Co., and will resume regular practice at 409 Boston Bldg., Denver, Colo.

J. E. Spurr has resigned as Executive of War-Minerals Investigations, Bureau of Mines, to take effect July 1. The War-Minerals Investigations work will be terminated on that date.

Van. H. Manning received the honorary degree of doctor of engineering at the commencement of the University of Pittsburgh on June 21, in special recognition of his activities in aiding the winning of the war.

V. H. Hughes, petroleum and mining geologist, announces that he has severed his connection with the firm of Valerius, McNutt & Hughes and has opened offices at 326 Mayo Bldg., Tulsa, Okla.

P. D. McLaurin, of Saskatchewan University, has been commissioned by the government of Alberta to investigate the possibilities of producing valuable by-products of the coal-mining industry.

E. H. Sollards has resigned as state geologist of Florida to join the bureau of Economic Geology of the University of Texas, at Austin. He is succeeded by **Herman Gunter,** previously assistant state geologist.

B. O. Pickard, district engineer for the U. S. Bureau of Mines, stationed at Houghton; A. E. Sporley, foreman miner, and Professor Sperr, of the Michigan College of Mines. attended the Lake Superior Safety Conference at Duluth.

E. M. Shipp, oil and mining engineer, representing the Lawrence C. Chamberlain Co., of New York, left New York for Texas on June 11 to make a survey of properties in which his company has become interested. Mr. Shipp expects to return on June 28.

G. H. Clevenger is now acting chairman of the Engineering Division of the National Research Council. The offices of the Engineering Division have been moved recently from Washington, D. C., to 16th floor, Engineering Societies Bldg., 29 W. 39th St., New York.

A. A. Hassan has been examining several prospective oil fields in Texas for the last six weeks and has decided to open an office in Fort Worth for the purpose of conducting a general business as oil geologist. His temporary address will be Westbrook Hotel, Fort Worth, Texas.

H. E. T. Haultain, professor of mining engineering, at Toronto University, on the occasion of his resignation as vocational officer in connection with the department of Soldiers' Civil Re-establishment, was presented with a McLaughlin touring car by 500 representatives of vocational training throughout Ontario.

Harold P. Banks, who served for 16 months during the war with the 2nd Division, A. E. F., in France and Germany, has been discharged from the service and will resume connections with the firm of John H. Banks & Son, 26 John St., New York. Mr. Banks was discharged with the rank of captain of field artillery.

Arthur C. Terrill, for the last four years head of the department of Mining Engineering at the University of Kansas, Lawrence, Kan., has resigned and accepted an appointment with the Kansas State Geological Survey. On July 1, he will move to Baxter Springs to take charge of lead and zinc investigations in southeast Kansas.

James A. Farrell, president of the United States Steel Corporation, has accepted an invitation to address the Pittsburgh Chamber of Commerce upon matters relating to America's participation in the field of foreign trade. Mr. Farrell is expected in Pittsburgh soon, and definite announcement of the date of his address will be made in the near future.

Albin F. Victor, the sales manager of the Lake Superior Loader Co., which is marketing the Armstrong underground shovel, recently returned from the service, where he was a captain in the 27th Engineers. Prior to his enlistment Mr. Victor was chief engineer for the American Manufacturing Co.'s. iron manganese mine on the Cuyuna Range in Minnesota.

C. M. Eye, superintendent for many years of the mines of the Benguet Consolidated Mining Co., at Baguio, Benguet, P. I., has resigned to return to the United States, where, after a vacation, he expects to be situated in or near San Francisco. He is leaving Manila on July 17, after which date his mail address will be San Francisco, care of Wells Fargo Nevada National Bank, until further notice.

B. Britton Gottsberger, general manager of the Miami Copper Co., has resigned his position with the company, to take effect June 15th. He is succeeded as general manager by **F. W. Maclennan,** formerly assistant manager. Mr. Gottsberger, who has had charge of the local management of the Miami Copper for a number of years, will take a long rest before again engaging in active mining operations.

John M. Longyear, of Marquette, has been reappointed, by Governor Sleeper of Michigan as member of the board of control of the Michigan College of Mines. **Ocha Potter,** of the managerial staff of the Calumet & Hecla, an alumnus of the Michigan College of Mines, has been named to succeed John W. Black, member of the board of management of the Ninth Federal Reserve bank board. Mr. Black recently moved to Minneapolis from Houghton.

Judge E. H. Gary, chairman of the United States Steel Corporation and president of the American Iron and Steel Institute, was recently honored by the trustees of the McKinley Memorial Building at Niles, Ohio, who have caused to be placed in the memorial a bronze bust of Judge Gary. The bronze is the work of J. Massey Rhind, New York sculptor. Busts of Roosevelt, Taft, H. C. Frick, and other statesmen and industrial leaders are also in the building.

D. G. Kerr, vice-president of the United States Steel Corporation, made his annual inspection of the mines operated by the corporation on the Minnesota ranges, during the week beginning June 16. He was accompanied by **W. J. Olcott,** president of the Oliver Iron Mining Co.; **Pentecost Mitchell,** vice-president; **John H. McLean,** general manager, and **J. H. Hearding,** assistant general manager. At the conclusion of their trip over the Mesabi and Vermillion ranges the party left to make an inspection of the mines on the Gogebic Range in northern Michigan.

Col. G. A. Burrell, president of the Island Refining Co., 62 Cedar St., New York, has been awarded the Distinguished Service Medal by the War Department for his work as chief of the research division of the Chemical Warfare Service. Colonel Burrell originated the Chemical Warfare Service in this country and had charge of a large research staff working on gas masks, poison gases, smoke screens, and signal lights. Wesleyan University, of Middleton, Conn., has given him the degree of doctor of science, and last year his alma mater, Ohio State University, gave to him the honorary degree of chemical engineer.

W. A. Sloan and **E. Leland** have taken over the assay and engineering office of Kempton & O'Neill in Nogales, Ariz., and will conduct a general engineering and assaying business under the firm name of Sloan & Leland. Mr. Leland for eight years was chief mining engineer for the Shannon Copper Co., Clifton, Ariz., and for the last year has been with the Phelps Dodge Corporation as chief geologist at that company's mine at Pilares de Nacozari, Sonora, Mexico. Mr. Sloan was formerly chief chemist for the Silver City Reduction Works, Silver City, N. M., and for the last ten years chief chemist for the Shannon Copper Co.

Societies

Society of Chemical Industry, London, will hold the annual general meeting on July 15, 16, 17, and 18.

The Institution of Mining Engineers London, held the 71st general meeting on June 19. Among a number of papers presented were the following: "The Difficulties and Dangers of Mine Rescue Work on the Western Front" and "Mining Operations Carried Out by Men Wearing Rescue-Apparatus," by Lieut.-Col. D. Dale Logan, D.S.O. The 30th annual general meeting will be held at Birmingham on Sept. 10, 11, and 12.

Industrial News

Westinghouse, Church, Kerr & Co., Incorporated, announce the election of Arthur King Wood, formerly president of the Franklin Trust Co., as vice-president and treasurer.

H. Gardner, No. 2 Metal Exchange Bldg., Leadenhall Ave., London, has taken out a license under the Non-Ferrous Metals Industry Act and will deal in metals. Cable address, Nonfermet, London.

W. E. Caldwell Co., of Louisville, Ky., tank manufacturers, associated with J. B. Crawford, will build a cut-band sawmill in St. Landry Parish, Louisiana, where the company owns large tracts of cypress, ash, oak, and gum timber.

The Edison Storage Battery Co. announces the election of Maj Charles E. Sholes as vice-president, director, and general sales manager. Major Sholes succeeds Harrison G Thompson, who has resigned to organize and conduct the Transportation Engineering Corporation of New York. Major Sholes has heretofore been identified with the construction, operation, and management of chemical industries and is familiar with the manufacture and consumption of heavy chemicals in the United States and Europe. During the war he served as a major in the Ordnance department, first as chief of the chemical branch and as Army representative before the War Industries Board. He was subsequently made contracting officer for the United States on the staff of Colonel La Mont and still retains his rank in the Reserve Corps.

Trade Catalogs

"Getting Results in Sheet Steel Work." Solar Metal Products Co., Inc., Columbus, Ohio. Pamphlet; 8½ x 3¾; 8 pp.; illustrated. A description of fabrication of sheet steel between ten and twenty gages.

Boss Cement Mixers. The American Cement Machine Co., Keokuk, Iowa. Catalog No. P20; 8½ x 11; 8 pp. Illustrates 1920 type of Boss steel roller and pinion drive portable building mixers.

Mine and Smeltery Structures. El Paso Bridge and Iron Co., El Paso, Tex. Pamphlet; 4 x 9; 8 pp. illustrated. Containing photographs of prominent milling and smelting plants erected by the company in Arizona, New Mexico, and Texas.

Boss Elevator Hoists. The American Cement Co., Keokuk, Iowa. Catalog H20; 8½ x 11; 8 pp.; illustrated Describes gasoline, kerosene, and electric hoists for use with single and double cage material elevators, derricks, spouting plants, drag lines, snatching wagons, excavating, and general construction.

Standard Reinforced Spiral Pipe. Standard Spiral Pipe Works, Chicago, Ill. Catalog No. 7; 7¾ x 10½; 40 pp.; illustrated. Descriptive of products of this company and method of manufacturing spiral pipe. Contains numerous illustrations of installations and complete price list for all sizes of pipe, fittings, valves, joints, and other accessories.

Overhead Material Handling Machinery. Sprague Electric Works of General Electric Company. Bulletin No. 48713; 8 x 10½; 16 pp., illustrated. Descriptive of the "Sprague Adjustable Loop System" for overhead material handling machinery applicable to terminal sheds for the temporary storage of freight or materials before loading or after unloading from ships, barges, or railroad cars, the primary purpose being to speed up the movement of freight, to reduce cost of handling, to utilize shed space to the fullest extent, and to relieve congestion at loading and unloading points.

Storage Battery Driven Locomotives, Cranes and Cars. The Atlas Car and Manufacturing Co., Engineers and Manufacturers, Cleveland, Ohio. Bulletin 1185, 6 x 9; 48 pp.; illustrated. Describes the company's line of standard storage-battery equipment. Special types of locomotives and cars for particular uses are also designed. Details are included of the drive unit, in the manufacture of which the motor cradles have been designed for accessibility, protection and elimination of twisting strains; of the motors, which have the armature mounted on ball bearings packed in grease and permit armature to be readily removed without disturbing coils, and of the charging equipment, made on the sectional system, as well as the battery, meter, controller, and other parts.

Direct Current Motors and Generators. Allis-Chalmers Manufacturing Co., Bulletin No. 1096-A, 8 x 10½; 20 pp.; illustrated. Describes types "K" and "KC". Special features of type "K" are the well-proportioned, cast-steel yokes, substantial housings, large bearings with interchangeable bushings, and rigid shafts, the motors being well adapted to belted, geared or direct-connected service and for either continuous or intermittent duty. In the manufacture of these motors a complete line of jigs and special tools is employed, and the interchangeability of all the parts is thus assured. Improvements in materials and methods of installation have been made, and these, with moisture-proof coils and dust-proof bearings, insure long life and reliable operation, even in exposed situations. Type "KC" has been introduced to provide a motor with a wide range of speeds. Speed adjustment is made through field control. Through the addition of commutating poles, sparkless commutation is secured when motor operates at maximum speed with weakened field.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Leaching—Metallurgical Process. Carlos Malsch and Carlos Hennes Gilson, Valparaiso, Chile, assignors to Sociedad Metalurjica Chilena Cuprum, Valparaiso, Chile. (U. S. No. 1,303,701; May 13, 1919.)

Lead Arsenate—Method of Making. Iens P. Lihme, Lakewood, Ohio, assignor to the Grasselli Chemical Co., Cleveland, Ohio. (U. S. No. 1,302,186; Apr. 29, 1919.)

Petroleum—Working Barrel for Oil-Well Pumps. William A. McGregor, Bradford, Penn., assignor to McGregor Working Barrel Co., Inc., Bradford, Penn. (U. S. No. 1,301,068; Apr. 15, 1919.)

Potash—Process and Apparatus for Separating Finely Divided Materials. Walter A. Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,298,409; Mar. 25, 1919.)

Process for Clearing Clayey Ores. Edward F. Goltra, Thomas S. Maffitt and Jesse D. Dana, St. Louis, Mo., and Robert W. Erwin, Waukon, Iowa, assignors, by mesne assignments, to Mississippi Valley Iron Co., Wilmington, Del. (U. S. No. 1,301,684; Apr. 22. 1919.)

Pulverized Fuel—Automatic Apparatus for Distributing Pulverized Fuel. William O. Renkin, Oradell, N. J., assignor to Quigley Furnace Specialties Co., Inc. (U. S. No. 1,301,168; Apr. 22, 1919.)

Sample-Taking Device. Walter Lee Church, Humble, Tex. (U. S. No. 1,300,346; Apr. 15, 1919.)

Editorial Correspondence

SEATTLE, WASH.—June 19

Good News Bay, near mouth of Kuskokwim River, is the destination of a U. S. Geological Survey party that left Seattle on June 16 on schooner "Ozmo." R. H. Sargent, topographical engineer, is in charge. Accompanying is G. L. Harrington, geologist. Data on geology and mineral resources will be collected.

The Talkeetna Bridge, 2200 ft. long, has been completed on the Government railroad 103 miles north of Anchorage, Alaska. At Juneau, bids have been received from several on what is to be the longest mine tunnel in years. Successful bidder should be known soon. At Nome, the first two boats of the season have arrived, but are unable to land, on account of ice floes.

Lost River Tin Mines, 100 miles from Nome, Alaska, are to be developed by the owner, James F Halpin Erection of a mill is considered when sufficient tonnage has been developed Equipment now being assembled Steamer "Cordova" left Seattle June 15 with 600 or 700 tons of equipment and will make special landing Shipment includes three compressors, drills, hoists, fans and other necessary appliances. Next winter about 30 expect to stay at mine, and suitable buildings will be erected.

SAN FRANCISCO, CAL.—June 19

Two Gas Wells bought in by Standard Oil Co at Elk Hills now making 100,000,000 cu ft of gas a day Property was bought not long ago for $25 an acre In addition to these gas wells, the Standard Oil has three producing oil wells.

The Present Scarcity of Labor in California mines is largely owing to the fact that wages in general throughout the state are little higher for underground work than for surface work, such as dams, highways, and construction work in general. The recent strike at Grass Valley, an account of which is given on another page, is an outgrowth of these conditions.

The Estabrook Gold Dredging Co. has put in operation the recently completed 20-cu.ft. gold dredge on Trinity River in Trinity County. Results have been entirely satisfactory on this boat, reported to be the largest wooden gold dredge in the world. The cost was in excess of $600,000. It is 152 ft. long, has a 68 ft. beam, and draws 10 ft of water. In construction 1,000,000 ft of lumber, cut from the surrounding forests, was used.

California Oil Prices posted by the Standard Oil Co. and effective June 10, 1919, represent a slight increase over prices scince May 1, 1918 These prices will no doubt, as formerly, govern all sales. For San Joaquin Valley fields the prices are as follows: 11 deg. to and including 17 9 deg., $1 23 per bbl.; 18 deg to and including 18 9 deg $1.24 per bbl 19 deg to and including 19.9 deg., $1 25 per bbl., and for each increase in gravity of one full degree above 19 deg gravity up to and inclusive of 36 9 deg., 2c per bbl. additional; 37 deg. to and including 37 9 deg., $1 62 per bbl., and for each increase in gravity of one full degree above 37 deg., 3c. per bbl. additional. Practically the same prices apply to the Whittier-Fullerton and Santa Maria fields and represent an increase of from 1c. to 6c. per bbl., according to the gravity of the oil

PHOENIX, ARIZ.—June 19

The Arizona Employers' Liability Law is held to be constitutional by the decision of the U S Supreme Court rendered June 9, affirming the judgment of the Federal court in the cases of Richard Bray and Joseph Hammer against the Arizona Copper Co., Ltd. The latter company and other companies were represented at the hearing by John A. Garver, of New York; Senator William H. King, of Utah, and Judge E. W. Lewis, of Arizona. Both of the above cases were appealed to the Supreme Court upon the ground that the Employers' Liability act, under which the cases were prosecuted, deprived the company of its property without due process of law, in violation of the Fourteenth Amendment of the Federal Constitution. The cases on appeal were heard before the U. S. Supreme Court during the latter part of January, 1918. The liability act provides that in cases of appeal judgments carry interest at the rate of 12 per cent.

WALLACE, IDAHO—June 19

Robert M. McWade, of Washington, D. C., U. S. Conciliation Commissioner connected with the Department of Labor, is in the Coeur d'Alene district for the purpose of adjusting the differences between the mine operators and the International Union of Mine, Mill and Smelter Workers The circumstances leading up to his coming are set forth in the *Journal* of June 21. Since his arrival he has conferred with representatives of the union and with the mine managers individually. It appears that Mr McWade's idea of "conciliation" is for the mining companies to tie up with the union, and his argument is at least novel. He assumes that all good citizens are opposed to the I. W. W. He then points out that the I. W. W. is quite strong in certain sections of the district, and that the miners' union is the enemy of that organization Therefore, he concludes, in order to combat the I W. W successfully, the mining companies should recognize and back up the union.

SALT LAKE CITY, UTAH—June 19

A Semi-Monthly Pay Day, provided for at the last session of the State Legislature, is now in effect at Utah mines. The law also requires that "Whenever an employer discharges an employee, the wages earned and unpaid at the time of such discharge shall become due and payable immediately. When any such employee not having a contract for a definite period quits or resigns his employment, the wages earned and unpaid at the time of such quitting or resignation shall be due and payable at the employee's next regular pay day.

DENVER, COL.—June 20

Separate Leasing Bills for coal and oil-shale lands have been introduced in the House by Congressman Taylor, of Colorado. These bills are identical with the coal and oil-shale sections of his general leasing bill. Ferris, of Oklahoma, and Raker, of California, have introduced similar bills almost identical in language.

Recent Discoveries in Barstow Mine, near Red Mountain, Colo., have caused considerable interest locally. The mine has at various times produced considerable rich gold-silver ore, and shipped 1500 tons of fluorspar last year. The discovery was made by the Lundberg-Curtis Lease, of Ouray, an association that subleased a block of ground last winter. Drifting 500 ft. on the vein last year by the Barstow Lease, which operates the property, disclosed an apparently insignificant streak of gold-bearing quartz. This was two to six inches wide and five feet long, but carried good gold and silver. Stoping on this streak has disclosed an orebody 75 ft. long and up to five feet thick, at a height of 90 ft., with the length still increasing as the stope continues upward. Most of the ore won so far is considered only good milling ore, being around one ounce gold by assay, with some silver and lead. The Lundberg-Curtis Lease plans to improve the present stamp mill by equipping it with a small re-grinding and flotation outfit, for the summer's milling run.

EDGEMONT, S. D.—June 20

The Mule Creek Oil Field in Converse County, Wyo., and near Edgemont, S. D., is receiving considerable attention, and indications point to a productive field. Though the district is a new one, drilling has disclosed oil at shallow depths. New rigs are being set up weekly and operators are active in pushing the work. The Ohio company has three wells drilling, and three rigs are to be set up as soon as they can be shipped in. In all probability this company will have six rigs at work within the next 30 days. The Midwest company has one rig ready to spud in, and the Stanley Greene company is erecting two outfits for the same company. The entire field is one of activity, and much is expected in the way of oil production.

The Richards Oil Syndicate has been formed to investigate the oil field in the Rocky Ford district, in Crook County, Wyo. Richard Blackstone, of Deadwood, formerly superintendent of the Homestake Mining Co., is president, and E. P. Peterson, of Terraville, secretary and treasurer. Smith Willey, of Deadwood, will have charge of the drilling. They have secured 640 acres of land four miles east from Sundance and 100 acres in the Rocky Ford district, where wells have heretofore been drilled and oil encountered at 150 and 200 ft. The oil that has been found in the wells is of high-grade asphalt quality. The new syndicate is completing arrangements for a new rig, and the field will be thoroughly tested, beginning with a 10-in. hole.

JOPLIN, MO.—June 21

Night Classes in Practical Mining have been started at Galena and Baxter Springs, Kan., as the result of agitation by Prof. T. E. Terrill, formerly with the Kansas State University.

A New Record for Initial Production by a moderate-sized concentrator in the Joplin district was made by the Big Elk plant during the last week. Operations were started on June 19, and the first hour five tons of zinc concentrates was made, and during the day 29,000 lb. of zinc and 5500 lb. of lead from 41 tons of mine-run ore. The mine lies between the Southern and Silver Fox properties, northwest of Picher, Okla., in Kansas, the office of the company being at Miami, Okla. J. T. Worley, of that city, is president. Chicago-Pneumatic gas engines are furnishing power.

Sale of the High Five Mine, at Waco, Mo., for $250,000, has been announced. The property includes a 70-acre lease, a developed mine, and a concentrator of 400 tons' capacity per shift. George Ball and associates, of Webb City, developed and sold the property, the buyers being Temple Chapman, of Joplin, and George E. Starr, of Philadelphia. Mr. Starr formerly was an operator in the district. Drilling at the property has indicated an orebody approximately 95 ft. in thickness. Development has been slow, on account of a heavy head of water, but this is gradually being eliminated by pumping by a number of different companies. The mill is new and has been operated only a few days. Full operation will not be started before July 4, and possibly not until later, Mr. Chapman being one of those favoring drastic curtailment of production.

ST. LOUIS, MO.—June 20

St. Louis, as an Oil-Refining Center, possesses advantages that are now being realized. With its central location in the heart of the Mississippi Valley, with 22 radiating railroads and its situation on the Mississippi River, the distributing facilities are exceptionally good, and there is also a local market of over one million people that absorbs a large amount of fuel oil in the large openhearth steel plants. There are three small refineries in East St. Louis. The Standard Oil Co. built a large refinery at Wood River, which now has a capacity of 15,000 bbl. daily; and the Roxanna Co. built a 5,000 bbl. refinery at Wood River, in the last year. The Tide Water Oil Co., which has a large exporting refinery in New York Harbor, has just purchased a 231-acre tract at Wood River for a new refinery, and the White Star Refinery has purchased a tract of 60 acres at the same place on which to build another large oil refinery. The Standard Oil Co. has two pipe lines to the Oklahoma fields and another pipe line to Eastern Illinois fields, and the Roxanna company has just completed its own pipe line to the Oklahoma and Texas oil fields.

DULUTH, MINN.—June 20

John A. Savage & Co., independent iron-ore operators of Duluth, Minnn., have received a verdict in district court against C. A. Remington, of Hibbing, in the amount of $2300 in a suit involving the stockpile of the Elizabeth mine at Chisholm. It developed at the trial that the mining company in 1918 had purchased the 55,000 tons of stockpile ore at a certain analysis, but that after shipment of 27,000 tons had been made the average silica content proved to be about 12%, instead of about 8.50%, as expected, whereupon the buyer refused to ship any more of the ore. Remington then sued for $60,000, based not only on the 27,000 tons shipped, but also on non-fulfilment of contract in refusing to ship the remainder of the pile. It was held by the court that iron ore is sold on analysis and that any wide misrepresentation is a violation of contract. The case will be appealed.

The U. S. Bureau of Mines has recently issued a bulletin setting forth the outcome of experiments conducted in coöperation with the Minnesota School of Mines on what is termed the "Jones Process for Concentrating Manganese Ores," perfected by John T. Jones. The bulletin sets forth the process as follows: "The process consists of two stages. In the first, called the low-temperature reduction stage, two products are made, namely, (a) metallic iron, suitable for direct use in the manufacture of steel, and (b) slag. Most of the manganese is concentrated in the slag. Separation of these two products, as outlined by the inventor, is accomplished by grinding of the sinter resulting from the low-temperature treatment of the ore, and thereupon extracting the magnetic iron pellets by means of magnetic-separation apparatus, producing thereby a high-grade magnetic iron concentrate, and a non-metallic manganiferous sinter. This method was used in the preliminary tests. In the final tests, however, separation was accomplished by pouring the material under treatment in a liquid condition and recovering the iron metal in the form of a button. The second stage, which may be called the high-temperature stage, involves the smelting of the manganiferous slag or sinter derived from the first stage, to produce a manganese alloy." The bulletin does not attempt a discussion of the commercial possibilities of the process, but concludes that the metal produced in the low-temperature process is suitable for conversion into steel by any basic steel process, and that the alloy produced by the high-temperature process might he termed a silico-ferro-manganese, and, though new to the steel-manufacturing industry, at this time could probably be used to advantage. About 72% of the manganese in the ore appears in the alloy.

HOUGHTON, MICH.—June 21

The Labor Situation in the Michigan copper district has taken a sudden change, and men have become scarce. Sixty days ago the mines were decreasing their force and curtailing production 50%. In all twenty-five hundred were discharged or quit, the majority being surface employees. Today every mine in the district could use more trammers and miners, and is endeavoring to get general physical conditions underground in healthy condition. This is a unique situation in the copper country.

Crosscut From the Seneca Shaft showed the lode 22 ft. wide, carrying copper all the way across, except for one horse of trap. Drifting on the lode has begun, the shaft now being cemented. This will be the first Seneca drift, and the opening on the formation will be watched with interest. It is necessary to go 100 ft. in the shaft to get out of the curve from the vertical to the incline. Then sinking will be pushed more rapidly. Seneca's purchase of Gratiot from Calumet & Hecla will not only add 3318 acres to Seneca's holdings, but will furnish necessary ventilation through the Gratiot shafts. Gratiot carries the Kearsarge amygdaloid under 175 acres and to a maximum depth of 2700 ft. Two shafts were sunk by the Calumet & Hecla following diamond-drill explorations. The first is 1500 ft. from the Seneca line, and is 1900 ft. deep, with levels every 200 ft. The second shaft, 1475 ft. southwest of No. 1 and 1800 ft. north of Mohawk line, went down 1520 ft., four levels being opened. Copper rock which went to the mill did not show 10 lb. to the ton. Ojibway, adjoining, contains 1560 acres and has two shafts, one down 2051 ft. and the other 1954. Work developed interesting geological conditions of the Kearsarge lode, as formation showed seven alternations of trap and amygdaloid, all above sandstone horizon.

ISHPEMING, MICH.—June 21

Iron-ore Shipments continue light from the Lake Superior district. The only heavy shippers are the Oliver Iron Mining Co. and Pickands, Mather & Co., both of which have excellent furnace connections. The Oliver company which is the mining branch of the U. S. Steel Corporation, is replenishing its stocks at the furnaces, it being the policy of the parent company to maintain large stocks of raw materials at its plants in Illinois, Indiana, and in the East, in order to be prepared against labor troubles and transportation difficulties. Only a small amount of ore is going forward from the stockpiles, and some of the operators are still placing the daily hoist in stock at the mines. Additional stocking space must be prepared at many of the properties. It is difficult to state just what is going to transpire the coming winter, but it is feared that some of the independents will have to curtail operations considerably unless the ore market takes a decided turn for the better within the next few months. The manager of one of the largest of the independent concerns stated a few days ago that his company had disposed of only one-fifth of the amount of ore that is usually sold at this season of the year. As one looks over the stockpiles of ore at the mines one cannot help but feel that the market is not in a healthy condition, although reports from the iron and steel centers state that steel is improving. Vessel owners are advising the ore men to move their ore during the summer, as the boats will be busy carrying grain during the fall months. In spite of the fact that the ore market is not in the best of condition, wages have been maintained throughout the district and few men are out of work. This is in great contrast to the copper districts, where forces have been reduced and wages lowered. The independents are hopeful that the ore situation will improve in time to permit them to move all or a part of their surplus stocks this year.

BIRMINGHAM, ALA.—June 20

Iron-Production Figures for May from the Birmingham district do not show the increase over April that was expected, but the situation as a whole shows marked improvement throughout the month. The renewed activities of some companies, particularly Woodward Iron Co., and the tendency of others to swing back to normal production and sales, are responsible for the optimistic views held by both producer and consumer. The attitude of the consumer is expressed in many small orders for iron for immediate delivery and inquiries regarding large orders for future delivery. It is believed that if the business offered for delivery during the last half of the year is accepted, between 100,000 and 200,000 tons of pig iron will be sold this week. That producers are expecting the upward swing in business is indicated by their renewed operations and the refusal of some to quote prices on iron to be delivered after October, 1919. Further proof of better conditions in this district is noted in the intra-district freight records. The volume of freight moving is gradually increasing to the point where it is believed the Sunday trains will be running soon, possibly before the end of the month.

Two furnaces of the Tennessee Coal, Iron & Railroad Co., at Bessemer, Ala., are to be blown in soon, it is expected. This done, the company will have four in operation in Bessemer, and this increase, with the Woodward furnaces operating, will tend to better the conditions in the mining camps along Red Mountain.

The labor situation in the Birmingham district is causing some trouble. The larger companies report a surplus at their mills and furnaces but serious shortages in their mining divisions. There seems to be no desire on the part of the men to go to the mines, and as a result large numbers of idle negroes can be seen on the streets in the district looking for transportation North or work at the furnaces or mills. There has been some shipment of labor north, particularly noted in Bessemer, Ala. This is an injustice to the district, and more so to the men shipped, for the negro is prone to ride the train on the slightest pretext, and the majority of negroes, after reaching their destination, go through many hardships before finally drifting back South.

An attempt is to be made to organize men employed in the Birmingham iron and steel industry into unions which will be affiliated with the American Federation of Labor. No statement from the larger companies as to their stand in this matter has been received, but it is believed they will bitterly oppose all attempts to organize. Samuel Gompers, president of the American Federation of Labor, has promised to send a number of organizers to the district at once, and mass meetings will be held in the near future in all centers in this district, particularly Ensley, Bessemer, Woodward and Westfield.

Suits for damages, totaling about $200,000, have been filed in the U. S. District Court against the Woodward Iron Co. by G. D. Walker and Raymond Fuqua. The company's employees are charged with negligence in the handling of a switch engine and some cars which crashed into a truckload of young people on a picnic recently, resulting in the death and injury of several.

TORONTO, ONT.—June 21

The Labor Troubles in Northern Ontario seem to be clearing, and the general impression is that there will be no strike in Cobalt. The result of the strike vote was announced on June 15, and showed a large majority in favor of the strike. However, the vote represented only about 50 per cent of the workers of the camp, and, as is the general rule, the men who were satisfied took little interest in the matter. With the high wages being paid and the prospect of still higher wages as silver keeps to its high level, a large number of the men, and particularly those who are married and have families, apparently have no desire to see a strike. In Kirkland Lake, when the men went out, the mines closed and made no attempt to operate, and as a result everything is shut down.

The Supreme Court of Canada has handed down a decision in the appeal taken by the Dominion Reduction Co. from a decision of the Supreme Court of Ontario in the action against the Peterson Lake company over the ownership of tailings. The case arose over the fact that for some years the Dominion Reduction Co. had been depositing its tailings in Peterson Lake, with the permission of the Peterson Lake Mining Co. When silver began to rise, the Dominion Reduction Co. wanted to re-treat the tailings, but the Peterson Lake Company claimed ownership. There are estimated to be 220,000 tons of tailings in the lake. The Peterson Lake got the decision in the two lower courts, and the appeal by the Dominion Reduction Co. was dismissed with costs.

MELBOURNE, AUSTRALIA—May 1

Ore Raised From Broken Hill Mines during 1918 totalled 1,251,161 tons, an increase of 219,802 tons over 1917. The output was valued at £6,232,931, and dividends paid amounted to £1,253,571. In addition to the foregoing, the zinkiferous tailings treated were valued at £576,952, and returned to shareholders £328,900. Of the individual mines, the output from the Proprietary again heads the list, with a value of £1,709,294, with that of the South Mine £1,189,238, and the Sulphide Corporation (Central Mine) £1,042,112.

The Mount Morgan Gold Mining Co. announced under date of May 3, that the output of copper since October last, totalling 3400 tons, remains unsold. Notwithstanding this, it is considered advisable by the directors to maintain productive operations, but they have announced that this policy will render it advisable not to declare any dividends for the present. An official notice to shareholders states: "Your directors find difficulty in expressing definite views, with regard to the immediate prospect of an alteration in the position. There has been a heavy curtailment of production in America, but the expected industrial demand is still absent." Apart from Mount Morgan, Mount Lyell is the only important copper producer in Australia that is still at work.

The Mount Boppy Gold Mining Co. Canbelego, N. S. W., is the premier gold producer in New South Wales, but is gradually coming to the end of its resources. During 1918 a total of 61,176 tons of ore was raised, for a production of 15,511 oz. gold, valued at £65,329. As the remodeling of the mine plant was not completed until early in the year, and operations were suspended in November owing to water shortage, a full year's work was not possible. A new main shaft was completed, making available large bodies of ore around the old shaft, which previously could not be removed. This ore is being taken out by means of two open cuts, one on each leg of the lode. In addition, a fair quantity of ore remains in several of the stopes underground. J. Negus, who has been to London to consult with the directors, is now on his way back to Australia. He has an option on the Occidental Gold Mine at Cobar, said to be a very promising property.

The Mining News

ALASKA

ALASKA SHIPMENTS of domestic copper ore, matte, etc., to United States during May were 1,134,272 lb., having value of $176,129.

ARIZONA

Cochise County

WOLVERINE & ARIZONA (Bisbee)—Copper-ore shipments to smelters suspended during April and May. Development of new orebody has added greatly to ore reserves.

Gila County

BARNEY COPPER (Globe) — Stockholders met June 2 to change company name to Porphyry Consolidated Copper Co., and to change par value of shares from $5 to $1 and number of shares from 1,000,000 to 5,000,000, capitalization to remain same. Col. J. D. Coplen president of both companies.

Mohave County

THUMB BUTTE (Kingman)—New machinery and telephone line just installed preparatory to resuming operations, after two years' idleness. Property carries strong fissure vein of gold-silver ores, and has been developed to the 400 level.

Pinal County

SOUTH RAY COPPER (Kelvin)—Unwatering operations have reached 350 level. Force of men put at work on 300 level. Mine will be completely unwatered and extensive development done on 500 level. New mining equipment being installed. W. B. Duvall in charge.

U. S. VANADIUM DEVELOPMENT (Kelvin)—Small force of miners at work in lower levels doing exploratory work. Property being thoroughly sampled. Exhaustive study of geology and occurrence of ores being made. Mill to be remodeled for experimental plant.

RAY BROKEN HILLS (Ray)—Development tunnel driven over 1200 ft. Body of gold ore, developed in shaft 500 ft. above, over 100 ft. in width, where cut by tunnel. Flow of water recently encountered in tunnel approximately 100 gal. per min. Company has recently acquired Alma group of 10 claims from J. A. Tillman and Little Bobbie group on west and south, respectively. Large force of men employed under Scott Litner. Property recently surveyed for patent.

Yavapai County

U. V. ENTENSION (Jerome)—Plans call for starting and gradually increasing smelter operations in near future upon completion of certain changes in reverberatory department.

STODDARD (Stoddard)—Sinking of main shaft being pushed by three shifts under S. E. Chaney, superintendent.

CALIFORNIA

Butte County

SURCEASE (Big Bend)—Reported deal pending between Goldfield Consolidated Mines Co. and Julius Kruttschnitt, Jr., for purchase of Surcease mine.

Eldorado County

KELSEY GROUP (Placerville) — Examination made by E. K. Finn, of New York. Reported that mine plant and mill will be installed.

Nevada County

NORAMBAGUE (Forest Springs)—Announced operations will be resumed. Worked by Prentiss & Pell before war conditions necessitated shutdown.

Plumas County

GOLDEN EAGLE GROUP (Quincy)—Placer-mining claims transferred by Nelson & Merrimac to Fisher Brothers, of Oakland, Cal.

Sierra County

TABLE ROCK (Table Rock)—Recently completed 3000-ft. tunnel to secondary channel, where commercial ore was uncovered. J. H. Hartley manager and Francis Gay principal stockholder.

Inyo County

PETERSON BROTHERS cut small blind vein at Caliente in Amalie district while running crosscut in water well for storage purposes. Vein said to be heavy sulphides of good grade.

BISHOP CREEK (Bishop)—Shipping concentrates from old mill tailings. Mine now unwatered and conditions satisfactory for steady production of about 75 tons per day. Cooper Shapely manager.

Nevada County

EAST EUREKA (Grass Valley)—Recently sold to Metals Exploration Co. by David Whildin, of Grass Valley, for $11,000.

CALIFORNIA MINING (Nevada City)—Tunnel being run to gravel deposit in Harmony Ridge now in 650 ft. and advancing about 110 ft. per month in hard granite. Company's ground four miles long, two miles wide. A. Hoge, superintendent.

Tuolumne County

COLUMBUS GROUP (Tuolumne)—Option on purchase for $50,000 granted to Murray Innes and L. D. Gordon, of San Francisco, by owners, Columbus Mining Co., principal stockholders of which are J. Goldman and S. G. O. King. Terms of agreement call for payments distributed over period of 1½ years, with royalty of 10 per cent on net proceeds to be applied on purchase price.

COLORADO

Boulder County

SMUGGLER (Jamestown)—Property at Balarat being developed by new Smuggler M. and M. Co. New orebody opened on

200 level south of main shaft. South heading being advanced. Will crosscut to prospect for parallel veins. Construction of small milling plant under consideration. T. W. Clements general manager, G. R. Prunty secretary-treasurer, and Melvin Brugger superintendent.

Lake County

WELDON (Leadville)—Leased to Griffin and Callahan, who are placing property in operating condition, and plan considerable underground development. Much zinc carbonate ore opened in upper workings.

Ouray County

GUADALUPE (Ironton)—Much development work done during last winter and commercial ore opened. Mill completed, and cable tramway will be built from mine to mill. Bond and lease secured on Beaver, Belfast and Ida L. properties. Reported 25,000 tons of ore blocked out and ready for mining. Shipment of 55 tons of smelting ore recently settled for at Salt Lake City.

San Juan County

GOLD KING (Gladstone)—Recent development work opened for 200 ft. payable oreshoot about 15-ft. wide. Estimated ore reserves available will supply 300-ton mill throughout present season. About 80 men employed in mine and mill.

San Miguel County

SMUGGLER-UNION (Telluride)—Will build one-story addition to boarding house at Sheridan adit, and at Smuggler a 3½-story addition to hoarding house and an apartment house of 4-room apartments for family use. Latter will be 26 x 116 ft. and 3 stories high. Building contract awarded to Harry Doyle, of Telluride.

IDAHO

Bonner County

CLARINDA COPPER (Clark's Fork)—John K. Ashley surveying route of proposed tunnel No. 4; tunnel to start at Northern Pacific R. R. and to cut all veins. Ore of shipping grade, principal value silver; also considerable milling ore. Compressor and machine drills being installed. J. P. Delaney, secretary. Project financed by Delaney & Co., 50 Broad St., New York.

Boundary County

IDAHO CONTINENTAL (Porthill)—Operations resumed with over 100 men. Mine on two shifts, mill on three.

Shoshone County

HECLA (Burke)—Drift on 2000 level struck foot of good ore 350 ft. in advance of point where oreshoot was expected, corresponding with ore on 1600. Good milling grade and believed to be beginning of main oreshoot. Carries considerable zinc. Ore in upper working practically free of zinc.

MARSH (Burke)—After long suspension work started to explore promising ground on main tunnel level. Shaft, now down 900 ft., abandoned for present. Hoist sold and removed from property.

BUNKER HILL & SULLIVAN (Kellogg)—Fire destroyed large supply of stull timbers and sawmill. Loss estimated at $150,000.

KANSAS

Joplin District

REDSKIN (Miami)—Resumed operations after shutdown of several weeks. Will start sinking north of mill soon to intercept ore run that has been dipping that direction. E. B. Edes, of Joplin, active manager once more, after recovering from influenza and pneumonia.

SOUTHERN LEAD & ZINC (Miami, Okla.)—Preparing to sink to take out 15 ft. of ore which could not be mined before without heavy water, but entire head of water has been lowered. H. S. Clarke, secretary-treasurer, P. O. Box 676, Miami.

MICHIGAN

Copper District

HANCOCK CONSOLIDATED (Hancock)—Shareholders, at their annual meeting, elected the following directors: John D. Cuddihy, Thomas Hoatson, James Hoatson, A. F. Rees, W. R. Thompson and John Hicok. Directors elected John D. Cuddihy president, Thomas Hoatson, vice-president, and John Hicok secretary and treasurer. Sale of 125 acres of mineral land to Quincy authorized without opposition. Active operations can be resumed on short notice. All work suspended, but pumps running. Physical condition excellent. Two east branches of Pewabic in good ground that will yield 17 lb. per ton.

QUINCY (Hancock)—Management has announced it will give underground work to all returned soldiers seeking it, whether formerly employees or not. No surface positions open.

MOHAWK (Mohawk)—May output of refined copper 1,052,738 lb. Wolverine produced 352,130 lb.

Iron District

Gogebic Range

NEWPORT (Ironwood)—Inventory made by Pickands-Mather & Co. experts. According to rumor, this was done for large bonding house, preparatory to issue of bonds by Newport Mining Co., but officials refuse statement.

TOWNSITE (Ironwood) — Deal made with Republic Iron & Steel Co. to handle ore from Townsite mine. Herbert E. Jussen has returned from Marquette Range and will act as superintendent for Republic company. Shipment from stockpiles begun.

PURITAN (Puritan)—Work in progress to connect workings with those of Ironton mine to provide outlet for miners in case of accident to shaft, Davis shaft outlet having been temporarily lost because of fire in same.

Marquette Range

STEPHENSON (Gwinn)—Pumps steadily gaining on water. Some months yet before operations can be resumed underground.

CLEVELAND-CLIFFS (Ishpeming)—Several diamond drills working in Ishpeming and Negaunee fields. Some using steel tripods with 50-ft. rods. Expected some new deposits will be discovered.

NORTH LAKE (Ishpeming)—A 10,000 ft. drift being extended to Barnes-Hecker at depth of 600 ft. Will be used for exploratory and development purposes.

OHIO (Miohigamme)—All ore in stock to be shipped. Mine not operating.

MINNESOTA

Mesabi Range

LAURA-DAY (Hibbing)—Prospect being drilled by Pickands-Mather & Co. Near Albany mine of same company.

HILL (Marble)—Great Northern lease, which has not shipped since 1916, taken over by Cleveland-Cliffs. Contains large tonnage of wash ore, which will necessitate concentrator later.

ENTERPRISE (Virginia) — Conducting supplementary test-pitting operation.

NORMAN (Virginia)—Famous property of Oliver Iron Mining Co. completed career recently with shipment of last car of ore. Opened in 1894, shipped 6,000,000 tons, figured in several fee-owner-operator lawsuits, and has been scene of one of worst accidents in Mesabi Range mining history.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Wise River)—Crosscut from Upper Idanha tunnel at Elkhorn mines advancing at rate of over 400 ft. monthly, 111 ft. being made last week. Raise from 1000 level on the Idanha fissure now up 400 ft., several sets being made weekly. Ore showing continues strong in raises.

Jefferson County

LEGAL TENDER (Clancy)—Syndicate of Butte men secure control and active development program under way. Ore high in silver, but fissure narrow, and yet to be picked up beyond faulted section. Carload of ore shipped last week.

Missoula County

POTOMAC COPPER (Potomac)—Road building, connecting properties with Potomac, eight miles distant, completed, and grading in progress for foundation for air compressor plant and miners' boarding house.

Silver Bow County

ANACONDA (Butte)—Custom zinc ore shipments increased, according to tonnage statement from Great Falls electrolytic plant, capacity of which is being increased from 100 tons daily to 150. New copper refinery at Great Falls now has capacity of 16,500,000 lb. of metal monthly, which can be enlarged to 21,500,000 lb. by operating old refinery in conjunction with new plant. Copper production slightly better than 50 per cent. Experienced miners scarce.

BUTTE-BULLWHACKER (Butte) — Mining operations will be resumed July 1 and shipments started to Washoe leaching works at rate of 250 tons daily.

BUTTE & RAMSDELL (Butte)—Ore shipments resumed last week through medium of Davis-Daly company, whose veins are leased in Ramsdell territory. Royalties paid Davis-Daly range from 10 to 25 per cent. Last 90 cars shipped averaged 6.20 per cent copper.

BUTTE & SUPERIOR (Butte)—When No. 2 shaft of Black Rock mine reaches 2,500 level crosscut will be driven to No. 3 shaft and that raised from 2500 to 2000 level. Orebody on 1800 and 1900 levels now opened for more than 1600 ft.

DAVIS-DALY (Butte)—Contract awarded to Minneapolis Steel & Machinery Co. for immediate installation at Colorado mine of skips, skip dumps, and steel and concrete ore bins. Skips will enable hoisting of increased tonnage, and capacity of bins will be enlarged from 150 to 600 tons. Timber being hauled to Hibernia mine, preparatory to sinking shaft additional 50 ft. to crosscut at 500. Shaft now down 400 ft.

TUOLUMNE COPPER (Butte)—Sinbad shaft of Main-Range mine now down approximately 135 ft. below 1,000 level and station cutting underway at this depth. Daily ore shipments approximating 100 tons. Showing on 500 level improving, as drift is carried westerly to zone corresponding with section opened on 700 and 800 levels.

NEVADA

Lincoln County

PIOCHE DISTRICT ore shipments for week ended June 12 were: Prince Consolidated, 24 cars; Virginia-Louise, 6 cars; Black Metals, 6 cars; Harney, 2 cars.

BLACK METALS (Pioche)—Increasing shipments of fluxing ore. Struck new vein of high-grade ore on seventh level.

Nye County

TONOPAH HASBROUCK EXTENSION (Divide)—Judge Walsh, at Goldfield, has decided in company's favor in suit against Silver King Divide involving surface conflict between Independence No. 1 lode and Silver King No. 1 lode. Court held Independence No. 1 was valid location and that Silver King No. 1 could not by making excessive location in first instance amend its lines as against junior Independence No. 1 so as to claim more than 300 ft. from location monument.

Storey County

MONTE CRISTO (Virginia City)—Old property formerly owned by Charles Butters Co., Ltd., of London, sold to Monte Cristo Mines Co., newly organized by R. R. Hillman, Morris Rosenthal, I. E. Selix, and others. Purchase includes all rights of way, mill site, and over 700 acres of land in Storey County; also 25,000 tons of tailing from other companies. Will start operations soon, using part of old Butters equipment. Will probably buy other equipment.

NEW MEXICO

Grant County

ATWOOD (Lordsburg)—H. V. Snell, of Globe, Ariz., has purchased controlling interest from Morningstar & Augustine, in Southern and Atwood groups, which join 85 Mine on the southeast. Development will be started soon.

BOSTON-HECLA (Lordsburg)—Receiving bids from contractors for 300 ft. double-compartment shaft. Fred Kroll, superintendent in charge.

CO-OPERATIVE (Lordsburg)—Has installed 20-h.p. hoist and 100-h.p. boiler and is working on mill foundations. E. Walters, superintendent.

EL DORADO GROUP (Lordsburg)—Six-months' option taken upon this group of mine claims by Inderreiden, Coon, and Ritter from Fairley and Killebrew, owners. Group of five claims adjoining 85 Mine on west also optioned from Killebrew and Malone.

LAST CHANCE (Lordsburg)—Has arranged to pump sufficient water to keep mill working full time.

OCTO (Lordsburg)—Main shaft down 160 ft. Working 25 men. E. K. Davis superintendent.

STEVENS (Lordsburg)—Property unwatered. Nine feet of ore reported on 200 level. Will be worked by local syndicate. B. Ford superintendent.

OKLAHOMA

Miami District

BLUE MOUND (Baxter)—Has taken over and will develop Lucky Strike lease, south of St. Louis, Okla. Tract at one time had concentrator, but heavy water prevented operation. About same time president of company died, and mine has been idle since.

OMAHA LEAD AND ZINC (Joplin)—New mill in operation. Will sink shafts 20 ft. or more to deeper run. Plant handling 400 gal. of water per minute. Mark R. Moore, Okmulgee, Okla., president. T. N. Chenoweth, Joplin, superintendent.

STANDARD LEAD AND ZINC (Joplin)—Operations again started on lease north of Tar River. Mine supposedly owned by Erdly Brothers, who are with Chanute Spelter Co. here.

DEFENDER (Picher)—Expects to build mill on tract now being developed near Blue Bird mine, west of Tar River, Oklahoma.

WHITE (Picher)—Has given up active operation for summer. Continuous drilling.

SOUTH DAKOTA

Lawrence County

CAPITAL GOLD (Deadwood) — Plans completed for beginning work on property adjoining Trojan company in Deadwood Gulch. Power line being extended to ground and complete compressor plant will be installed. Ores will be shipped to Trojan cyanide plant. P. A. Griswold, of Omaha, Neb., president. R. M. Harrot secretary and general manager.

Pennington County

EGYPTIAN (Keystone) — Miners working on 120 level in North Pope mine of Egyptian company have broken into shoot of high-grade ore. Impossible at present to determine width or extent of ore. Free gold can readily be seen throughout rock. Work being pushed. Property adjoins Holy Terror, which was noted for high-grade, and lies on strike of that vein.

MAYWOOD CHEMICAL (Keystone)—Formerly Standard Essence Co. Shipping 50 tons spodumene weekly to Maywood, New Jersey.

TEXAS

Brazoria County

SEVERAL DEEP WELLS at West Columbia now being drilled: Crown Oil Co.'s No. 1 Sealy in rock at 3129 ft.; Harris Co.'s No. 1 Moody at 3232 ft.; Gulf Coast Oil Co.'s No. 1 Smith at 3547 ft.; Sun Co.'s No. 1 McGregor in dry sand at 3780 ft.; Gulf Production Co.'s No. 1 Hogg at 3147 ft. showed some oil with 80% water.

FREEPORT SULPHUR CO. (Freeport)—Large tonnage sulphur being shipped to French government via Galveston, where arrangements made with U. S. Railroad Administration for wharfage facilities. British steamer "Tregothnan" carried out first cargo, and British steamer "Tremayne," operating under charter from French government, passed Sand Key June 12 en route to Galveston for second cargo.

Concho County

RUSSELL WELL (Paint Rock)—This well, in wild-cat territory, 10 miles northwest of Paint Rock, was shot and is flowing by heads, although not yet entirely cleaned out. Promises to be good producer.

Dallas County

GULF PIPE LINE (Dallas)—Material ordered for 150-mile pipe line from Fort Worth to Burkburnett. Company subsidiary of Gulf Oil Corporation.

Glasscock County

CONTRACT FOR SIX WELLS near Garden City, let recently to Houston firm. Two to be drilled not later than middle of September.

Harris County

GULF COAST DEVELOPMENT (Humble)—No. 2 Rodgers at 1830 ft. and No. 5 Landslide at 630 ft., each a 10-bbl. pumper, brought in recently

GULF PRODUCTION (Humble)—No. 5 Eyers, largest producer of field, brought in during second week in June, now making 1500 bbl daily During this week field produced over 10,000 bbl. per day.

Liberty County

HUMBLE OIL AND REFINING (Hull)—No 1 Palmer brought in flowing 350 bbl.

TEXAS CO. (Hull)—Has temporarily abandoned No. 1 Fee at 3914 ft.

Nacogdoches County

MILLER OIL (Nacogdoches)—Operating for several months on Jose Maria Mora land grant 16 miles southeast of Nacogdoches, and now has six producing wells Officials of company state many wells will now be drilled and refinery built

Orange County

SEABOARD OIL AND REFINING (Orange)—Making tests and analyses on oil from Orange County field, with intention of extending pipe line to field if sufficient number of producing wells are brought in.

Runnels County

GULF PRODUCTION recently shot Russell well at 2300 ft. and brought in 300-bbl. producer. Well about 25 miles southwest of Coleman. Well demonstrates that Strawn sand, in which oil occurs, traverses Coleman County from northeast to southwest.

UTAH

Beaver County

GOLD CROWN (Milford)—High-grade ore carrying gold, silver, lead, reported on 200 and 300 levels, and continuous between. Work suspended to install oil engine and two new compressors. Shaft down 200 ft.

MAJESTIC (Milford)—Owns Old Hickory and Hoosier Boy. Work to be resumed. Old Hickory has produced considerable copper ore running about 4 per cent.

Juab County

BIG HILL (Eureka)—To sink shaft; funds to be provided by increasing capitalization from 500,000 to 1,000,000 shares. New issue to be placed in treasury and stockholders given first chance to purchase. Jesse Knight president.

CHIEF CONSOLIDATED (Eureka) — New pumping equipment underground; consists of three units, each of 1000 gal. per minute capacity. Being installed on 600, 1200 and 1800 levels, where company is operating smaller pumps. Some of best ore mined recently coming from below 1800.

INDEPENDENCE (Eureka)—Recently organized company operating in east Tintic has purchased old Bullion Beck mill, at Eureka, and is tearing down to use timber for mine buildings. Has ordered equipment for shaft sinking.

PROVO MINING (Eureka)—Option given on property of 13 acres adjoining Tintic Standard on west at rate of 9c. a share on capitalization of $840,000, placing value of about $80,000 on property. Small cash payment made. Entire amount due in nine months. Sale made in preference to levying assessment for development.

TINTIC STANDARD (Eureka)—May production 78 cars, or about 4000 tons, and April, 92 cars. On completion of Goshen Valley R.R. by August, shipments to be increased. Old shaft to be retimbered and enlarged to 1000 ft. Considering mill for treatment of low-grade ores.

Salt Lake County

CARDIFF (Salt Lake City)—Truck has made first round trip up and down Big Cottonwood Canyon this season. New ore running high in silver; averages five to nine feet in width; followed about 200 feet.

Washington County

DIXIE (St. George)—Orebody shut off by cave-in occurring week ended June 7. May be necessary to sink 1200-ft. shaft, as believed not possible to clear out winze and retimber workings. Shipping 50 to 70 tons monthly of good-grade copper ore last two years.

WASHINGTON

Okanogan County

OKANOGAN VALLEY POWER CO. officials expect to start work about Aug. 1 on first unit of power plant. Dam will be built on Similkameen River 3½ miles above Oroville, above falls 23 ft. high. Will be 350 ft. long, and 60 high. Expect to furnish power to mines in Oroville district

APACHE (Nespelem)—Silver mine under working bond; 15 men employed. Owned by Biggs and Ostrowskie, of Nespelem.

GREAT METALS M. & M. (Nespelem)—Reworking old dump about three miles above Nespelem; 100-ton mill operating full capacity.

Stevens County

O-LO-LIM COPPER operating near Detillion Bridge on former Spokane Indian Reservation. Expects to resume shipping crude ore soon. May build mill if development warrants

YOUNG AMERICA (Bossburg)—Machinery for mill in place, and experimental runs being made on ore from dump.

LOON LAKE COPPER (Loon Lake)—Putting mill in condition preparatory to resuming work.

NORTHERN LIGHT GROUP (Northport)—Development resumed under direction of C. C. Knutson.

CANADA

British Columbia

CAMERON AND DALLAIRE are testing their gold-platinum placer on Government Creek, 40 miles south of Prince George

PROSERPINE (Barkerville)—Tregillus, Carey, and Blair have resumed shaft sinking on Proserpine Mountain gold quartz vein.

ROCK CANDY (Grand Fork)—Consolidated M. and S. Co. pushing development of this fluorspar property. Mill bins full and plant ready for work. Spur between Kettle Valley Ry. and mill unfinished, but rails now on spot.

MOLLY GIBSON (Kitto Landing, B. C.)—Consolidated M. & S. Co. has resumed work on this property. Tramway damaged by snowslide restored.

SILVERSMITH MINES (Sandon)—Putting 100 tons of ore daily through new mill, which is running smoothly, concentration ratio being about 10 to 1. Expect to ship about five carloads of concentrates and crude ore monthly.

SOVEREIGN (Sandon)—Building tramway from mine to Sandon. Irwin White in charge of this Cunningham property. Ore will be treated at Alamo mill, now almost ready for operation.

WONDERFUL (Sandon) — Tramway completed, half mile long.

GOLD CURE (Slocan, B. C.)—Operating seven claims on south fork of Kaslo Creek. To resume operations about July 1. H. Park, general manager. Index and Silver Bell properties in same district both operating. Motor trucks used to haul ore to railroad, distance of eight miles.

Ontario

CATHERINE (Boston Creek) — Camp buildings completed and surface work being done.

CHARETTE (Boston Creek) — Steam-driven mine plant installed and shaft being sunk.

BOURKES (Bourke's Station) — Mine plant being installed. Construction of new mill of about 80-ton capacity will soon begin.

REEVES-DOBIE (Gowganda)—Installation of oil flotation equipment of about 100 tons daily capacity nearly completed.

FOUR NATIONS (Kenogami Lake)—Prospecting shaft being sunk on promising vein.

EAST KIRK (Kirkland Lake)—Camp buildings put up. Exploration and development plans made and mining plant will be installed.

LAKE SHORE (Kirkland Lake)—Owing to strike, pumps have been removed from mine, which is now flooded, management holding that dewatering later on will be cheaper than keeping pumps going.

GOLDFIELDS CONSOLIDATED (Larder Lake)—Contract let for extensive diamond drilling on Reddick property.

KENABEEK CONSOLIDATED (Montreal River District)—Arrangements made to resume work by new company known as Triangle Silver Mines, capitalized at $2,000,000.

SOVEREIGN (Porcupine) — Diamond drilling indicates orebody 8 ft. wide at 164 ft. depth.

COLOMBIA

SOUTH AMERICAN GOLD AND PLATINUM CO. preparing to install additional equipment for mining by modern methods. Subsidiaries working platinum- and gold-bearing ground in Intendencia of El Choco. Recently disposed of 300,000 shares. Adolph Lewisohn, of New York, president.

KOREA

ORIENTAL CONSOLIDATED (Unsan)—Suribong power plant cannot be started until end of rainy season, as turbines cannot be shipped from San Francisco before July 15. All excavation complete. Expect to finish dam with division walls early in July; also work on power house and draft tubes. Labor demonstrations seem over. Everything quiet at Unsan (written May 5), where Japanese infantry detachment is still stationed. Little rain during April.

BURMA

BAWDWIN MINES (Bawdwin)—Burma Corporation, Ltd., reports—No. 3 level, east crosscut, 402 ft. north, from 0 to 25 ft., no value; from 25 to 30 ft., 5 oz. silver, 5% lead, 4½% zinc, 2% copper; No. 4 level, east crosscut, 501 ft. north, from 20 to 22 ft., 39 oz. silver, 2% lead, 2% zinc, 17% copper; from 22 to 24 ft. on north side, 55 oz. silver, no lead, 2% zinc, 24% copper; from 22 to 25 ft. on south side, 6 oz. silver, no lead, 1% zinc, 2% copper. Lead production for April 2,023 tons gross; refined lead 1,710 tons; and refined silver 209,000 oz.

The Market Report

SILVER AND STERLING EXCHANGE

Jun	Sterling Exchange	Silver		June	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
1	4 6144	112⅜	54¾	23	4.6056	110⅛	53¾
2	4 6063	111¾	54½	24	4 5988	111⅛	$54\frac{5}{16}$
2	4.6088	111¼	54¼	25	4.5900	110⅞	$54\frac{5}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

June	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
9	17.80 @17.85	†72½	5.40	5.15	6.50 @6.60
0	17.85 @17.87½	†72½	5.40	5.15	6.57½ @6.62½
1	17⅞	†72½	5.40	5.15	6.65 @6.75
3	18.10	68	5.40	5.15	6.70 @6.80
4	18 15 @18.35	68	5.40	5.15	6.85 @6.90
5	18.15 @18.35	68	5.40	5.15	7.00

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

June	Copper			Tin		Lead		Zinc
	Standard		Electrolytic					
	Spot	3 M.		Spot	3 M.	Spot	3 M.	Spot
19	84¼	85	86½	243	239	22⅞	22⅝	36½
20	86⅜	87¼	89	242¾	239	22¾	22½	37¼
21	....	....	....	....	....	....	....	....
23	86½	87½	89	239½	236	22½	22¼	37½
24	88	88¾	90	240½	237	22½	22¼	38¼
25	87¼	88¼	90	242	241¾	22	22¼	38¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—June 25, 1919

In both copper and zinc there were sharp rises, the advance in zinc being rather spectacular. In both cases the advances happened on relatively small business. Lead was quiet, but very firm.

The regular lines quote $18 per 2000 lb. for freight from New York to British ports, but terms as low as $15 may, perhaps, be obtained from outsiders. Rates to French ports also are easier. Much better terms are obtained from Galveston than from New York. The rate from Pacific ports to Hongkong and Kobe remains at $14.

The director of sales of the War Department reports the following metals on hand as of June 1: Soft pig lead, 3698 tons; antimonial pig lead, 472 tons; heavy sheet lead, 5000 tons; lead disks, 590 tons; lead calking wire, 613 tons; zinc, 38,000 tons; platinum, 20,000 oz.

Copper—Domestic sales were relatively light, and although there were some encouraging export sales to England and France, both through the Copper Producers' Association and outside of it, the quantity was not great. Nevertheless, even on small business producers had no difficulty in advancing their prices almost from day to day and meeting with prompt acceptance of the new terms. The advance in copper in England aided materially in this. In the latter part of the week producers were asking £93 in both France and England, which could be figured as netting 18¾c., f.o.b., New York, on the British business, and a trifle less on the French. In the meanwhile, July copper for domestic consumption was to be had on the basis of 18.15c., New York, but during the last two days some fair business for July-August delivery was done at 18.35c. For August alone all producers would probably require that price.

The copper market, like other markets, is strong on sentiment, and at present small influences are sufficient to move it upward. A contributory factor in shaping opinion is the anticipation that there will be a strike in Butte in July which will result in the closing of the mines.

In the copper manufacturing districts of New York and New England a strike developed this week at Hastings-on-the-Hudson. On the other hand, the American Brass Co. yielded to its strikers, granting them an advance of 10c. per hour, which will probably compel the other concerns at Waterbury and Ansonia to do likewise, and will end the troubles at those places.

Copper-wire manufacturers report that business has become very good. The first demand was mainly for rods and bare wire, but now there is considerable demand for cables. The business is both for repair work and new construction, the latter being especially for extensions of existing lines. Some considerable export business has been done right along.

Copper Sheets—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 20½@21c. in carload lots, f.o.b. mill.

Tin—The Government ban was lifted on June 23, and beginning with that day an open market, subject to the restrictions that we reported last week, began. Straits and electrolytic tin were immediately quoted at 70c., and common tin (99%) at 68c. However, the market has not yet found itself. It is believed that there are some important consumers who are greatly oversupplied, and that they will naturally dispose of their surplus and either take chances on the market later in the year or else cover themselves immediately by purchases of tin for shipment from points of origin. On June 24 contracts for July shipments from Singapore were made at 52c, and for July-August shipments from Batavia, at 51⅜c. Such operations will naturally bring the American market to its true level.

Lead—This metal was quiet, but very firm. The statistical position without doubt has experienced further improvement. Lead manufacturers report that business has become very good. In white lead there is an especially noteworthy activity.

There were some substantial sales of Mexican lead this week, both for Europe and to the Orient. There have been some unfavorable comments from Great Britain respecting the manner with which Mexican lead has been handled in that market.

Zinc—This market advanced sharply from day to day on what looked like speculative buying, but when the price approached 7c. consumers, including galvanizers, appeared to have become interested, and they made some purchases. The advance in the London market helped things along. Zinc at £39, London, which has practically been reached, is equivalent to 7c., St. Louis. Some export business has been done, and there is reason to anticipate that more will follow. High-grade zinc has not advanced in the same proportion as common zinc. Even in the latter part of the week it probably could still have been bought at 7½c., delivered in the East, which would indicate a premium of only about ¼c. per lb. over common zinc. Zinc dust has advanced even less. Prolong dust can probably still be bought at 9c., f.o.b., works.

The smelteries at Clarksburg and Meadowbrook, W. Va., are closed, owing to labor troubles.

The electrolytic plant of the River Smelting and Refining Co., at Keokuk, Iowa, has been closed, probably permanently.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 32c. per lb. Market weaker.

Antimony—Quiet at 8⅜@8½c., for spot. Futures were quoted at 8¼@8⅜, but very little is offered.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50 per lb. in lots of 500 pounds. For lots under 200 pounds, $1.75 per lb.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—A further advance brought the market to $95. San Francisco telegraphs $92, strong.

Silver and Platinum

Silver—Owing to the decline in exchange on London, as well as the fact that the China exchanges have weakened, the price of silver has not been maintained. The cession of Shantung to Japan has caused more or less disturbance, and trade has quieted down for a time.

Mexican dollars at New York: June 19, 87; June 20, 86; June 21, 85¾; June 23, 85; June 24, 85½; June 25, 85⅜.

Platinum—Refined ingot, $105@107½.

Palladium—Strong at $120.

Zinc and Lead Ore Markets

Joplin, Mo., June 21.—Blende, per ton, high, $45.10; basis 70 per cent zinc, premium, $43; Prime Western, $42; Sludge and flotation, $41@37; calamine, basis 40 per cent zinc, $25@22. Average settling prices: Blende, $40; calamine, $23.83; all zinc ores, 39,78.

Lead, high, $62.15; basis 80% lead, $60; average settling price, all grades of lead, $59.13 per ton.

Shipments the week: Blende, 9,789; calamine, 284; lead, 1,295 tons. Value, all ores the week, $477,580.

Men are leaving the mining field at the rate of 100 a day. All are not miners, but many are, and the result is noticeable in reduced ore production. The mine owners failed to agree on a general close down during the harvest, but so many of the miners are leaving that all mines in operation are seriously handicapped, and several mills have been forced to close down. The output is estimated reduced 20 per cent.

Platteville, Wis., June 21—Blende, basis 60 per cent zinc, $45 base for premium grade, and $42.50 base for high lead or Prime Western grade. Lead ore, basis 80% lead, $59 base for top grade and $56 to $58 for second grade. Shipments reported for the week are 2,012 tons blende, 79 tons galena, and 378 tons sulphur ore. For the year to date the totals are 48,319 tons blende, 2,327 tons galena, and 6,748 tons sulphur ore. During the week 2,250 tons blende was shipped to separating plants.

Other Ores

Molybdenite—Quoted nominally at 75@85c. per lb.

Tungsten Ore—Some business in off-grade ore was reported at $7@7¼. High-grade ore is held at much higher prices, but buyers are unwilling to meet the views of sellers.

Pyrites—Spanish pyrites is quoted at 19c. per unit for furnace ore, c.i.f., New York or other Atlantic port. Gradual reduction in ocean freights.

Iron Trade Review

PITTSBURGH—June 24

The signing of the peace treaty by Germany will probably release promptly a great many construction jobs, held hack as a matter of judgment or of principle until the treaty should actually be signed. It is the opinion of the steel trade that a great deal of investment work will be undertaken. Hitherto the demand for steel has been chiefly for ordinary current consumption, and this demand has been larger than would have been expected from such quarters. It is not true, however, as suggested, that there has been no demand for steel for construction purposes. The monthly reports of the Bridge Builders' and Structural Society show that twice as much fabricated steel was let in May as in April. The monthly reports of bookings of fabricated steel jobs, in proportion to capacity of the fabricating shops, have been as follows: January, 12%; February 12½%; March, 17½%; April, 24½%; May, 49%.

Though official announcement has not been made, it is known to the steel trade that the Railroad Administration has decided to buy 300,000 tons of rails, following the 200,000 tons recently purchased with a protest as to the price paid. It is understood that this time there will be no protest, as the Mar. 21 steel prices have justified themselves by holding and by developing a widespread demand.

There has been further slight increase in the volume of buying of most finished-steel products.

Last night at Atlantic City the union sheet and tin mills came to an agreement with the Amalgamated Association, which controls considerably less than half the total, on scales for the twelvemonth beginning July 1. The union receded from the extreme demands that had been formulated, including a 25% increase in base rates and the establishment of four turns instead of three turns per day, and accepted 10% and 6 advances for certain members of the crews, chiefly the less well paid, whereby the average of scale rates, which are per ton of output, is increased 3.6% for sheet mills and 2.6% for tin mills.

Pig Iron—The local market, which had not been as active as markets in various other districts, has quieted down, but the furnaces in blast are well provided with orders, and the market is steady if not strong. There is still less competition from outside districts, the Valley furnaces having more of a hold in this territory than formerly. Valley prices, which may perhaps be shaded sometimes, remain: Bessemer, $27.95; basic, $25.75; foundry, $26.75; forge, $25.75, at furnace, with $1.40 freight to Pittsburgh. Some furnaces with less freight to Pittsburgh are giving buyers the freight advantage.

Steel—Producers still complain that billets are too low at $38.50, the Mar. 21 price, by comparison with finished products, and with sheet bars at $42 and slabs at $41, and do not seem anxious to sell, but at the same time there is scarcely any demand. Sheet-bar orders are being placed freely from week to week, according to the requirements of sheet mills, but there is scarcely any buying ahead. Slabs have been quiet, but there is now an inquiry from the National Pressed Steel Co., Massillon, Ohio, for 10,000 tons for delivery over three months, to be used in rolling "steel lumber," a sort of H-beam section in which the company is building up a trade.

Ferromanganese—Reports that domestic producers have made sales at $120 to $125 delivered, for 80% ferromanganese, are probably premature, and the market may be quoted at $110@115 on the basis of former transactions in resale material. The English asking price continues at $125 delivered. Spiegeleisen is nominal at $33@35, delivered, for 18%.

Coke—Sales of second-half furnace coke by the Oliver & Snyder Steel Co., reported last week at 32,000 to 33,000 tons, have now been increased to about 50,000 tons, which is all the interest desires to sell. Nearly all contracts are on the ratio basis of the price of a net ton of coke at ovens being 16c. to each dollar in the price of basic pig iron at Valley furnaces; in other words, a ratio of 6¼ to 1, making coke $4.12 when pig iron is $25.75. Only a relatively small part of the possible output can be sold by reason of so many furnaces being out of blast, and in the last two years many furnaces have established byproduct ovens. Some of the Eastern furnaces formerly using Connellsville coke are likely to purchase byproduct coke, Bethlehem being a seller and the Rainey-Wood and Midvale interests are about to start byproduct plants, part of the output being offered in the market. There has been fairly free contracting in foundry coke for second half, generally at $5@5.50. Spot coke is $4 for furnace and $4.50@$5 for foundry, per net ton at ovens.

MONTHLY AVERAGE PRICES OF METALS

Silver

	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75 630	88 702	101.125	36 682	44 356	48 438
Feb.	77.585	85.716	101 125	37.742	42.792	48 027
Mar.	73 861	88.082	101 125	36 410	43 620	48 171
April	73.875	95.346	101 125	36.963	47.215	48 885
May	74.745	99 505	107 135	37.940	48.980	52.104
June	76 971	99 500		39 065	48 875	
July	79.010	99 625	.	40 110	48 813	
Aug.	85 407	100.292	.	43 418	49 077	.
Sept.	100.740	101.125	.	50 920	49 500	..
Oct.	87 332	101.125	.	44 324	49 500	.
Nov.	85 891	101.125	.	43 584	48 969	.
Dec.	85.960	101 125	.	43 052	48 492	.
Year	81 417	96 772	.....	40.851	47 516	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23 500	(a)	110.000	92 238	125 000	106 619
Feb.	23 500	16.763	110.000	78 700	125 000	95 700
Mar.	23 500	14.856	110.000	76 821	125 000	82 071
April	23.500	15.246	110 000	77 300	125 000	82 200
May	23 500	15.864	110 000	77.767	125.000	81.227
June	23 500	.	110.000		125.000	
July	25 904	.	119 913		134.913	
Aug.	26.000	.	122 000	.	137.000	
Sept.	26 000	. .	122 000	.	137 000	
Oct.	26 000	. . .	122 000	.	137 000	
Nov.	26 000	.	122 000	.	137 000	
Dec.	(a)	...	118 417	. .	133 167	
Year	24 628		115.530		130 507	

(a) No Market.

Tin

	New York		London	
	1918	1919	1918	1919
January	85.500	67 702	293 227	248 557
February	92.000	66 801	311.525	223.963
March	(a)	67 934	318.875	246 843
April	(a)	72 500	329.905	225 275
May	(a)	72 500	364 217	234 398
June	(a)	.	331 925	
July	(a)	. .	360.347	
August	(a)	. .	380.900	.
September	(a)	. .	343.905	. . . .
October	(a)	. . .	335.543	.
November	(a)	.	323.550	. . .
December	(a)	. . . .	267.736	. .
Av. year	(a)	. . .	330 138	. . . .

(a) No average computed.

Lead

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6 782	5 432	6 684	5.316	29 00	37 227
February	6 973	5.057	6 899	4.784	29 00	28 675
March	7 201	5 226	7 091	4 992	29 00	27 952
April	6 772	4 982	6 701	4 722	29 00	24 888
May	6 918	5.018	6 704	4.773	29 00	23.852
June	7 611		7 511		29 00	
July	8 033		7 750		29 00	
August	8.050		7 750	.	29 00	
September	8 050		7 750		29 00	
October	8 050		7 750		29 00	. . . .
November	8 050		7 750		31 20	
December	6 564		6 324		40 00	
Year	7 413		7 222		30 10	

Zinc

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7 836	7 272	7 661	7 922	54 000	56 045
February	7 814	6.623	7 639	6 273	54 000	46 150
March	7 46[illegible]	6 500	7 286	6 150	54 000	38 500
April	6 890	6 465	6 715	6 114	54 000	36 118
May	7 314	6.429	7 114	6.079	54 000	35.477
June	8 021		7 791		54 000	
July	8 688		8 338		54 000	
August	8 98[illegible]		8 63[illegible]		54 000	
September	9 412		9 092		54 000	
October	8 801		8 451		54 000	
November	8 491		8 11[illegible]		54 100	
December	8 163		7 81[illegible]		56 050	
Year	8 15[illegible]		[illegible]		54 180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pittsburgh

	Bessemer†		Basic†		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37 2[illegible]	[illegible] 00	$33 95	$31 40	$33 95	$32 40
February	37 2[illegible]	33 60	33 95	31 40	33 95	32 40
March	37 [illegible]	32 54	33 95	31 40	33 95	29 12
April	36 1[illegible]	29 35	32 95	27 15	33 95	28 15
May	36 [illegible]	29.35	33 00	27.15	34 00	28 15
June	36 [illegible]		33 16		34 1[illegible]	
July	36 60		33 40		34 10	
August	36 60	....	33 40	. . .	34 10	
September	36 60	..	33 40	. . . .	34 10	
October	36 60		34 40	. .	35 40	
November	36 60		33 40	. . .	35 40	
December	36 60		33 40	. . . . .	35 40	
Year	$36 67	.	$33 70		$34 45	

† As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. Exch.†	June 24
Alaska Gold M.	3
Alaska Juneau	2¼
Am.Sm.&Ref.,com.	80¼
Am.Sm. & Ref., pf.	107
Am.Sm.Sec., pf., A.	95
Am. Zinc	22
Am. Zinc, pf.	58½
Anaconda	71¾
Batopilas Min.	1⅛
Bethlehem Steel	85½
Butte & Superior	27
Butte Cop. & Zinc	12½
Cerro de Pasco	53¾
Chile Cop	25¾
Chino	41⅞
Colo. Fuel & Iron	47
Crucible Steel	90½
Crucible Steel, pf	100½
Dome Mines	13½
Federal M. & S.	14⅝
Federal M. & S., pf	41
Great Nor., ore ctf.	45¼
Greene Cananea	43
Gulf States Steel	65½
Homestake	85
Inspiration Con	60¼
International Nickel	31¾
Kennecott	39¾
Lackawanna Steel	82
Mexican Petrol.	181¾
Miami Copper	27¾
Nat'l Lead, com.	77
National Lead, pf	109
Nev. Consol	19
Ontario Min	8
Ray Con	23½
Republic I &S.,com	88¾
Republic I &S., pf.	104
St. Joseph Lead	13⅞
Sloss-Sheffield	66⅞
Tennessee C. & C.	12¾
U. S. Steel, com.	106⅛
U. S. Steel, pf	116⅜
Utah Copper	86¾
Va. Iron C. & C.	66
Worthington Pump	77⅜

Boston Curb*	June 24
Boston Ely	1¼
Boston & Mont.	84
Butte & Lon'n Dev.	.20
Calaveras	1½
Chief Con	3½
Contact	‡ 05
Cortez	15
Crown Reserve	.25
Crystal Cop	.13
Eagle & Blue Bell	2⅜
First Nat. Cop.	1⅜
Gadsden Cop	3½
Houghton Copper	1¼
Intermountain	‡ 05
Iron Blossom	40
Iron Cap	10½
Majestic	22
Mexican Metals	15
Mines of America	‡ 05
Mojave Tungsten	.15
Nat. Zinc & Lead	10
Nevada-Douglas	.16
New Baltic	1¼
Oneco	.75
Pacific Mines	‡ 35
Rex Cons	‡ 14
Yukon Gold	.80

San Fran.*	June 24
Alta	‡ 08
Andes	20
Best & Belcher	13
Caledonia	15
Challenge Con.	‡ 03
Confidence	‡ 25
Con. Virginia	1.35
Gould & Curry	05
Hale & Norcross	19
Jacket-Cr. Pt.	03
Mexican	35
Occidental	‡ 40
Ophir	1 00
Overman	‡ 10
Savage	15
Sierra Nevada	05
Union Con	17
Utah Con	‡ 01
Belmont	3 50
Jim Butler	38
MacNamara	76
Midway	37
Mont.-Tonopah	‡ 20
North Star	09
Rescue Eula	20
West End Con	1 70
Atlanta	.04
Booth	09
Comb. Frac	.04
Florence	51
Jumbo Extension	11
Kewanas	03
Nevada Hills	.04
Nevada Packard	23
Round Mountain	30
Silver Pick	06
White Caps	18

Colo. Springs*	June 24
Cresson Con.	4 00
Doctor Jack Pot	03½
Elkton Con	04½
El Paso	.15
Gold Sovereign	‡ 02
Golden Cycle	1 67
Granite	12
Isabella	04½
Mary McKinney	07½
Portland	95
United Gold M.	.16½
Vindicator	40

Boston Exch.†	June 24
Adventure	‡1½
Ahmeek	79
Algomah	‡.80
Allouez	41
Ariz. Com.	14
Arnold	‡ 20
Bingham Mines	‡9
Bonanza	‡ 20
Butte-Balaklava	38
Calumet & Ariz.	67
Calumet & Hecla	410
Carson Hill	‡15
Centennial	‡16
Copper Range	50½
Daly West	‡2½
Davis-Daly	7¼
East Butte	14½
Franklin	4
Granby	‡76½
Hancock	6
Hedley	‡12
Helvetia	5
Indiana	‡1½
Isle Royale	34½
Keweenaw	1¾
Lake	4½
La Salle	‡3¼
Mason Valley	‡3¾
Mass	7
Mayflower	9½
Michigan	6½
Mohawk	66½
New Arcadian	‡4
New Cornelia	23½
New Idria	8
Nipissing	11½
North Butte	13½
North Lake	‡1½
Ojibway	‡2½
Old Dominion	41
Osceola	57
Quincy	68½
St. Mary's M. L.	59
Santa Fe	‡ 35
Seneca	24
Shannon	3½
Shattuck-Ariz.	‡15½
So. Lake	‡3
So. Utah	23
Superior	8
Superior & Bost.	3½
Trinity	3½
Tuolumne	1⅛
U. S. Smelting	67
U. S. Smelting, pf.	50
Utah Apex	‡3
Utah Con	10½
Utah Metal	2½
Victoria	3½
Winona	1½
Wolverine	21

N. Y. Curb†	June 24
Alaska Mines	½
Big Ledge	
Butte & N. Y.	½
Butte Detroit	‡ 03
Caledonia	41
Calumet & Jerome	⅞
Can. Cop. Corpo	1⅞
Cashboy	.08½
Con. Ariz. Sm.	
Con. Coppermines	7¼
El Salvador	4
Goldfield Con.	16
Goldfield Merger	04
Hecla Min	5½
Howe Sound	4¾
Jerome Verde	1½
Louisiana	
Magma	‡37½
Marsh	07½
McKinley-Dar-Sa.	63
Milford	‡ 75
Mother Lode	43
Nixon Nevada	23
Ohio Cop	
Rawley	12½
Ray Hercules	2½
Richmond	‡ 50
Rochester Mines	19
So. Am. G. & P.	11½
Standard S. L.	
Stewart	26
Success	04½
Tonopah	‡ ⅜
Tonopah Divide	8
Tonopah Ex	2½
Tribullion	‡ 25
Troy Arizona	‡ 10
United Eastern	4⅛
United Verde Ext.	40½
United Zinc	‡ 25
Utica Mines	‡ 08

Toronto*	June 24
Adanac	15
Bailey	03
Beaver Con	42
Coniagas	1 37½
Hargraves	02
Kerr Lake	5 75
La Rose	31½
Lake Shore	‡1 00
Min. Corp. of Can	2 50
Peterson Lake	09
Teck Hughes	20
Temiskaming	37
Trethewey	.37
Wettlaufer-Lor.	03
Davidson	‡.68
Dome Exten.	32
Dome Lake	18
Hollinger	6 50
McIntyre	1 62½
Newray	12½
Porcu. Crown.	27
Vipond	20
West Dome	.12

*Bid prices. † Closing prices. ‡ Last quotations.

BINDING SECT. JUN 12 1980

TA E/MJ. Engineering and
1 mining journal
E42
v.107

Engin.

ENGIN STORAGE

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY